18 MINUTES AND 11 SECONDS ONLINE: EXPLORING THE
COGNTIVE PROCESSES OF 12 GOOD WRITERS WRITING
ON THE INTERNET

By

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ABSTRACT

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New technologies and Internet resources are becoming more and more integral to 21st

century writing. To write well in the 21st century requires the coordination of new technologies,

new skills, and new information. The central challenge to coordinate these new elements of

contemporary writing is the deictic influence they have on writing. Currently, there is very little

research-based information available to understand and theorize this constantly-evolving

phenomenon.

This dissertation study is an initial effort to closely examine the essential factors and

cognitive strategies involved in the processes of writing with the Internet. Specifically, the study

seeks to understand: (1) the role of prior knowledge in college writers' online searching, reading,

and writing; (2) the strategies that college writers use to manage information load during online

searching and reading; (3) the strategies that college writers use to transform online information

into essay texts, and (4) the interstitial moments from searching to writing. The study employed

a multiple-case study design that allows exploring and comparing the strategies and emerging

patterns among a representative group of writers. Twelve good first-year college students

participated in the study.

The results of the study show: (1) the writers' prior knowledge served as the primary

source to orient their online searching. Associative patterns were found between the participant

writers' prior knowledge structures and their online searching and reading. (2) The writers

applied four cognitive strategies to manage cognitive load during the course of writing and searching, including minimal online reading strategy, deep online information engagement strategy, offloading useful web information strategy, and searching and reading behavior self-monitoring strategy. (3) The writers used five strategies including direct quoting, factual information picking, information restating, information summarizing, and information synthesizing to transform online information into essay texts. And (4) The writers' interstitial moments of searching, reading, and writing occurred when they evaluated web information based on their prior knowledge and the given writing topic, and when they integrated prior knowledge and web information to build an effective argument.

The findings in this study enable researchers in digital writing, educational technology, and web-based learning to understand more fully the cognitive processes of writing that are particular to 21st century writing and learning.

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CHAPTER 1: INTRODUCTION

Statement of the Problem

Instant, easy access to information has become one of the most influential and exciting

promises of the digital age. According to Pew Internet and American Life project data, by the

year of 2011, 92% of online Americans have used search engines to locate a wide range of

information types; and 44% depend on Internet search engines to look for vital information they

absolutely need (Pew Research Center, 2011). Increasingly, this widespread use of Internet

search engines has transformed people's connection with information in almost every aspect of

life (Leu, 2004, RAND 2007).

The effects of this transformation are widespread. One of the most educationally

significant effects occur in the transformation of reading and writing. In particular, Internet

search engines amplify the nature of the writing process in several ways. First, it adds layers of

complexity to the writing process (Hartman, Morsink, & Zheng, 2010). Writing has long been

understood as a "mind-juggling" process, during which a writer used pencil, paper, prior

knowledge and experience, and a source article or two to orchestrate a number of cognitive

constraints: ideas, wording, sentences, organization, and genre. Writing with Internet search

tools still involves the juggling of constraints, but extends the juggling of constraints and

resources to a scale heretofore unseen. Such a transformation adds new dimensions of

complexity to the writing process. For example, a writer needs to search online, evaluate online

resources, coordinate technology use, and manage online information effectively. The fusions of

Internet search engines into writing processes--which permit continuous, widespread, in-depth

interaction with online information—possibly make a writing process even more complex than it

was once thought to be.

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Second, Internet search engines amplify the role of prior knowledge in the writing process (Hartman, Morsink, &Zheng, 2010). A writer's prior knowledge was conventionally thought to be the major source of information to be represented in a piece of writing; and the quality of an essay heavily depended on the quantity and quality of a writer's prior knowledge. If a writer had a limited supply of prior knowledge about a topic, the potential breadth and depth of the essay was shallower than if a more abundant supply of prior knowledge was accessible. Internet search tools make possible a more formative, generative, and augmented use of prior knowledge when searching and reading on the Internet (Deschryver & Spiro, 2010). This transformation enables the rapid gathering of relevant information, which can significantly extend the writer's existing prior knowledge, resulting in an amplified knowledge base for writing about the topic. For instance, a writer working online can learn a considerable amount from dozens of relevant online sources and progressively integrate that information with his prior knowledge, which in turn provides an enlarged base for writing a higher quality essay. The expanded and varied role of prior knowledge in online writing environments deserves even greater attention than was once devoted to it.

Third, Internet search engines proliferate the skill sets to be used during the writing process (Hartman, Morsink, & Zheng, 2010). Previously, writing was conceived as a set of stable and finite skills and knowledge to be mastered. Determinate demands were put on the writer to exhibit skills for: (a) carrying out the process (e.g., brainstorming before outlining a first draft, then editing it through successive versions, and finally crafting the piece for publication), (b) replicating the genre or device (e.g., narrative, informational, procedural, thesis-proof, etc.; flashback, personification, enumeration of ideas, provides an explanation for a term, etc.) and (c) using the technology (e.g., how to wield a pencil and paper). In contrast, Internet

search tools demand the development of skill sets that are well suited for carrying out multiple sets of processes simultaneously, recreating and melding genres and devices, and re-using technologies in novel ways to produce writing that is suited for a broad range of audience and purposes. For example, a writer composing with the Internet can: use one more search tools and tabs to find information resources; learn from these online information resources and adapt the search or writing goals based on what is learned; manage memory load by archiving or indexing resources on the fly; continue to search for more information resources, if necessary, while concurrently monitoring search and learning goals; discriminate the quality of online information resources throughout the searches, keeping the purpose(s) of his writing in mind; reappropriate online information for use in his written text (now or in future texts); generate new ideas and forms to communicate the reappropriated information; and again use one or more search tools and tabs to find more information resources to complete the writing task. The sets of multiple skills necessary for effective online writing are little understood and even less studied.

While Internet search engines can theoretically amplify (and thereby transform) the nature of the writing process in these three ways, the research field has very limited knowledge about what this transformation of the writing process looks like in detail. Specifically, we have very limited knowledge about the role of the prior knowledge in a writer's online searching, reading, and writing process, particularly about interactions between a writer's prior knowledge and web information. We also have very limited knowledge about how a writer manages cognitive constraints during online searching. In addition, little is known about how a writer use online information to improve his writing and how a writer orchestrates the roles of a searcher, reader, and writer during the repetitive, iterative cycle of search and writing.

This study attempts to fill the research void by investigating the online writing processes of 12 good writers using Internet search tools to write an argumentative essay. It is an exploratory study that drew upon the data from the participant writers' prior knowledge, screen behaviors, think-aloud protocols, interview and survey responses, and written essays.

Purpose and Importance of the Study

The present study is premised in the belief that an understanding of the increasingly prevailing phenomenon of writing with powerful Information search technology must be approached with an in-depth understanding of the complexities of interactions among prior knowledge, web resources, and information search technology, to which this study will contribute an increased understanding. Such an informed understanding is critical to creating instructions for students when they are searching and reading online for academic purposes. This study aims to contribute to the knowledge of writing researchers and instructors so that they may enhance their understanding of the fundamental processes of writing with the Internet and help students initiate and sustain meaningful uses of Internet search technology and Internet resources.

Specifically, a clear understanding and description of the processes and strategies involved in writing with an Internet search tool is important for at least three reasons. First, it will help to better understand the process of writing in technology-rich writing environments. The knowledge will contribute to a theoretical model of "writing with information search technology" and give a timely update of the existing writing models that were constructed during an era of print-based media. Second, it will inform the debate regarding widespread claim and skepticism about whether or not a writer can benefit from the vast availability of information powered by information search tools and the reasons of being successful or not successful when provided with a large amount of information. Revealing the

process can help us to identify effective strategies that writers use to search for and appropriate web information and help the writing instruction at the time of increasing demand of writing from web sources. Third, it will help define writing assessment in the new era of writing with technology. In the face of emerging technology, an authentic writing task should represent the writing activities that happened every day in life and workplaces. The examination of the processes and strategies of writing with the Internet search technologies can shed a light for policy makers to understand what critical skills needs to be assessed when devise a new form of writing assessment that gauges how students use information search technology and write from web sources.

<div align="center">Organization of the Dissertation</div>

The dissertation is organized in the manner that the research unfolded and patterned findings emerged. The contents of the chapters are as follows: Chapter 2 presents the theoretical perspectives that guided this multiple-case study. This complex topic is informed by three theories: (a) constructivism (Bruner, 1961; Vygotski, 1978); (b) Cognitive Flexibility Theory (Spiro &Jehng, 1990; Spiro, 2010), and (c) New Literacies (Leu, 2007). Chapter 3 provides a literature review of writing with Internet search technology. Included is an examination of the literature related to four bodies of research—prior knowledge and learning, searching and learning on the Internet, research on writing from sources, and connections among searching, reading, and writing. Chapter 4 specifies the methodology of the study, providing the research design and methods. Included is an explanation for the use of qualitative methodology as well as a description of the study design, sampling, data collection, and data analysis procedures, and trustworthiness. Chapter 5 contains the findings. In this chapter, the core findings for each research question are presented. The chapter contains quotations from the participants, statistics,

and visual models to assist in the analysis and description. Chapter 6 provides a discussion of the study's findings. Limitations of the study, implications for future research and knowledge translation are discussed in this chapter. Chapter 7 concludes the study by restating the major findings of the studying and its major implication to educational researchers and practitioners.

CHAPTER 2: THEORETICAL FRAMEWORK

Researchers support the use of multiple theories when examining learning phenomenon, because multiple theories can provide "differing but complementary views on the issue" (Rank & LeCroy, 1983), allowing for a fuller understanding of the subject. This study of writing with information search technology and online resources was guided by three different, but inter-related theories: (a) constructivism (Bruner, 1961; Vygotsky, 1979); (b) Cognitive Flexibility Theory (Spiro &Jehng, 1990); and (c) New Literacies Theory (Leu et, al 2004). Broadly, these three guiding theories contribute the following elements to the overall theoretical framework of the study: (a) an understanding that learning occurs within an extended social environment with situated and interactive exchanges of information between the learner and the environment; (b) an understanding that a mastery of knowledge can be developed and reinforced through multiple representations of and random accesses to the knowledge in different contexts; and (c) an understanding of online reading comprehension as a problem-based inquiry process involving new skills of locating, evaluating, synthesizing, and communicating information on the Internet. These three theories also establish the framework for understanding the role of prior knowledge, strategies to manage cognitive load on the web, and the processes of web information re-appropriation.

The relevance of each of the theories must be understood in an integrated manner. For the purpose of clarity, however, they are presented linearly. Beginning with a discussion of constructivism theory, the layers that contribute to learning and writing with the Internet search technology are presented. The constructivist framework, with its concepts about learner-centered, exploratory learning through meaningful interaction with the learning environment, provides an overarching theory, within which Cognitive Flexibility Theory and New Literacies Theory can

be examined. Cognitive Flexibility Theory is essential to the theoretical framework because the guiding question of this study examines what strategies may facilitate knowledge acquisition to occur in a fluid environment that features openness, flexibility, random access, and multiple knowledge representations. New Literacies Theory is important because it assists in understanding the dynamics that occur in unprecedentedly interactive search-based, online reading comprehension.

Constructivism

The first grounding theory in this study is the constructivist perspective of learning that views learning as an active process, during which learners construct meaning of the world through intimate interactions with social environment. In particular, learning is seen as a change in meaning constructed from experience (Newby et al, 1996). The nature of learning is thus to construct understanding and knowledge from experience *within* each individual human mind rather than transmit a particular body of objective knowledge and truth that exist *outside* the mind of a learner (Runes, 1962). In other word, from constructivist perspective, learning is *personal* instead of *objective*. Learner's prior knowledge of subject contents and ways of assimilating new information influence both learning process and learning results. Learners activate prior knowledge and try to relate new information to knowledge they already possess. By doing so, an understanding of a subject matter is achieved through knowledge construction and transformation, not merely through information acquisition and accumulation (Blumenfeld, 1992). Information may be imposed to a learner, but the understanding of which must be actively constructed from within.

Problems and social supports are considered to be two essential elements to constructivist descriptions of learning environment (Jonassen, 1997). Meaningful and realistically complex

problems are crucial in a constructivist learning environment. Problems serve as a stimulus for learning that drives a learner to explore the environment for the unknown knowledge. A good problem identifies the goals of learning, the prior skills, experience, and knowledge that a learner brings to the construction of a new understanding and experience. Cognitive conflicts or puzzlement that aroused by problems is the primary factor to challenge the learner to achieve both intellectual and pragmatic goals for learning, as in Dewey's terms it is the "problematic" that leads to and is the organizer for learning (Dewey, 1938; Rochelle, 1992). A support from peers and adults that allows a scaffolded knowledge to be applied to the solution of the problem is another critical factor of the constructivist learning process.

Constructivists also suggest that the support of the learning comes from social interactions with teachers and peers. Teachers can act as a coach as in reciprocal teaching (Palinscar & Brown, 1984) or as a facilitator to support students' ownership of learning activity (Scardamalia & Bereiter, 1991). Social interactions among peers can also facilitate communication of ideas about subject matter because their level of understanding is more similar to each other as compared to the teacher's level (Slavin 1996).

Together, constructivism suggests that learning is a process that is influenced by reciprocal interactions with internal and external factors. Under the umbrella of this framework, the complexities of identifying, searching, comprehending, and utilizing online information are explored.

Cognitive Flexibility Theory

Cognitive Flexibility Theory emerged from research addressing how learners acquire expertise of knowledge from an intermediate level to an advanced level, especially in ill-

structured domains (Spiro & Jehng, 1990; Spiro, Coulson & Feltovich, 1994; Jacobson & Spiro, 1995). Cognitive Flexibility theorists contend that although a sequenced, linear instruction is necessary for a well-structured problem at an introductory level, a non-linear learning environment is critical to knowledge acquisition, application, and transformation in advanced level. Such a non-linear learning environment promotes multiple access points to the intended knowledge, multiple representations of the knowledge, and multiple connective structures of the knowledge. A learner's cognitive flexibility refers to the ability to adapt to the differing problems by associating, reorganizing, restructuring, and applying the learned knowledge to new situations. As described by Sprio (1992):

> *The ability to represent knowledge from different conceptual and case perspectives and then, when the knowledge must later be used, the ability to construct from those different conceptual and case representations a knowledge ensemble tailored to the needs of the understanding or problem-solving situation at hand.*

Cognitive Flexibility theorists insightfully point out that the nature of irregularity in an ill-structured domain makes the strategy of learning from a single, individual case insufficient. Learning the same knowledge item from a number of resources will allow learners to appreciate the varieties of the knowledge item in different situations. Knowledge reinforcement, according to Cognitive Flexibility Theory, means not only repeating the knowledge a number of times, but also repeating the knowledge in different formats, different scenarios, and different connectivities.

Random-access instruction is an essential instructional principle promoted in the Cognitive Flexibility Hypertext environment. Random-access instruction emphasizes the importance of empowering a computer-based learning environment with the inherent ability of

nonlinear retrieval of information from the information system. The design of the open Web environment, powered by Information search technology highlights the tenet of random-access instruction.

In sum, Cognitive Flexibility Theory supports a computer-based learning environment that allows multiple access points to knowledge content, multiple representations of a the knowledge content, and non-linear retrieval of information pertaining to the knowledge content. All these can now be inexpensively afforded by the search technology-empowered open Web environment.

New Literacies Theory

Literacy activities are changing with the advancements in information technology. With the ubiquitous presence of online resources and information search tools, much more frequently, the activity of reading occurs online in a digital format with much more interactivities between readers and the reading environment. The media switch from the print-based offline reading environment to the web-based online reading environment requires more theoretical knowledge about online reading. In such a context, New Literacies Theory identifies theoretical constructs of online reading posed by the emerging phenomenon of online literacy practices.

New Literacies Theory considers technology as an integral component of online reading. A reader's control over available technologies at the time of reading influences the scopes, the ways, the paths, and the results of reading comprehension. New Literacies Theory extends the notion of technology from the static notion in print media such as papers, books, and articles, to a dynamic inclusion of WebPages, information search technologies, note-taking tools, blogs, wikis, tweets, and other newly-invented technologies.

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While a precise definition of New Literacies Theory is still in progress, Leu et al (2004) advanced the understanding of the theories by presenting the following definition:

The new literacies of the Internet and other ICTs include the skills, strategies, and dispositions necessary to successfully use and adapt to the rapidly changing information and communication technologies and contexts that continuously emerge in our world and influence all areas of our personal and professional lives. These new literacies allow us to use the Internet and other ICTs to identify important questions, locate information, critically evaluate the usefulness of that information, synthesize information to answer those questions, and then communicate the answers to others.

It can be observed from the above definition that the New Literacies Theory explores the skills and strategies required by a learner to perform literacy practice online. Five constructs were identified in the New Literacies Theory: identifying questions, locating information, evaluating the information, synthesizing information, and communicate the answer to others. These five components have been evidenced in recent research studies of online reading (Coiro, 2007; Coiro & Dobler, 2007; Castek, et al, 2007; Castek & Bevans, 2006;Mcverry & O'Byrne, 2009). However, the research in writing with online resources and information search technology is yet to be explored. The current study is situated in the framework of New Literacies Theory and endeavors to enrich the knowledge base regarding writing with the Internet search tools and web resources.

CHAPTER 3: LITERATURE REVIEW

In this chapter, in alignment with the research questions, the literature review examines four areas of prior research that are pertinent to the research questions: (1) what are the relationships between prior knowledge and hypertext learning that have been identified in the research literature? (2) what are patterns of Internet searching that have been identified in research literature, (3) how do writers coordinate prior knowledge, Internet resources, and technology while composing?, and (4) how do writers move from searching to writing in print media?

Prior Knowledge and Internet Search

Empirically, little is reported in the existing research literature regarding how writers' prior knowledge may influence the exploration of the topics on the open web, such as making on-the-fly decisions about what, when, and how to explore for further knowledge on a topic. However, earlier investigations on the effects of prior knowledge in a hypertext learning environment that focus on problem-solving and reading comprehension can provide suggestive information on how prior knowledge could possibly influence a writer's navigation, selection, and use of online information in a hypertext environment.

First, preceding research literature indicates that prior knowledge affects a learner's hypertext navigation (McNamara, Kintsch, Stoner, & Kintsch ,1996; Conklin, 1987; Dias & Sousa, 1997). Low prior knowledge learners are found more likely to get disoriented in a hypertext learning environment (Conklin, 1987; Dias & Sousa, 1997; Girill & Luk, 1992), one explanation was that when a low-prior knowledge learner is confronted with extensive links with little structural support, he is more likely to experience cognitive overload due to the excess amount of information beyond his processing capacity (Dias & Sousa, 1997). Besides, research

also suggested that low prior knowledge learners and high prior knowledge learners differed in their navigational success in hypertext system structures: low prior knowledge learners navigated more efficiently in a well-structured hierarchical text that reduces navigational difficulties (Gomes, & Correia, 1999). High prior knowledge learners, by contrast, profited most from a less structured, inductive hypertext learning environment (Pazzini, 1991; Shapiro, 1999).

Second, preceding research also indicates that that prior knowledge influences the rate of concept learning. For instance, Shapiro (1999) identified that high prior knowledge learners can actively solve learning problems in an ill-structured hypertext learning systems while low prior-knowledge learners felt difficult to learn new knowledge in an ill-structured hypertext learning systems because they lack of an existing mental model of the content to support their learning.   In addition, Moller et al. (2000) showed that a well-formed hierarchical hypertext system facilitates low prior knowledge learners' comprehension and low prior-knowledge readers gave better answers to questions with a hierarchical map than without a map.

Third, researchers have also shown that prior knowledge influences hypertext reading comprehension strategies. High-prior knowledge readers often use knowledge-based coherence building strategies to select nodes that are semantically related to previously read nodes in order to establish a coherent reading order for a linked set of texts (Foltz, 1996). By selecting a semantically related text, a high-prior knowledge reader is able to mentally organize the texts into a logical order or structure (e.g., Budd, Whitney, & Turley, 1995). The skillfulness of implementing coherence building strategies depends to a large extent on the prior knowledge of the individual reader (McNamara, 2001; McNamara, E. Kintsch, Songer, & W. Kintsch, 1996; McNamara & W. Kintsch, 1996). With sufficient prior knowledge, readers can still learn more from less coherent texts. In addition, there is evidence that prior knowledge also influences the

interest of readers, and thereby the effort they exert to seek and select new links among texts (Garner & Gillingham, 1991). Low-knowledge readers, on the one hand, find a new text incomprehensible, and thus quite boring. High-knowledge readers, on the other hand, find texts with familiar information to be redundant, and therefore without interest.

Taken together, the existing research indicates that prior knowledge influences a learner's hypertext navigation, rate of concept learning, and hypertext reading strategies. High prior knowledge learners appear to prefer a less structured hypertext learning environment while low prior knowledge students are likely to learn more effectively in a well-structured hypertext learning environment. Based on prior research, it is can be expected that high prior knowledge learners can also be successful in an open-web learning environment, while low prior knowledge learners are likely to be disoriented when searching and learning on the Internet.

Searching for Online Resources

Research on searching for online information has had different emphases, such as models of Internet searching, strategies associated with information use (Brand-Gruwel et al., 2005; Hill, 1999; Hölscher & Strube, 2000; Kuhlthau, 1993; Lazonder, Biemans, & Wopereis, 2000) and text evaluation and comprehension strategies (Leu, 2000; Coiro & Dobler, 2003; Coiro, 2005).

Seeking information on the Internet often results in a long list of results, which link to a myriad of websites that in turn have information with links that represent a particular purpose and perspective. To gather useful information, a student needs to weed through information sources on the Internet to determine relevancy, placing himself in a role traditionally preformed by an information expert. This is not an easy task. As stated by Cronin and Hert (1995), "searching for information on the Web is like foraging---only we do not necessarily possess all

the necessary skills and tools we need to help ensure a successful hunt". To better understand the Internet information-seeking process, several researchers (Guthrie and Weber, 1993; Marchionin 1995; Kuhltha, 1993;Hill, 1997; Eisenberg and Berkwitz, 2001; Brand-Gruwel, Woperis, and Walvaren's, 2009) proposed conceptual models to capture the phases of Internet information searching. To date, three prominent conceptual models are the: (a) open-ended information seeking process model (Hill, 1997), (b) Big 6 information and technology literacy model (Eisenberg and Berkowitz, 2001), and (c) Internet information problem solving model (Brand-Gruwel et. al , 2009).

The open-ended information seeking process model (Hill, 1999; Hill & Hannafin, 1997, Hjorland,1997; Kuhlthau, 1991; Laurel, 1993; Marchionini, 1995; Stonier, 1997; Stripling & Pitts, 1988; Walster, 1996,) consists of two phases: navigation, and process. During the navigation phase, a searcher typically employs a series of navigational strategies such as planning, organizing, selecting, scanning, browsing, searching, foraging, retrieving, and exploring. During the process phase, a searcher characteristically engages in two additional phases: (a) evaluation, and (b) transformation and integration.

The Big 6 information and technology literacy model (Eisenberg and Berkowitz, 2001) also specifies the process of using Internet search tools to solve information problems in six steps, but using slightly different terms. The phases include: task definition, information seeking strategies, location and process, use of information, and synthesis.

The Internet information problem solving model describes the skills needed to solve an information problem when the Internet is used (Gruwel, Woperies, and Walraven, 2009). Five search skills are defined in this model: define information problem, search information, scan information, process information, and organize and present information. In this model, three

overarching layers of skill serve as preconditions for skilled Internet information searching: (a) reading skills, (b) evaluating skills, and (c) computer skills. Self-regulation activities such as orientation, monitoring, steering, and evaluating are embedded in the five skills.

Taken together, these three models identify the phases, strategies, and the skills needed to search for information on the Internet. However, unattended to in these three models is a detailed explanation of how a searcher manages cognitive loads and keeps track of search goals. Knowing details for modeling strategies about information load is important because when the input of information is beyond the processing capacity, a searcher is very likely to be lost among a fast stream of information and not be able to benefit from the large volume of web information.

How do Students Locate Online Information? Several empirical studies have identified the strategies students use to locate intended online information (Bilal, 2002; Eagleton, Guinee & Langlais, 2003; Hill & Hannafin, 1997). Together, these studies identify use three broad Internet search strategies: "dot-com formula", "shopping mall approach," and "search engine approach."(Fidel et al, 1999; Guinee, Eagleton, 2002; Leu, et. al, 2004; Coiro, 2003) The "dot-com formula" refers to students' attempts to formulate a web address by typing the research topic plus ".com" in the browser address bar with the hope of finding an existing website for the topic of search. For example, if a student intends to find information about George Washington, he may type "www.georgewashington.com " in the browser address bar, assuming the existence of such a website containing information for the topic of search.

The "shopping mall approach"(Guinee, Eagleton, & Hall, 2003) refers to another student approach to Internet search in which they seek to locate information as if at a shopping mall by visiting a particular store (i.e., a particular website) for a specific type of product (i.e., information on a topic). For example, a student already knows about discovery.com and directly

visits the site to explore the history of dinosaurs, or, directly connects to

mayoclinic.com because he has heard it is a good source for health information to treat a disease.

Note that both the "dot.com formula" and ''shopping mall approach" are non-search engine

oriented strategies. Instead, students formulate website addresses, be it by guess or for-sure prior

knowledge, and use the web browser as a tool to go directly to a known site for information

rather than search broadly among a number of sites for the one that is likely to yield the best

information needed.

By contrast, the "search engine approach" refers to the process whereby students

construct search keywords in a search engine text box and then screen search results to locate

intended information. Several studies have concluded that two factors are relevant to the

employment of the "search engine approach": (1) strategies for identifying effective search

keywords, and (2) strategies for recovering from unsuccessful search attempts (Eagleaton, 2000;

Coiro, 2007; Leu, 2004). For the first factor, most strategies for constructing effective search

keywords were identified as a "Single Term", "Topic + Focus", a "Topic", a "Focus", and a

"Question". For instance, using a "single term" strategy, a student would type "Jack London" in

the search engine box to find websites including information about Jack London. For the second

factor, successful strategies for recovering from unsuccessful search attempts include switching

topics, visiting additional websites, trying new keywords, changing search engines (Fidel, 1999,

Bilal, 2000, Bilal, 2001: Guinee, Eagleton, & Hall, 2003; Dobler, 2002, Henry, 2006; Leu et al,

2004; Brand-Gruwel et al. 2005; Eisenberg and Berkowitz 2000; Hess 1999; Land and Greene

2000; Lin and Tsai 2007). When a student is dissatisfied with the results of the search, he

usually implemented one or more of these recovery strategies to continue his search.

How do Students Evaluate Online Information? Students at different developmental levels have demonstrated varied levels of ability to critically evaluate information when they interact with online resources. At K-12 levels, empirical studies show that students from elementary school to high school seldom use strategies consciously to determine the quality of web information (Hirsh, 1999; Kafai & Bates, 1997; Large and Beheshti, 2000; Gunstone, 2002; Hoffman, 2003; Zhang & Duke, 2008). These studies consistently found that students tend to think that the presence of pixilized information itself was a solid enough reason to accept information as high-quality from online resources. Uniformly, students did not actively question the accuracy and reliability of online resources and assumed the online resources to be reliable just because they were published. In just a few cases, researchers found that students did evaluate website informaiton, however, the strategies they used were either oversimplified or ineffective ones (Clark and Slotta, 2000; Lorenzen, 2002; Hoffman, 2003, Henry, 2007). For example, in Hoffman et al's study, students judged the quality of online resources merely on the domain name. In Henry's study, only 1 percent of the students understood that authors and sponsors of a website can intentionally misrepresent the truthfulness of information online. And in Clark and Slotta's study (2002), students did not take into account the authority of the source when evaluating a theory on a controversial scientific topic presented on an Internet page.

At the adult level, studies indicate that sophisticated adult online readers used different strategies when reading online information (Zhang and Duke, 2008; Fitzgearald, 2000). Zhang and Duke (2008) investigated the evaluation strategies used by very skilled graduate-student readers. Their findings showed that effective evaluation strategies that good adult Internet readers used included: (a) constantly evaluating the credibility of the website before they made any judgment on the quality of online information; (b) evaluating website from multiple access

points; and (c) using official websites to retrieve relevant information. Interestingly, skilled adult readers in their study also evaluated websites based on their design, appearance, organization, affiliation, and point of view. Similarly, in Fitzgerald's (2000) investigation of 2nd-year doctoral students' online information evaluation strategies, she found that they used an ensemble of questions to judiciously evaluate the veracity of a site's information, such as: (a) Does the website mentioned research? (b) Does the website contain all active links? (c) Is the site overly burdened with graphics? (d) Who is the sponsoring organization? (e) What are the sponsors' motives?

In addition to descriptive empirical studies that examine the strategies students and adults use to determine the quality of web information, researchers from new literacies and media and information literacy have been prescriptive about the criteria that ought to be used when teaching students how to critically evaluation web information (Britt & Gabrys, 2001; Kurland, 1996; Stapleton, 2005; Coiro, 2007; Zhang & Duke, 2007). For instance, Coiro conceptualized the skills of critically evaluating web information as the abilities to "(a) question, analyze, and compare the resources they located; (b) judge the quality of information on various characteristics, and (c) defend their opinions with evidence from multiple sources and their prior knowledge" (p. 325). At a more practical level, Zhang (2007) proposed the WWWDOT approach to help elementary students to evaluate web information. Stapleton (2005) similarly suggested six questions that students should ask themselves when retrieving information from the Web: (a) Who is the author? (b) What authority does the site have? (c) How current is the information? (d) What is the intended audience? (e) What agenda does the author have? and (f) Is the content biased?

The data from the above empirical studies suggests that immediate access to a vast amount of information on the Internet can prompt students to use short search cycles that permit multiple, rapid variations on search strategies (Jacoson & Ignacio, 1997; Kuhlthau, 1997: Spires & Estes, 2002). Even when searching for exactly the same information, each information seeker's online path of cycles and stretches may be uniquely different (e.g. Bilal, 2000, Bilal, 2001: Guinee, Eagleton, & Hall, 2003; Leu et al , 2005) . In many cases, different information seekers actively construct unique texts as they read and evaluate the search results and make decisions about which links to follow or not follow in their quest for information (Coiro & Dobler, 2007). This rapid process prompted by the instant presence of boundless online information prompts new skills and strategies for keeping track of searching goals and connecting the located information with the purpose of searching. The work from these and other scholarly pieces suggests that when students ask a number of evaluative questions of each website and page in order to determine the relevancy, accuracy, reliability and bias of pictorial, textual and structural characteristics of online sources, they need a clear sense of their goals for information searching and need to be able to adjust the goal for new searches according to the critical evaluation of located web texts. More research is needed to address how students keep track of searching goals when locating and evaluating online information.

Writing from Sources

To date, the process of writing from sources has only been studied in offline, print-based settings that use a finite set of texts which are pre-selected for the students. In these studies, writing researchers (Graves, 1994; Spivey, 1984) have identified that writing from sources is a nonlinear, recursive process. Graves modeled his writing-from-sources approach on the everyday practices of journalists and other professionals who craft prose in their work activities. Spivey

designed a model of writing-from-sources which included the phases of organizing, selecting, and connecting. Her data indicated that composing from sources is a re-iterative process--writers repeatedly attempt to get successively closer to a writing goal by reading, writing, and re-cycling content, strategies, and structures in a myriad of purposeful ways--rather than a lock-step process of reading a source text first and then proceeding to write. Data from several other writing-from-sources studies support this argument. Fisher (1992), for example, who studied 14 students as they wrote in response to a task that required them to write from sources, found that nearly all students began writing as they read the sources texts and that their writing was not a stand-alone stage. McGinley (1992) found that the college students in his study were already thinking about possible sources to use when writing while they read source texts. In another study of six college students, Kennedy (1985) found that all students referred to their reading sources as they composed text, but at different points in the process. Thus, the claims made by Graves, Spivey, and others about the offline process of writing from sources are supported by data from a number of studies: the process does not proceed in a sequential fashion; rather, it is a non-liniear, recursive, and contingent process. There are theoretical and conceptual reasons to think that studies on writing from sources in the open, online, media-based environments will describe a similar process, but a body of empirical evidence is nascent (e.g., Spiro & DeSchryver, 2009).

Several studies have examined the offline information seeking process during the process of writing-from-sources and found the search process to mirror the offline writing-from-sources process in many ways: both were nonlinear, recursive, and contingent. Kuhlthau (1988) examined the search processes of high school students from the time they began their search for a topic to the moments they put final touches on their written document. From the verbal protocol data on these students she developed a six-phase model of the research process that

included the thoughts, actions, and feelings of students as they searched for information, formulated a focus, and began to write. Similarly, studies of college students indicate that they: (a) integrate research and writing (Fisher, 1992), (b) complete information search tasks as efficiently as possible (Marsella, Hilgus, & McLaren, 1992), and (c) use low- or high-investment strategies to search for the information they will use when writing (e.g., low-investment strategies: choosing a topic that is easy to write about, making a cursory search for materials, and summarizing that material; high investment strategies: choosing a topic of personal interest, search extensively for a specific text) (Nelson & Hayes, 1988). Given the scholarly work of Leu, et al (Leu, 2004) there is a strong case to be made that research that examines the online writing process from online sources will promote the understanding of the composing process in the digital age.

The offline tasks in these writing-from-sources studies have been of two types: write a *summary* of a single text or writing a *synthesis* of multiple texts. Both the summarizing and synthesizing tasks prompted students to select, organize, and connect content from source texts, but the cognitive demand of each prompt differed in important ways. The synthesis tasks were more cognitively demanding than the summarizing task. They demanded more complex elaboration and integration of ideas from different ''macropropositions'' of multiple textual sources (Segev-Miller, 2004a) and more decisions about the organizational structure to adopt when integrating the information from the different sources (Flower et al., 1990; McGinley, 1992; Spivey, 1997).

Research that builds on this distinction between offline tasks may need to consider the elements that online tasks demand of students writing from sources. For example, when a student searches the Internet to find information to support his writing, the process could be even

more demanding than summarizing and synthesizing. The student is not only asked to synthesize information from multiple sources, but also to select, critique, and integrate the source information with the main idea he is arguing.

<p style="text-align:center">Transitioning between Searching, Reading and Writing</p>

Little research has described how writers transition between searching, reading, and writing. While the research literature acknowledges that capable writers are generally skillful at selecting, transforming, and reusing resources to creating meaning in a new context (Hyland, 2007), the interstitial moment when a writer connects his/her searching goals with writing purposes, identifies the reading-writing nexus, and shapes the content of reading in relation to the requirements of a particular writing context, are largely unexamined. In this section of literature review, I reviewed several studies whose research questions are connected with the transitioning strategies between searching, reading, and writing.

Albeit in a tangential way, one study that examined such transitional moments and strategies between reading and writing, is a study by Kamberellis & Scott (1992). In their year-long investigation of how two students "appropriated" other people's language in their own essay writing, they found that children kept defining and redefining themselves in terms of their social identities (who they were and who they would like to become). In their writing, the two children used several transitional strategies such as *quoting*, *adopting*, *stylizing*, and *idealizing* to appropriate, orchestrate, and resist information from other resources. These strategies, thus, were the means by which students churned the ideas from their reading into the material for their writing.

In workplace writing environments, two studies describe how technical writers compose in a distributed writing environment where they are required to manage and coordinate a myriad

texts and technologies toward the goal of creating a manual for technical products (Slattery, 2004; 2005). The data indicates that technical writers employed "textual coordination" strategies, which involve selecting information from a large, complex information environment, and then "staging" it locally to support the writing document. The writers were skillful at (a) reusing entire documents from the information environment (e.g. saving a document with a different name and then making changes within it), (b) reusing parts of a document (copying and pasting text into another document), and (c) viewing multiple texts simultaneously. When reading source documents, the professional writers also decided how to proceed with editing the target document and how to incorporate elements from the source documents in the final target document. The writers described the recursive reading, copy-pasting, and editing process they used as an efficient way to work on the target document. These studies also found that writers who were best able to control environment conditions and maintain technology operational fluency were best able to stay focused on achieving higher-order writing goals. Put another way, the affordances of information technology provided the technical writers with the flexibility to solicit needed information and assemble it into the target document

Chapter Summary

To summarize, the foregoing four sections review the literature related to writing from sources. The review first identified under-informed areas in writing research, such as the role of prior knowledge in open-web searching and learning. Then by specifying the existing Internet search models, the review reveals the need for clarifying and describing the strategies students use to manage cognitive loads and keep track of searching goals during Internet searching and learning. Also, the review suggests the need for a knowledge about (a) the interstitial moments of

transitioning between searching, reading, and writing, and (b) a lucid description of the ways

students utilize search information in an argumentative essay.

CHAPTER 4: METHODOLOGY

The study employed a multiple-case study approach (Yin, 2003). Case study approach has been widely used by educational researchers to describe learning phenomena of small samples in depth (e.g. Merriam, 1998; Bassy, 1999). It is well suited to answering research questions that focus on describing, identifying, and explaining individual learning phenomena in depth. Researchers often adopt case study approach to investigate the *process* of an unknown phenomenon to uncover important variables and generate assumptions for future research.

In this study, the multiple-case study approach was used because it permits an in-depth analysis of a small sample of participants with a purpose to reveal the cognitive strategies that good college writers use when searching on the Internet for writing purpose. One of the salient strengths of using multiple cases is that it allows researching a situation through the minds of multiple students while preserving the exploratory and explanatory power of case studies. While the number of participants in this study is adequate to uncover some variability among the writers, it is acknowledged that the number of the cases in this study is not enough to give inferential power to the study.

The participants were 12 first-year excellent college writers. In the prior research studies that also adopted case study approach to investigate relevant topics such as reading from multiple sources, writing from resources, and online information reading and retrieving, the number of the research participants varied from 4 to 24 (Kennedy, 1985; Hartman, 1997; Spatt, 1996; Coiro, 2007). The reason behind recruiting a small sample size was because of the primary interest in the rich description of the phenomenon in these studies as well as the complex nature of the learning phenomenon that the studies attempted to explore.

In a chronological manner, this chapter outlines the steps of the research process. The participants, the instruments, and the analysis of data are described in detail. A review of trustworthiness is provided.

Participants

Participants in this study were all *proficient*, first-year college writers who were invited to the study according to the following four criteria: (1) They all have scored above 650 in SAT Writing Test; (2) They are all native English speakers; (3) They all have used the Google search engine as their primary search engine for more than 1 year; and (4) they were all above the age of 18 at the time of participating in the study. Participants were recruited with the assistance of the program director at a large mid-southern research university who helped to send the study invitation to the students in the program's internal email list. Students who are interested in participating in the study responded to the study invitation. At the meantime, multiple study fliers were posted in the main classroom buildings around the campus to encourage students' participation. Each participant received a $50 value gift card of a major online merchandise in appreciation of their time and effort.

Instruments and Materials

With the purpose of the study in mind, altogether, six instruments were designed, piloted, revised, and used in the study. The six instruments included pre-writing concept map prompt, writing prompt, video clips, post-writing concept map prompt, interview protocol, and survey questionnaire. Each instrument is described below.

Concept Map Prompt

A concept map prompt was given to the participants to capture their prior knowledge and knowledge structure of the writing topic (Appendix A). The introduction and instruction for the concept map were worded as follows:

> *Your task is in the next few minutes is to make a concept map. A concept map is a visual sketch of what you already know about the writing topic. It is a brainstorming technique. You will write as many different terms and phrases that you can think of about the writing topic onto a sheet of paper and then link these words together into a "map" or "web" of what you know. You can by randomly writing or drawing key terms and phrases on the page. Then you can create some order out of it by adding lines, arrows, or other connecting symbols. There is no right or wrong way to make a concept map. Try your best to jot down as many terms and phrases you know about the topic and try to link them together. Some of the words or phrases may not be connected to others, that's totally fine. Do you have any questions? [Pause] Let's get started.*

> *Now draw a concept map showing all you know about whether a city show preserve its old, historic building or destroy them and replace them with modern buildings.*

This prompt for the concept map was piloted in an earlier pilot study and the 10 collected concept maps indicated that the prompt effectively elicited students' prior knowledge and knowledge structure of the writing topic.

Writing Prompt

Given that writing research indicates a writing topic should be meaningful, interesting, and permit depth of learning (Eskola, 2005; Ford, 2004), the first three criteria for selecting a writing topic for this study were that the prompt focus on a topic that is potentially: (a)

meaningful, (b) interesting, and (c) permits depth of learning. Based on other writing research (Beheshti, et al., 2005; Hultgren and Limberg, 2003), two additional criteria were added to this study: (d) the topic must be vaguely recognizable yet not too familiar to the participants (i.e., students may have heard about the topic because it was mentioned in newspaper or other public media, but they haven't thought much of about it in depth), and (e) there must be sufficient information on the Internet to permit a complex, in-depth response to be derived from it (taking approximately 1.5 hours to search, read, and write).

Based on these five criteria, the following writing prompt (Appendix B) was selected for the study:

> *Should a city try to preserve its old, historic buildings or destroy them and replace them with modern buildings? Use specific reasons and examples **of your own and from the web** to support your opinion.*

This writing prompt was chosen from the TOEFL Writing Database developed by Educational Testing Service (Educational Testing Services, 2005). The prompt was slightly revised because of a pilot study so that it would more explicitly direct students to use information from their web searches to respond to the prompt. During the summer and fall of 2009, the original prompt was field tested with 10 first-year college undergraduate students. The results from students' concept maps as well as students' Internet search activities showed that students didn't have much prior knowledge on this topic and engaged in active online information searching and reading in order to complete an essay writing task.

Video Clips

While the participants were searching, reading, and writing, they were asked to verbalize their thoughts during the processes. The participants received training of the think-aloud method

before they started the given writing task. These think-aloud protocols and their searching and writing processes were recorded and saved as video clips.

Post-Writing Concept Map Prompt

After the participants completed the writing task, they were requested to draw another concept map based on their updated knowledge of the writing topic after searching on the Internet (Appendix C). The instruction for the post-writing concept map was worded as follows:

> *Now that you have searched on the Internet and completed the writing task, please draw*
> *a concept map showing all of your knowledge about whether a city should preserve its*
> *old, historic building or destroy them and replace them with modern buildings.*

The purpose of using post-writing concept maps in this study was to provide information for the changed knowledge model after the students set out searching and reading on the Internet.

Interview Protocol

During the study, the students were asked four clusters of questions in line with four research questions to elicit their reflections on how they use prior knowledge for online searching, how they connect searching, reading, and writing, how they keep track of searching goals, and how they transform web information into contents of their essays. In particular, four topics were asked about their searching and writing in general: *prior knowledge*, *connections among searching, reading, and writing*, *search goals*, and *online information use*. These topics were selected because they were the central foci of this study and they provided additional information about the participants' use of Internet search technology for writing purposes beyond the period of the research section. The interview data was corroborated with the screen searching behavior and verbal protocol data. Structurally, there is an underlying pattern to the type and

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sequence of questions asked about each of the four topics. For instance, the interview questions

for the topic of *prior knowledg*e progress in following order:

What do you think it means to use your prior knowledge to search on the Internet for a

writing task?

How do you go about deciding to use your prior knowledge to search on the Internet?

How do you do that?

How important is it to you to use your prior knowledge to search on the Internet for a

writing task? (Follow-up: When you are on the Internet, is checking information sufficiency a

low priority or a high priority for you? Why?)

The questions for *information connection*, *search goals*, and *information transformation*

followed a similar structure (Appendix D). The interview questions have been piloted with 10

first-year undergraduate students at Michigan State University during summer 2009 (Zheng &

Hartman, 2010).

Survey

At the end of the study, the participant writers answered a pre-designed survey (Appendix

E). The survey instrument was developed in an earlier study to explore factors underlying

students' use of Internet search tools to support the writing process (Zheng & Hartman,

2010). Forty-two survey questions were designed, revised, and tested with 249 undergraduate

students at a Midwestern university in the earlier study. The 37 non-demographic items explored

6 factors of Internet searching and writing: (1) perceived usefulness of Internet search tools, (2)

flexibility in adapting online information, (3) Reliance on Internet search tools during writing, (4)

self-monitored search goals, and (5) strategies of retaining online information, and (6) experience

of using Internet search tools. The internal consistencies of each factors ranged between 0.63-0.74, which indicated the reliability of the survey.

Research Procedures

Between the months of July 2011 and November 2011, I met with each of the 12 participant writers in a quiet study room at the university library. Each research session was composed of seven research activities arranged in a sequence as described below:

Pre-research Setup

The study used Techsmith Morae 3.0.1 tracking software to capture students searching and writing activities as well as their think-alouds and their answers to the interview questions. Prior to the study, the Morae software was installed in the "recorder laptop" which the participant used to complete the writing tasks. To ensure browser equivalence, the Google search home page was set as the default homepage of both "Firefox" and "Internet Explore" browsers. At the beginning of the study, the participants were informed about the purpose and procedures of the study and then signed the IRB form.

Think-aloud Training Task

To begin with, each participant was first explained the meaning of think-aloud and was asked to do a practice search task to locate the next day's local weather forecast while practicing thinking out loud. The purpose of this fairly easy task was to help participants feel comfortable with the request to think aloud while searching and reading.

Reading Writing Prompt out Loud and Drawing a Concept Map

Next, the printed writing task was provided to the participants. The participants were requested to read out loud the writing prompt so that they understood that they will be using web information as well as their personal knowledge to complete the writing task. After reading out

loud the writing task, the participants were asked to draw a concept map of the selected topic on a piece of blank A4 paper. There was no time limit on the concept map task, and the participants decided on their own when they completed the task.

Internet Searching and Essay Writing

When the participants finished drawing their concept maps, they started Internet searching and essay writing. During this period, participants were instructed to think out loud while they searched online and wrote the essay. If a participant stopped talking during the search, and writing, he or she was reminded to "keep talking," but the participants were not asked to elaborate on any specific thing they said for the purpose of maintaining their flows of thinking. No additional guideline was given in terms of time limit or procedures of searching and writing based on web information. Participants were merely told to search and write in a way that they thought would help them write a better essay and they were encouraged to use other available tools such as Word document, bookmarks as they usually do. The purpose of doing so was to provide the participants with a natural writing environment that would allow the participant writers to search and write as they usually did.

Post-Writing Concept Map Drawing

After the completion of the essay writing task, the participant writers drew the second concept map based on their updated knowledge on the writing topic. The purpose of drawing the second concept map was to identify changes of the students' knowledge and knowledge structure on the selected writing topic after interacting with online resources.

Interview and Survey

In a semi-structured interview format, participants were also asked the interview questions. The interview questions asked participants to reflect on how they usually use Internet

search tools for writing purposes. It were emphasized that there were no "right" or "wrong" answers to the questions and that "I just want to know what you think." The questions were read from the research script (Appendix F) in a conversational style in the same order for all participants. If a participant was unable to answer or clearly misunderstood a question, it was repeated. The entire interview responses were also recorded by Morae software. In general, the interview sessions were informal, and lasted approximately 30 minutes for each participant. At the end of the study, the participants completed the pre-designed questionnaire.

Data Analysis Procedures

As a result of data collection, a total of 84 data files from 7 different data sources were collected including 12 video recordings, 12 thinkaloud protocols, 12 interview responses, 12 pre-writing concept maps, 12 post-writing concept maps, 12 written essays, and 12 survey responses. Data analysis followed a grounded-theory model (Glaser, 1992; Glaser & Strauss, 1967), which seeks to identify patterns and strategies that emerge from the data. With the primary interest in the four research questions, the goal of data analysis was to develop an understanding of (1) the role of prior knowledge in searching and writing, (2) strategies student used to reduce cognitive loads locate information, (3) strategies to transform web information into written texts for an effective essay, and (4) the interstitial moments of connecting searching, reading, and writing. Corresponding to each data source, data analysis proceeded along six paths. The following describes the data analysis procedure for each data source.

Data Analysis for Concept Maps

Data analysis for both pre-writing concept maps and post-writing concept maps were followed the recommendations given by Novak and Gowin (1984) that coding of a concept map

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should highlight both relationships and contents of each identified items. In this study, the coding scheme was developed in four categories to inform participants' prior knowledge and know: perspective, supportive points, additional Interpretations, and specificity. Table 1 presents categories for a concept map coding scheme.

Table 1: Coding Scheme for Concept Maps

Codes	Definition	Examples
Perspective (Yes/No)	The participant indicated an <u>explicit</u> stance in a concept map stating a particular position and attitude he/she adopted toward the writing topic.	"A city should preserve it's old buildings rather than tear them down" "building modern structures"
Supportive points	The participant listed the major points in a concept map that support the essay's perspective.	(1) "safety issues," and (2) "create new jobs/economy." (1) "nice to be able compare life style from different times," (2) "architecture can not be replicated the same," (3) "bring a balance to life," and (4) preserve old buildings for future generations' benefit."
Additional Interpretations	The participants added additional interpretations under the major points to strengthen his/her argument	"The architecture of historic buildings often becomes ingrained in the minds of visitors; when replaced, are often viewed more fondly and prettier than the replacing building." "modern appliances are very different than those of past decades, and require different energy sources and different arrangements."

Table 1 (Cont'd)

Specificity	The participants used specific terms, names, labels, and examples in a concept map	Alcatraz prison, UNESCO world heritage site

Data Analysis for Think-aloud Protocols

The analysis for think-aloud protocols evolved through three phases, each of which involved reviewing data from think-aloud protocols to provide insights for the research questions. During the first phase, an overall sense of the data was gained from a general review of think-aloud transcripts to gain an understanding of the nature of decision making process of online searching and writing. Within the think-aloud protocols, the unit of analysis was identified. In this study, the unit of analysis was identified as think-aloud utterance. The think-aloud utterance comprises those words spoken aloud by a student that are preceded and followed by some period of silence (Kamberelis & Scott, 1992). An utterance usually begins when a participant starts think-aloud; it ends when a participant resumes silent reading (Hartman, 1995). For example, the following utterances a participant said represents one think-aloud utterance:

I keep reading and I see some points that argue with, which I wrote on my concept map, the new construction will give money or give jobs to tons of people, which is good, but I see the replacing will take up money, which was bad, but I was thinking I can argue because if you preserve it, it will become the icon of the city, which is going to make money because a lot of tour people will come. So I can cover that part.

The think-aloud utterance has been used in a number of verbal protocols to analyze the interconnections of knowledge use and to identify the linking between utterances (e.g Hartman, 1995).

During the second phase of analysis, Glaser's (1992) grounded-theory procedure was

applied. First, the transcripts of think-aloud protocols were reviewed to (a) get a general sense of

the data, (b) assign tentative labels to each think-aloud utterance, and (c) look for patterns across

these think-aloud utterances. The first three transcripts were coded using categories that are

tentatively defined. Next, the tentatively-defined categories were reviewed in light of previous

research on the theories of online reading comprehension and Internet searching to inform

the formal coding process.

The third phase of think-aloud data analysis was informed by the tentative patterns

presented among our participants in relation to the four research question about Internet

searching and writing processes used by students. When the cases were compared, evidences of

the writers following a loose structure of steps and strategies that seemed to recur during their

searching and writing process was emerged.

Data Analysis for Video Clips

Data analysis for video recordings proceeded along two paths. The first path involved the

identification of patterns in the data that *Morae* generated in a spreadsheet while the participants

were searching and reading online (e.g., number of URLs viewed, number of hyperlinks clicked

etc). Simple descriptive statistics were calculated (Graham, Tse & Keselman, 2006). The second

path involved coding participants' searching and reading moves as captured by the Morae video

of on-screen activity. Codes were developed to distinguish between a variety of distinct

participant actions such as clicking on a browser's "back" button and typing a URL directly into

a browser's address bar, or clicking a link chosen from a results list on a search engine results

page and clicking a link in the navigation sidebar of a "content" webpage (i.e., a non-search

engine page). The application of this coding scheme to the Morae recordings of the participants'

screen activity resulted in a linear trail of codes for each participant. Each individual code

represented a distinct "move," and the order or syntax of the codes represented the sequence in

which searching and reading activities occurred.

Table 2: Coding Scheme for Screen Movements

Sample Coding Categories	Coding Definition
1. URL	Typing in the text box of the address bar and hitting enter (and copy the string used)
2. S-BEG	Search engine start-to-use (with note re. name of search engine or SWITHIN for a search engine/tool on a non-search engine webpage) (GOO, YAH, BIN, DOG)
3. S-END	Search engine stop-to-use (Note: code 3 *before* 9 when a subject clicks on a link from a search engine results page)
4. S-TYP	Typing in search engine box start and click (note "NOTEN" if the student did not click enter; also: copy the string used into the Morae notation box)

Data Analysis for Written Essays

Data analysis for written essays was driven by the interest in identifying the new

knowledge presented in the final writing products as well as the strategies and patterns of the

students' uses of web information for writing. Coding schemes were thus developed to capture

the relationships between the original web information and the transformed web information in

the written essays. Accordingly, the data analysis for written essays followed four steps.

The first step was to identify the sentences in the students' essays that incorporated web

information. To do so, the video clips and students' think-alouds were reviewed. The sentences

that incorporate web information were identified in the following three situations: (1) Every time

during the essay writing process, a student made a pause in his writing and turned to the notes

he/she took earlier or went to the Internet to search for certain information, the sentence he/she

immediately wrote after the note-, or web-referencing event was evaluated. If the sentence contained the note and the web information, that sentence was highlighted and identified as the sentence that incorporated web information. A screenshot of the original webpage(s) he/she was referring to was taken and linked to the sentence. (2) Every time during the essay writing process when a student indicated in his/her think-aloud that he/she was using the information that was found earlier, even though without referring to the note or a website, the sentence she/he was writing was highlighted and identified as the sentence that incorporated web information. The original webpage(s) were identified and linked to the sentence. And (3) every time during the Internet searching process when a student took a note or indicated he/she will use the particular web information he was browsing on a web page later in his/her essay, a screenshot of the webpage was taken and compared with the student's' essay. If a sentence in the essay contained the particular information the student mentioned in the screenshot webpage, the sentence was highlighted and identified as the sentence that incorporated web information.

The second step was to evaluate the statistical contributions of the sentences that incorporated web information to each essay. Descriptive statistics such as numbers of the sentences that incorporated web information identified in each individual participant's essay, the percentage of the identified sentences in the entire essay was calculated.

The third step was to examine the quantitative relationships between the highlighted sentences and the written essays. The identified relationships were reported through four angles based on their contributions to the classic structure of an argument: theme, claims, evidence, and counter arguments. These four angels were chosen to determine the qualitative contributions that the highlighted texts contributed to the written essay: Table 3 presents the coding scheme that applied to code the highlighted sentences.

Table 3: *Coding Scheme for the Sentences Incorporating Web Information*

Coding Category	Category Definition	Example
Theme	The highlighted sentence serves as the theme of the essay	To a city's population, the most important question faced will be the price tag on the final project. In the current global economic recession, group will be more likely to pay less for a project, as long as quality and durability are considered.
Claims	The highlighted sentence serves as a topic sentence in the essay	Going back to history and its effect on the citizen, historic towns tend to create a strong cultural background that helps facilitate a sense of self and awareness of decisions being made through local government.
Evidences	The highlighted sentence serves as an evidence of a topic sentence in the essay	Kell hall had safety concerns with the buildings structure and it was costing the university millions of dollars per year. If the University kept it like it was the University would be wasting money on something that was not safe for students. There are over 80,000 properties maintained by the National Register of Historic Places in order to connect the present with the past.
Counter-argument	The highlighted sentence serves as the counterargument or part of counter argument of the essay	While she thinks that destroying old buildings also destroys the sense of community, it will in fact do quite the opposite.

The fourth step was to evaluate the relationships between the highlighted sentences and the original web information. For each highlighted sentence, the relationships between the highlighted sentences and original web information were analyzed to determine the types of transformation from original web sources to essay sentences. By using the above coding schemes, the relationships between highlighted sentences and the written essay, between the highlighted sentences and the original web page were captured.

Data Analysis for Interview Responses

The data analysis for interview responses followed earlier qualitative researchers' suggestions (Bogdan and Biklin 1998). The interview transcripts were first read two times to obtain a general sense of the data. The students' answers were grouped based on each interview topic. Then the initial coding categories were generated and special vocabulary that the students used were marked. After combining and subdividing coding categories, the repeating ideas and larger themes that connect codes were identified. The identified patterns were corroborated with think-aloud data and video recordings to answer the research questions.

Data Analysis for Survey Responses

The data analysis for students' survey responses proceeded in two steps. First, a students' survey response was linked with his/her research data from other research activities (verbal protocol, interview, video recording, essay etc) to supply additional background information of the participant and to corroborate with the findings. Students' answers to the survey question were reported. The second step involved analyzing students' survey responses as a group. Simple statistics such as mean score and frequencies were report to gain an understanding of patterns of students' searching and writing behaviors with the Internet search tools.

Data management was conducted using two computer programs. For the quantitative analysis, SPSS statistical software was used; and the Nvivo program was used to manage the qualitative data. Specific data sources and procedures used to answer each of the research questions are described below.

Data Sources for Research Question 1

The question addressed the role of prior knowledge during the participants' Internet searching and reading. Five data sources—pre-writing concept maps, screen recordings (Internet search portion), verbal protocols (Internet search portion), and interview and survey responses (the first cluster of interview questions)—were used to answer the first research question. Answers to this question were sought by describing the patterns emerging within the concepts maps, (Internet search) screen recordings, and (Internet search) verbal protocols. Emerging relationships among prior knowledge measured by the concept maps, Internet search screen recording, and Internet screen protocol data sources were identified and presented. Representative examples for each emerging pattern and relationship were detailed, described and analyzed.

Data Sources for Research Question 2

The question examined how the writers managed cognitive load online. This question was addressed by the information provided from four data sources: screen recordings (Internet search portion), verbal protocol (Internet search portion), interview data, and survey data. A primary focus was put on screen recordings and verbal protocols. The strategies that the participants used to manage cognitive load and to track searching goals were identified. Examples for each identified strategies and patterns were detailed, described and analyzed.

Data Sources for Research Question 3

The third research question explored how the writer used online information for the given writing task. Six sources of data—verbal protocols (essay writing portion), screen recordings (essay writing portion), written essays, post-writing concept maps, as well as the interview and survey responses—were used to answer the research question about writers' uses of online resources. The written essays provided patterned information about the ultimate use of searched online information and prior knowledge in the final written essays. Screen recordings and verbal protocols provided patterned information about the writers' strategies for determining where and how they use online resources in their essay writing. Interview and survey answers provided information in terms of how they usually use web information for their writing tasks. Taken together, the analysis of these 6 sources resulted in an understanding of how online information influences the composition of written essays.

Data Sources for Research Question 4

Four sources of data— Participants' verbal protocols, video clips, Interview responses and survey responses—were analyzed for patterns during the interstitial moments from searching to writing. The interview responses provided information about the writers' approaches to connecting online information with the given writing task. The survey responses yielded secondary information regarding how the participants connecting online information with a writing task. The students' responses were analyzed to understand how the writers become aware of, and handle the connections between online information and a writing task.

<center>Trustworthiness</center>

Many researchers (Lincoln & Guba, 1985; Padgett, Onwuegbuzie and Leech , 2007) have addressed directly to the issues of trustworthiness of qualitative research studies. In general, they explain trustworthiness as a fair and ethical process by which researchers use rigorous collection

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and analytic procedure to closely represent the experiences of the participants (Lincoln & Guba, 1985; Padgett, 1998). Researchers identified several threats to trustworthiness of a qualitative study and suggested methods to address these threats. In this study, there were two areas where the trustworthiness of the data could be questioned.

The first threat to trustworthiness was the possibility of researcher bias. A review of literature indicates that there are several ways that research bias can be threaten a study a priori. For example, a threat to trustworthiness could occur if a researcher fails to recognize other themes that may emerge during the data analysis process, or if a researcher misinterprets the data. This type of threat was addressed in the current study through the use of inter-coder agreement measures, and the constant revising of themes throughout the analysis process. To ensure reliability in data coding, a second coder was invited to code three randomly-selected participants' research data from each of the data source including think-aloud transcripts, recorded screen movements, interview transcripts, pre- and post- writing concept maps. This second researcher was provided with the coding schemes for each of the data source and asked to identify codes that conceptually fell within the provided codes. The second researcher's coding results were then compared with the codes identified in the initial coding of the data. The two sets of coding results were compared to establish inter-coder agreement, which was 81.67% agreement between the two researchers' coding. The disagreements in coding results were discussed between the two coders and recoded. After the establishing of the inter-rater reliability of codes, I independently coded the rest of the 9 participants' research data. Each of the 9 participants' data was coded twice to ensure the reliability of the coding results.

The second threat to trustworthiness was the possibility of over-interpretation of themes from one particular data source. Data triangulation was applied to address the threat in this study.

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The study used multiple data sources to inform the participants' online searching, reading, and writing processes. In addition to direct analyses of data from the participants' online searching behavior and think-aloud protocols, the interview data and survey data were analyzed to confirm, disconfirm, clarify, or extend emerging findings from the searching and think-aloud data, and also provided additional information that contributed to online searching and writing. Finally, the pre-and post- concept map provides additional evidence of the changes of knowledge and knowledge structure after Internet search and learning occurred.

CHAPTER 5: FINDINGS

Description of the Research Participants

As a result, 12 students who met the study recruitment criteria participated in this

research study. Table 4 shows a summary of the writers' demographic data and their uses of

Internet search tools for writing assignments, including gender, age, race, SAT writing score,

experience of using Internet search engines, frequency of using Internet search engines,

frequency of using Internet search engines for high school writing assignments, and frequency of

suing Internet search engines for college writing assignments. Of the writers participating in this

study, ten (83.33%) were females; two (16.67%) were males. Eleven (91.67%) of the participants

were between the age of 18-20 at the time of the study; and one (8.33%) was between the age of

21-23. Eight (66.67%) participants were white, two (16.67%) were Asian-American, one (8.33%)

was African-American, and one (8.33%) was Hispanic.

The participants' SAT writing scores ranged from 650 to 760, with an average score of

690. According to the statistical report from College Board, they all achieved above 90 percentile

in the SAT writing test and can be considered as proficient writers when compared to their same-

grade peers. Of these 12 participants, two (16.67%) participants' SAT writing scores were

between 730--760, two (16.67%) between 700--730, and eight (66.67%) between 650--700.

Ten (83.33%) participants reported that they had used Google search engine for more

than 5 years, and two (16.67%) participants reported that they had used Google search engine for

four to five years. All 12 (100%) participants reported that they used Internet search tools on

daily basis.

Furthermore, one (8.33%) participant had used Internet search tools for less than 40% of

high school writing assignments. Four (33.33%) participants had used Internet search tools for

between 40%-60% of high school writing assignments; four (33.33%) for more than 60%, and three (25%) for every high school writing assignments.

For college writing assignments, the numbers increased considerably. Two (16.67%) participants had used Internet search tools for between 40%-60% of college writing assignments. Three (25%) had used Internet search tools for more than 60% of college writing assignments, and 7 (58.4%) used Internet search tools for every of their college writing assignments. Half of the participants (50%) reported that they used Internet search tools more often for college writing assignments than for high school writing assignments.

In addition to Table 4 that presents the summary of the demographic characteristics and background of writing with the Internet for the 12 participants as a group, Table 5 provides the background information of each individual participant for the purpose of a better understanding of the examples and cases presented in the following sections.

Table 4: Essential Characteristics of the Study Participants

Characteristics		Frequency	Percent
Gender			
	Male	2	16.67%
	Female	10	83.33%
Age			
	Between 18-20	11	91.67%
	Between 21-23	1	8.33%
Race			
	White	8	66.67%
	Asian-American	2	16.67%
	African-American	1	8.33%
	Hispanic	1	8.33%
SAT Writing Score			
	Between 730-760	2	16.67%
	Between 700-730	2	16.67%
	Between 650-700	8	66.67%
Years of Using Google Search Engine			
	More than 5 Years	10	83.33%
	Between 4-5 Years	2	16.67%
Frequency of Using Internet Search Tools			
	Daily	12	100%
Frequency of Using Internet Search Tools for High School Writing Assignments			
	Less than 40%	1	8.33%
	Between 40%-60%	4	33.33%
	More than 60%	4	33.33%
	Every time	3	25%
Frequency of Using Internet Search Tools for College Writing Assignments			
	Between 40%-60%	2	16.67%
	More than 60%	3	25%
	Every time	7	58.33%

Table 5: Background Information of Individual Participants

Participant	Gender	Race	SAT Writing Score	Years of Using Internet search Tools	Frequency of Using Internet search Tools	Frequency of Using Internet search tools for High school writing Assignment	Frequency of Using Internet search tools for College writing Assignment
Anne	F	White	670	More than 5 years	Daily	Between 40% -60%	Every time
Yaira	F	Asian	730	More than 5 years	Daily	More than 60%	Every time
Kaitlyn	F	White	710	More than 5 years	Daily	Between 40-%60%	More than 60%
Emma	F	White	720	More than 5 years	Daily	More than 60%	More than 60%
Keen	F	Asian	760	More than 5 years	Daily	Every time	Every time
Kathy	F	White	670	More than 5 years	Daily	Between 40%-60%	More than 60%
Matthew	M	White	710	More than 5 years	Daily	More than 60%	Every time
Delaney	F	White	690	More than 5 years	Daily	Between 40% -60%	Between 40% -60%
Monica	F	Hispanic	660	More than 5 years	Daily	More than 60%	Every time
Jon	M	White	650	More than 5 years	Daily	Every time	Every time

Table 5 (Cont'd)

Nana	F	African-American	650	4-5 years	Daily	Less than 40%	Between 40% -60%
Gail	F	White	670	4-5 years	Daily	Every time	Every time

N=12

Research Question 1: What are the Roles of Prior Knowledge?

The first research question explored the role of prior knowledge in the 12 good writers'

online searching and writing. Analyses and corroboration of data sources including writers' pre-

writing concept maps, Internet searching video clips, think-alouds, and the writers' responses to

the interview and survey questions yielded multiple findings that are arranged below in six

sections. The first section investigates the importance of prior knowledge in orienting online

searching, revealing that prior knowledge is the major source to orient the participants' online

searching. The second section specifies the three specific roles that the writers' prior knowledge

played in orienting online searching. The third section investigates the relationships between the

writers' prior knowledge and their online searching, reading, and writing behavior, suggesting

the potential linkages between them. The fourth section presents the nature of prior knowledge

and the varied priorities of checking one's prior knowledge as reported by the participants. And

lastly, the fifth section summarizes the major research findings for this research question.

Prior Knowledge as a Major Source to Orient Online Searching

At the moment a writer is landing on an Internet search page, he/she is

immediately prompted by the Internet search engine to determine what information to search for

and what search query he/she would like to use to find the intended information. Search queries

are, therefore, straightforward expressions of a writer's intentions of online searching, and, at the same time, serve as vehicles to bring the writer from a local, individual-based knowledge context to an external, interconnected web of information. An understanding of the sources that contributed to the participants' search queries, hence, can provide an insight to how writers are oriented to search for what they are searching as well as well as how important the writers' prior knowledge is in orienting their online searches.

In this study, three sources were identified as the sources that contributed to the search queries generated by the 12 good writers: prior knowledge, writing topic, and web content.

Prior Knowledge. Prior Knowledge was identified as the most significant source that the participants drew from to orient the writers' online searching in this study. The participants used all levels of knowledge listed on the concept maps including opinions, supporting points, and specific details as search queries to conduct online searching. Table 6 presents the coding scheme for the category of prior knowledge as a source of to orient online searching. Examples of drawing upon prior knowledge to construct search queries included "plantations historic houses", "house of slaves", "famous plantation house in North Carolina", "Belville Plantation circa 1790" "Margret Mitchell house", "rates of building material", and "tourism income".

Table 6: Coding Scheme for Prior Knowledge as a Source to Orient Online Searching

Category	Search Queries Sources	Example
Prior Knowledge	Specificities listed in a concept map	crow nest college park GA
	Specificities not listed in a concept map	King Tut Robert Toombs

Table 6(cont'd)

	Supporting points listed in a concept map	A city should preserve old historic buildings for future generation. benefit of visiting museums for children Historic building health hazard
	Combined supporting points listed in a concept map	architecture rehabilitation
	Additional interpretation based on supporting points listed in concept map	cost of renovation tourism income cost of demolishing a house how much does it cost to replace a historic landmark?

In this study, an extreme case of using prior knowledge to generate search queries was found in Kathy. During the course of her online searching, Kathy closely referred to her prior knowledge and generated 7 search queries. They included "ways of expanding a city without destroying existing buildings" "buildings as a source of heritage and history", "when there is no room left in the city to build buildings, should you destroy buildings" "a city should preserve older historic buildings for future generation's benefit", "benefit for children visiting a museum", "historic buildings create a sense of history". These 7 search queries were all originated from the supportive points she listed on her concept map. Instead of searching online to increase the general knowledge on the writing topic, Kathy was very specific in searching for more information pertaining to her prior knowledge of the topic.

Out of the 85 search queries that the 12 participants generated during the study, 59 of the search queries came from the participants' prior knowledge. Although these 59 search queries all drew upon the participants' prior knowledge, they varied in their roles of guiding the participants'

online searching. Specific roles of prior knowledge in guiding the participants' online searching are explained later in this chapter.

   Writing Topic. The writing topic was identified as the second major source that the participants used to generate search queries in this study. The participants used either original phrase from the given writing prompt or similar ones as search keywords to conduct online searching. Table 7 presents the coding scheme used for the category of writing topic as a source to orient online searching.

Table 7: Coding Scheme for Writing Topic as a Source to Orient Online Searching

Category	Search Queries Sources	Example
Writing Topic	Original writing topic	should a city try to preserve its old historic buildings or destroy them and replace them with new modern buildings
	One of the perspectives provided by the writing topic	advantages of historic buildings benefits of preserving historic buildings reasons to tear old buildings down
	Variations of the writing topic	destroying historical landmarks pros and cons

   The writing topic was used as the source of search queries when the participants were searching for general ideas about the writing topic, mostly at the beginning of online searching. For instance, at the beginning of Yaira's online search, she said *"I open up Google. First, I usually entered the question that they gave, which is "should a city try to preserve its old historic buildings"* Then Yaira typed the entire writing topic in Google " should a city try to preserve its

old historic buildings or destroy them and replace them with new modern buildings". For the same reason, Matthew started his online searching by using the query "benefit of historic buildings", as he explained, "I searched benefit of historic buildings just to get an overall reach of the essay." Other participants used the phrases such as "advantages of historic buildings" , "disadvantages of historic buildings", "benefits of preserving historic buildings" to search online for general ideas of the writing topic.

Using the writing topic as search keywords also occurred in the middle of online searching when the participants were unable to find the desired information online and decided to start all over again. Kaitlyn, after several rounds of unsatisfactory searches, she decided to try a different approach "At this point, I would probably change my approach because this is not working for me." Kaitlyn thought out loud, "I will start from scratch, destroying historical landmarks pros and cons, as she was typing in Google "destroying historical landmarks pros and cons". In a similar situation, Nana couldn't find a satisfactory result for her search of a historic location, she decided to abandon the search and on the Google search bar at the top of the search result page, she typed in "non benefit of old historic buildings" .

In this study, a noticeable case of using the writing topic to generate search queries was found in Gail. Throughout her online searching process, Gail generated 7 search queries that were all came from the given writing topic: "preservations of historic building", " reasons for destruction of historic buildings" , "reasons to tear old buildings down", "advantages of modern buildings" "advantages of demolition of old buildings" "advantage of new buildings", and "advantage of preserving historic buildings". All of these search queries centered on the essential inquiry about advantages and disadvantages of modern buildings and historic buildings prompted by the writing topic. Gail took a global approach to the writing topic and searched the

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web for the information regarding to the two possible perspectives of the writing topic. Instead of referring to one's prior knowledge like Kathy did, Gail was interested in searching for and reading the available online information on each perspectives.

In this study, out of the 85 search queries, 23 of them were identified as originating from the given writing topic.

Web Content. Web content was identified as the third source of search queries that the participants used to generate search queries. When the participants were reading online, occasionally, they were inspired by the online information and used a segment of online information as search keywords to orient online searching. Table 8 presents the coding scheme for web content as a source to orient online searching.

Table 8: Coding Scheme for Web Content as a Source to Orient Online Searching

Category	Search Queries Sources	Example
Web Content	Phrases in a webpage	National Registry of Historic Places Washington's Headquarters State Historic Site
	Questions based on the information on the web page	how five India vaults were opened
	Combinations of web information and prior knowledge	Black mold health hazard

Jon, when reading from a web page, noticed a statistical citation from an authoritative source-- National Registry of Historic Places on a web page. He decided that "So now I want to look at that web page for the 'National Registry of Historic Places' and let's just find the

webpage." At the same time, he entered "national registry of historic places" in the Google search bar. Similarly, on the Wikipeida page of "List of National Historic Landmark in Washington D.C.", Keen found the name of a historic site-- "Washington's Headquarters State Historic Site". Immediately, she typed the name of the site into the Google search bar.

As an additional example, while Anne was reading a news article on a webpage, she highlighted a sentence in the article -- "But this week, five India vaults have been opened" on the web page, she brought up the question "I wonder what technology they used to open the vaults" ,then she typed in the Google search bar "how five India vaults were opened".

Evident from the participants' explanations and the contexts of their online searching, when web content was used to orient online searching, the participant regarded the information that they just located on the webpage worth exploring further. The information they just located served as intermediate information to bridge the gap between the writers' prior knowledge and expected information. Out of the 85 search quires, 6 search queries came from the web content that the participants were reading.

*Importance of Prior Knowledge in Orienting Online Searching***.** Given the above three identified sources that contributed to the participants' online search queries, the importance of prior knowledge in orienting online searching and the differed uses of these three sources among the 12 participants were examined. Table 9 presents the percentage of each of the three sources in orienting the participants' online searching.

Table 9: Frequency Counts and Percent of the Identified Source in Orienting Online Searching

	Pseudo Name	Prior Knowledge	Writing Task	Web Content	Total
1	Anne	10(91%)	0 (0%)	1 (9%)	11 (100%)
2	Yaira	3 (75%)	1 (25%)	0 (0%)	4 (100%)
3	Kaitlyn	5 (56%)	3 (33%)	1 (11%)	9 (100%)
4	Emma	2 (67%)	0 (0%)	1 (33%)	3(100%)
5	Keen	1 (33%)	1 (33%)	1 (33%)	3 (100%)
6	Kathy	7(100%)	0 (0%)	0 (0%)	7 (100%)
7	Matthew	7 (67%)	2 (23%)	0 (0%)	9 (100%)
8	Delaney	4 (57%)	3 (43%)	0 (0%)	7 (100%)
9	Monica	10 (72%)	3(21%)	1(7%)	14 (100%)
10	Jon	6 (85%)	0 (0%)	1 (14%)	7 (100%)
11	Nana	1 (25%)	3 (75%)	0 (0%)	4 (100%)
12	Gail	0 (0%)	7 (100%)	0 (0%)	7 (100%)
Total		59 (69%)	23 (27%)	6(4%)	85(100%)
Average		4.91	1.92	0.5	7.08

As can be observed from Table 9, out of the three sources that the participant utilized to orient online search, prior knowledge accounted for 69% and was thus identified as the most significant source of the three. Among the participants, the percentage that prior knowledge accounted for total online searching orientation varied drastically from 0 percent to 100 percent, suggesting the existence of the two largely varied search approaches among the participants: prior knowledge oriented search approach as found in Kathy, and writing topic oriented approach

as found in Gail. Most participants' (10 out of 12) used at least two sources of prior knowledge, the writing topic, and web content to orient online searching. Particularly, 7 out 12 participants used both prior knowledge and the writing topic to search online, meaning that when searching online, they were interested in finding specific information pertaining to their prior knowledge as well as general information pertaining to the writing topic.

Writing prompt was also found as an important source of the participants' online searching. Particularly, the writing prompt accounted for 27% of the participants' search queries sources. The fact that only 4% of online searches were oriented by web content indicated that although from time to time the participants' Internet searching was stimulated by the web content, the participants' prior knowledge and the writing task were the primary anchors of online searching. The writers in this study, when reading on the web, rarely deviated from their current search routes when interacting with new information on the web.

While the above findings resulted from the participants' one-time online searching experience on the particular writing topic, the findings were consistent with the participants' responses to the survey items that asked about how they usually generate search keywords for a given writing topic. Table 10 presents the participants' responses to the survey questions.

Table 10: Sources of Search Keywords from Survey Responses

	I come up with search keywords based on the writing prompt.	I come up with search keywords based on the ideas and knowledge I already have in my mind	I refine search keywords based on results from the first few searches I do
Never (0pt)	0participant	0 participant	0 participant

Table 10 (Cont'd)

Rarely(1pt)	0participant	0 participant	0 participant
Sometimes(2pts)	1partcipant	0 participants	1participants
Frequently(3pts)	6participants	5 participants	7 participants
Always (4pts)	5participants	7 participants	4 participants
Mean Score	3.33 points	3.58 points	3.25points

As it is shown in Table 10, the students reported that they frequently generated search keywords based on prior knowledge (M=3.58), writing prompt (M=3.33), and search result (M=3.25). Worth of mentioning, in the survey responses, the participants reported that they frequently refined search keywords based on the search results (M= 3.25). However, their actual searching behavior in the current study revealed less adoption and integration of web content in their search queries than they reported.

Three Specific Roles of Writers' Prior Knowledge in Online Searching

To identify the specific roles that prior knowledge played in the writers' online searching, the search episodes for the 59 search queries that originated from writers' prior knowledge were further coded. After coding the writers' online searching think-alouds and screen videos relating to these 59 search episodes, three specific roles that prior knowledge played in online searching were identified. When the writers' prior knowledge was used to orient online searching, the writers were found to (1) use prior knowledge as tentative references; (2) use prior knowledge as anchors, and (3) use prior knowledge as springboards. Table 11 presents the coding scheme for each role of prior knowledge, following by a detailed explanation of each role of prior knowledge.

Table 11: Coding Scheme for Roles of Prior Knowledge in Orienting Online Searching

Category	Purpose of online searching	Observations	Example
As Tentative References	Verifying existing knowledge	For a search query, participant used a specific term to search online and indicated in the think-aloud that he/she searched to check the accuracy of the information they had in their minds	For one of my examples, I used bomb shelter in Japan and I wasn't sure it was called this or not" so I am going to check. I am going back to Google, I typed in "crow's nest" to verify this is the location that I was thinking
As Anchors	Justifying existing knowledge	For a search query, participant used a supporting point listed on the concept map to search online and indicated in the thinkaloud that he/she search for the topic sentences	Let's start with "historic house health hazard" as I believe that is my strongest argument so far. I am going to Google, I am going to type in 'ways of expanding a city without destroying existing buildings
As Springboards	Expanding existing knowledge	For a search query, participant used a specific concept and terms to search online and indicated that they would like to know more about the concept or the events etc.	Actually I have heard that there is a fact that there is a cemetery that they had a parking lot next to it, and there are skeletons next to the Jackson street" "so first I am going to look at buildings codes just to see what kind of concept it has so I can see if I can use that "

Using Prior knowledge as Tentative References. The first type of using prior knowledge

observed in this study is using prior knowledge as references to search on the Internet. Like a

tentative reference, the writers' prior knowledge was pending to be verified by web information. When prior knowledge was used as tentative references, three components were identified in the participants' think-alouds: (1) an uncertainty of the accuracy of existing information; (2) a need to confirm the existing information by searching on the Internet, and (3) a construction of search queries by using an excerpt of prior knowledge. For example, Yaira, during the course of her online searching, expressed her concern about an example in her concept map: "For one of my examples, I used a bomb shelter in Japan and I wasn't sure it was called this or not. So I am going to check. So I am going to search 'atom bomb shelter Hiroshima' online." In the meantime, Yairatyped in "atom bomb shelter Hiroshima" in Google search engine. Nana, as another illustrative example, when she was typing "crow's nest college park GA" into the Google search bar, she explained to herself: "I don't know about this. I am going back to Google, and I typed in "crow's nest" to verify this is the location that I was thinking." Similarly, in the middle of her essay writing, after Anne finished typing "Robert Toombs was a prominent statesman" on her essay document, she paused, and said to herself, "I want to say he was the secretary of state of confederacy". Immediately, she typed in "Robert Toombs" to the search engine. As can be observed in Yaira, Nana, and Anne, when they used prior knowledge to orient online searching, their purposes of online searching were invariably the same--to verify the accuracy of their prior knowledge. Prior knowledge, in these cases, played a role of tentative references in online searching. It was pending to be confirmed or modified after being compared with the information searched online.

An examination of the search keywords used for this type of prior knowledge use found that the search keywords were very specific terms relating to the name of a particular person, a

building, a street, a historical location, or an event such as "Robert Toombs", "Kikakuji Temple" "Genbaku dome Hiroshima", " crow nest college park GA ; and "King Tut".

Furthermore, the analysis of the relevant screen codes reveals that when the participants' prior knowledge was used as tentative references to orient online searching, the participants' corresponding online searching behavior presented a pattern of rapid, straightforward, "grab-and-go-or-left" approach. Out of the 16 identified searching episodes that prior knowledge played a role of tentative reference, the participants were able to successfully find their desired information on websites listed on the first search result page for 12 online searching episodes. When the first result page didn't yield desired information, the participants either revised their search keywords by using alternative terms or abandoned the search topic. Figure one captured the online search strategies the participants used for this type of prior knowledge use in this study.

Figure 1: Online Search strategies when Using Prior Knowledge as Tentative References
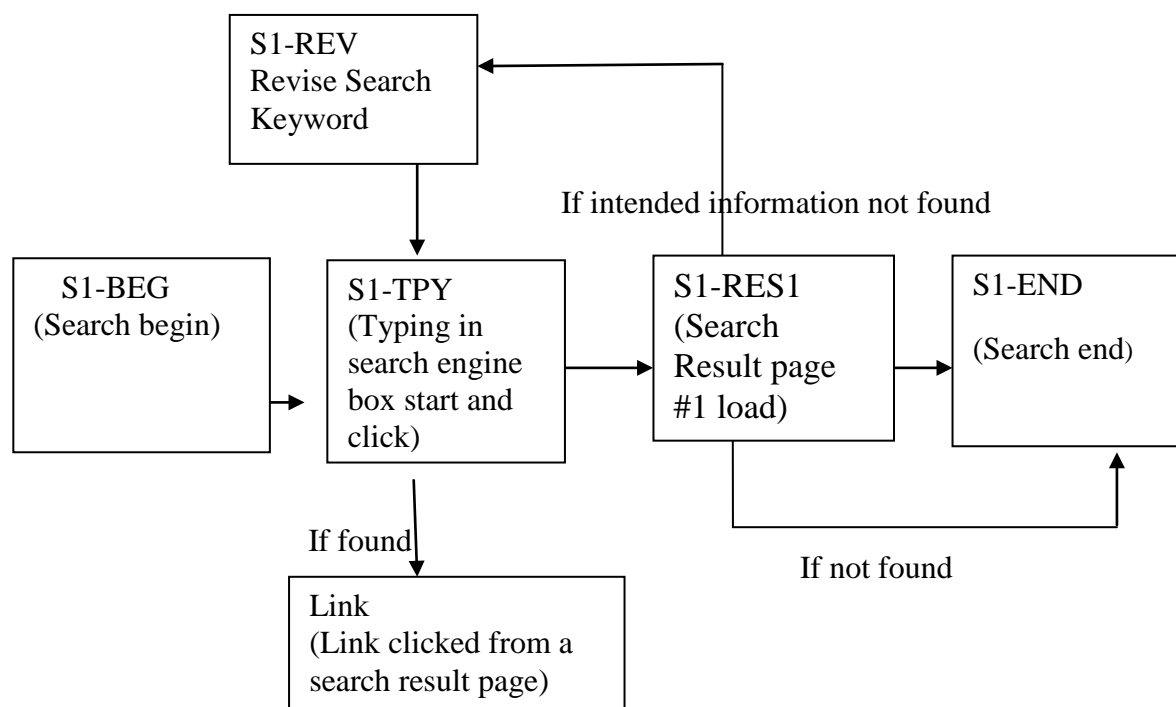
As can be observed in Figure 1, the participants' online searching involved typically one-time keyword searching with at most one-time keyword revision. To illustrate the participants' online search strategies for this type of prior knowledge use, the online searching strategies used by Yaira, Nana, and Anne are followed. After Yaira typed in the "atom bomb shelter Hiroshima" to the Google search engine, she reviewed the first result page and didn't find satisfactory information. She commented on the search results while coming up the strategy to conduct the second search:

> ...doesn't seem like it has it, so I am going to use (the) Japanese (name) Genbaku, and I found it, and it is called Hiroshima Peace Memorial. So I clicked on the Wikipedia, and I corrected the word I used on my concept map.

On her second search, Yaira found the official name of the historic place in Wikipedia webpage. Like Yaira, Nana didn't find what she wanted in her search of "Crow's nest college park GA" within the first Google result page. However, she decided to abandon the current search and started a search for a different topic. As she talked to herself, "they have Crow's next mega-plex college park, but it is not saying what I think it should be saying. So I am going back to the search box and type in "non benefit of historic building". The other participant, Anne, successfully found the intended information during her first round of online searching. By clicking on the Wikipedia page presented on the first search result page, Anne found that Robert Toombs was the secretary of State Confederacy and confirmed her prior knowledge.

Together, using prior knowledge as tentative references promotes the participants to search online to verify existing information in mind. The search keywords were featured with very specific terms retrieved from the memory. Their online searching strategies showed a pattern of rapid, grab-and-go-or-abandon approach.

Using Prior Knowledge as Anchors. The second type of prior knowledge use was

identified as using prior knowledge as anchors. The writers treated their prior knowledge as the

base of online searching, and searched online to find information to justify their prior knowledge.

When the participants' prior knowledge played the role as anchors, web information was used to

add to and support their existing opinions. The participants searched online to find information

only to support and justify their existing opinions and claims on the writing topic.

A review of the participants' think-aloud and online searching keywords for this type of

prior knowledge use indicated that the participants systematically went through the claims they

listed on the pre-writing concept maps and conducted online searching based on these claims. In

their think-alouds, the participants indicated that they were looking for examples and statistics

that would support their claims. Unlike in the previous type of prior knowledge use where the

search keywords were specific and concise, high-level claims are used as search keywords where

prior knowledge was used as anchors to guide online searching. Three search keyword

construction strategies were found among the online searching episodes that used prior

knowledge as anchors: (1) using keywords from a claim; (2) using an entire claim; and (3)

combining and abstracting from two claims.

Katelyn started searching her first argumentative point on the Internet by entering the

search keyword "historic house health hazard" on the search engine, during which she explained

that because she believed it was her strongest point and she would like to look up examples of

how historical buildings with lead paints and health standards were much lower in the past.

After she finished searching the first argumentative point, Katelyn went on searching the second

and the third argumentative points online to look up examples and details to justify the existing

opinions that she held on the writing topic. Her search keywords were distilled from her existing

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opinions: "historic buildings black mold" "lead paint health hazard "lowering property values historic houses".

Participants also found to use the entire claims they made earlier on the concepts search keywords. Every time, Kathy used the claims that she made on the concept map as search keywords, such as "ways of expanding a city without destroying existing buildings" "buildings as a source of heritage and history", "when there is no room left in the city to build buildings, should you destroy buildings" "a city should preserve older historic buildings for future generation's benefit", "benefit for children visiting a museum", "historic buildings create a sense of history". For one of Katelyn's search, she used the same strategy as Kathy did by typing in the entire claim to the Google search engine: "New shopping center increases community value"

Interestingly, in addition to the straightforward way of using the claims listed on the concept maps as search queries, in order to justify their opinions, the participants also construct search keywords that reflected the counter-arguments of their opinion. Emma, when she was trying to argue for building modern buildings, she was aware of the concerns of preserving the historic characters in the city, she explained the rationale for her search keyword:

> *My main point was like if they are still be able to rehabilitate the buildings that would still support both of my points and preserve the nature character of the city. Like a compromise, so I am going to research architecture rehabilitation.*

Then she typed "architecture rehabilitation" to the Google search engine. By combining and compromising two opinions, Emma was trying to conduct web search to justify the claims she had. In this type of prior knowledge use as anchors, the participants held a purpose of finding information online to support their existing opinions on the writing topic.

When the participants' prior knowledge was used as anchors to orient online searching, their online searching strategies show mixed approaches. In addition to one-time grab-and go-or-abandon approach, an evolved, deep, evidence-building approach was identified. The participants showed willingness to read more search result pages, click more links within a website in order to find desired information Figure 2 presents Katelyn's progressive, evidence-building online searching strategies when using prior knowledge as anchors to orient online searching.

Figure 2: Katelyn's Online Searching Strategies When Using Prior Knowledge as Anchors
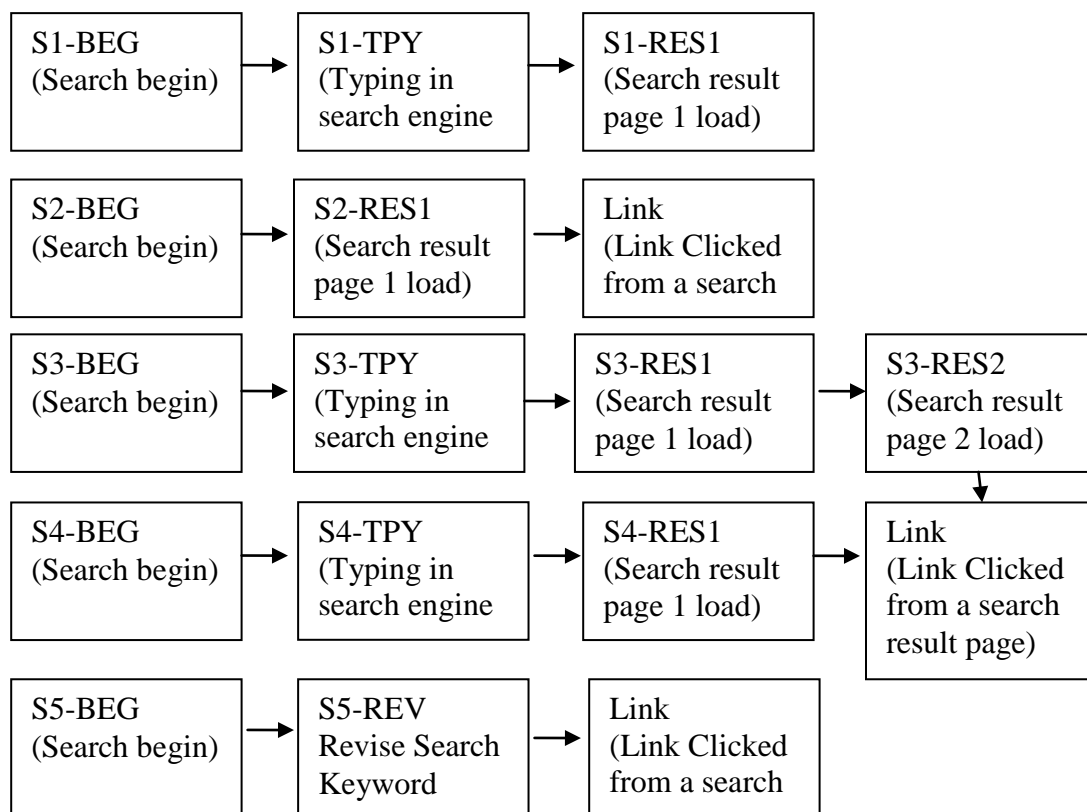
As Figure 2 represented, Kaitlyn's online searching for this type of prior knowledge use showed an iterative, step-by-step knowledge building process. After she searched "historic house health hazard", on the first search result page, she found three major health hazards of historic

houses: lead paint, black mold, and cracked foundations. Then she initiated more online searches to find specific information regarding two health hazards. During her search of "historic house lead paint", she found specific health risks were associated with lead paint. She then further searched "lead paint health hazard" to obtain the information. Then she searched "historic house black mold" to find information on black mold. In the process of online searching, she focused on gathering government statistics and examples from individual website to support her supporting point about health risks of historic houses.

Emma's search of architectural rehabilitation didn't give her a satisfactory result. She clicked on the first website on the first search result page and clicked additional links within the website in order to find information. But the website doesn't seem to contain the information she needed. When she was back to the Google search result page, she carefully reviewed the rest of websites , but decided that none of the websites met her information needs. She tried to revise her search keywords, but paused, and seemed to be challenged by coming up a new search key word. So she decided to stop the search.

*Using Prior Knowledge as Springboard*s. The third type of prior knowledge use identified in this study is using prior knowledge as springboards to expand existing knowledge or concepts relating to the writing topic. In this type of prior knowledge use, the participants searched online in order to find previous-unknown, undefined, supplemental information on the Internet. In their online searching think-alouds, the participants invariably indicated that they were going to search more information about particular terms and concepts, but typically did not explain further how the intent information could be used for the writing task.

A case was found in Matthew's online searching. When Matthew typed in "Eminent domain on taxes" to Google, Yahoo and Wiki at the same time, he stated, "The last thing I want

to read more about is 'eminent domain on taxes'." Likewise, when Jon searched "building codes" online, he commented, "so first I am going to look at buildings codes just to see what kind of concept it has so I can see if I can use that".

Two strategies were identified to construct search keyword for this type of prior knowledge use: (1) focused questions in mind originated from prior knowledge; and (2) terms and concepts originated from prior knowledge. The transformed question included "how much does it cost to replace a historic landmark?" "preserved historic buildings" "historic buildings almost torn down", "Price to preserve historic buildings" "cost to renovate historic buildings" "why reserve Georgia town county society" "what historic buildings has been preserved for historic reasons" , "Registry of historical place mission" , and "Registry of historical place goal." An observation of these search keywords reveals that the writers have a focused search goal for these searches. They inferred from their prior knowledge that a particular piece of information such as the cost of preserving a historic building and the cost to renovate historic buildings will be helpful for the argument.

In addition to use focused questions in mind to search online information, the participants also used terms and concepts to search online to expand their knowledge on the details of historic sites and events. Search queries such as "twisted spiral chestfield", "demosthnian literacy society", "Jackson Cemetery", "Eminent tax credit" were used by the participants as springboards to find more detailed information about the terms being searched. The review of the participants' thinkalouds showed that the participants had less focused search goals for these searches. The overall lack of clear explanation on the definitive uses of searched information in the thinkalouds indicated that when prior knowledge was used as springboards for the purpose of expanding existing knowledge, the writers were less certain about the searching goals at the time

of searching. When the memory was triggered, the writers identified the relevance between the particular knowledge in his/her mind and the writing task, but did not define the types of information they would need, and thus let the content of web information present them a range of choices that would assist them to define what they would need based on the search results.

To summarize, prior knowledge served as the primary resources to orient students' online searching. Prior knowledge played the roles as references, a springboards, and anchors to guide students' online searching, respectively when the writers had an uncertain memory or a sense of inaccuracy of a particular knowledge, when the writing situation demanded more information about a particular knowledge, and when the writers need more supportive evidences for an argument. Prior knowledge, including high-level concepts and opinions as well as low-level facts and examples such as places, person and building names, varied in their utilities when they were retrieved from a writer's memory at the moment of searching. It is pending to be verified, justified, and expanded with online information. Prior knowledge offered the students a triggering point of searching, from which the students started exploring the web materials relating to the particular topic knowledge in their minds.

Associative Patterns between Prior Knowledge and Online Searching, Reading, and Writing

Patterns of Writers' Prior Knowledge. The student writers' prior knowledge was analyzed based on the information presented in the writers' pre-writing concept maps. As defined in the previous chapter, four hierarchical categories were applied to code the data presented in the concept maps: perspectives; supportive points, additional Interpretations, and specificity. Table 12 below presented the results of coding each of these four categories in the 12 student writers' concept maps.

Table 12: Patterns of Prior Knowledge

	Pseudo Name	Perspectives	# of Supportive points	# of Additional interpretations	# of Specificity	Total
1	Anne	Yes	4	0	0	4
2	Yaira	Yes	3	9	3	15
3	Kaitlyn	Yes	3	8	0	11
4	Emma	Yes	3	0	0	3
5	Keen	Yes	4	5	0	9
6	Kathy	Yes	4	5	0	9
7	Matthew	Yes	3	4	1	8
	Prior-Perspective Average		3.43	4.42	0.57	8.43
8	Delaney	No	5	3	0	8
9	Jon	No	4	0	0	4
10	Monica	No	10	0	0	10
11	Nana	No	8	0	1	9
12	Gail	No	8	0	0	8
	Non Prior-Perspective Average		7	0.6	0.2	7.8

As shown in Table 12, out of these 12 writers, 7 adopted a prior perspective on the writing topic by making an explicit, single-sided statement on their concept maps before searching on the Internet. They wrote phrases such as "preserve old historic buildings", "destroy

old buildings", and "should preserve historic buildings", which showed that these students made prior decisions on the perspective that they would adopt before online searching. The remaining 5 students, on the other hand, chose to first search online and then made decisions on which perspective they would like to take on the provided topic. Their concept maps contained two comparative lists (one for pros, and one for cons), under which they wrote down the reasons and supportive details for each position.

When the numbers under each hierarchical category were calculated, it was interestingly observed that the fact whether or not a writer adopted a prior perspective on the writing topic before Internet searching is associated with both the depth and the width of their prior knowledge presented on their concept maps. A pattern of wider-but-shallower prior knowledge structure emerged among the 5 students who considered both perspectives in their concept maps, whereas a pattern of narrower-but-deeper knowledge structured presented among the 7 students who adopted a particular perspective in their concept maps. This discrepancy in the knowledge structures was detected by observing the numbers of each level of coded knowledge nodes.

Particularly, the number of supportive opinions given by the students who included both pros and cons lists varied from 5 to 10, with an average of 7, while the number of supportive opinions given by students who adopted a prior perspective on the concept maps contrastively ranged from 3 to 4, with an average of 3.43. In other words, the students who considered both perspectives listed 104% more supportive opinions than the students who only considered one particular perspective. The result from Mann-Whitney Test ($\mu = 1.5$, $p < 0.05$) among these two groups of students showed that the differences in the supportive points given by the students who have adopted a prior perspective before Internet searching and who did not were significant.

Also can be observed in Table 12 was the scarcity of additional interpretations and specificities provided by the 5 students who considered both positions. They rarely explained the reasons or provided facts or examples to support their earlier statements. Only one of these 5 students provided an item of specificity. However, the other 7 students who adopted a prior perspective on the concept maps, although presented less supportive opinions (3.43 averagely), were capable of explaining and extending their reasons by offering more granulated rationales in the concept maps. The number of extended opinions given by those 5 participants ranged from 4 to 9, with an average of 4.42. Overall the students who adopted a prior perspective averagely presented 8.43 knowledge items, 8 percent more than the students who did not adopt a prior perspective. The result from Mann-Whitney Test ($\mu= 6.00$, $p <0.05$) among these two groups showed that the differences in the given supportive points between the students who have adopted a prior perspective before Internet searching and the students who have not adopted a prior perspective were significant.

Based on the statistical results of the writers' prior knowledge, the prior-perspective group is also called "Narrower-but-deeper knowledge structure group" and non prior perspective group is also called "Wider-but-shallower knowledge structure group". In the following sections, comparisons are made between these two groups in terms of their online searching, reading, and writing behaviors.

Writers' Prior Knowledge Structure and Online Searching Orientation. When the writers' prior knowledge structure and the writers' online searching activities were compared, some noticeable patterns were observed. The table 13 compares the average uses of each of three above identified sources from two groups of students: the students who have adopted a prior

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perspective on their concept maps, and the students who have not adopted a prior perspective on their concept maps.

Table 13: Writers' Prior Knowledge Structure and Online Searching Orientation

	Prior Perspective	**Average # of times of Using Prior Knowledge to orient searching**	**Average # of times o f Using of Writing Topic to orient searching**	**Average Use of Web Content to orient searching**	**Total**
Narrower- but Deeper Prior Knowledge Structure (N=7)	Yes	5	1	0.57	6.57
Wider-but- shallower Knowledge Structure (N=5)	No	4.2	3.2	0.40	7.8

It can be seen in Table 13 that the participants in the narrow-but-deeper knowledge structure group showed slightly more dependence on prior knowledge to orient online searching. Averagely, "Narrower-but-deeper" prior knowledge students used prior knowledge to orient online searching for 5 times, "wider-but-shallower" prior knowledge structure students for 4.2 times. A noticeable difference surfaced when the average number of times of using writing topic to orient online searching. "Narrower-but-deeper" prior knowledge students averagely used writing topic to orient online searching for 1 time, "wider-but-shallower", by contrast, for 3.2

times. In other words, for the students who presented a wider-but-shallower knowledge structure, their online searching were more frequently oriented by the writing topic. Their online searching was more globally-oriented, focusing on the higher conceptual level of the writing topic than on prior knowledge. When the particular search queries were examined, it is confirmed that the these students were open-minded and trying to looking for evidences and reasons for both preserve and destroy historic buildings. The students who showed a "narrower-but-deeper" knowledge structure, by comparison, only used the writing topic to guide their search for an average of 1 time and more focused on looking for information based on their prior knowledge. In terms of the use of web content to orient online searching, both groups of students showed similar pattern of use. Overall, "wider-but-narrower" prior knowledge structure students on average, conducted search 7.8 times, a slightly more than the "narrower-but-deeper" prior knowledge students whose average number of conducting search was 6.57 times.

Writers' Prior Knowledge Structure and Online Searching and Reading Behavior. After investigating the associations between the writers' prior knowledge and online searching orientation, the relationships between prior knowledge and online searching behavior were explored. Numbers of search queries generated, numbers of search results page viewed, numbers of websites viewed, numbers of web pages viewed were compared between the participants. Table 14 presented the results of web page viewing behavior from two groups of participants: the participants who have displayed a "Narrower-but-deeper" knowledge structure on the writing topic and the participants who have displayed a "Wider-but-shallower" knowledge structure.

Table 14: Writer's Prior Knowledge Structure and Online Searching Behavior

	Prior Perspective	Average number of search queries generated	Average number of search result pages viewed for each search keyword	Average number of web sites viewed for each search keyword	Average number of web pages viewed for each search keyword
Narrower-but Deeper Prior Knowledge Structure (N=7)	Yes	6.57	1	0.98	1.34
Wider-but-shallower Knowledge Structure (N=5)	No	7.8	1.05	1.05	1.25

N=12

The results reported in Table 14 highlighted a noticeable pattern of the participants' searching and exploring online. This metric provided one view of the participants' strategies for choosing the particular websites or webpages they then visited. On average, the participants viewed only 1.03 search result page for each search keyword, with the "wider-but-shallower" knowledge structure group viewed slighted more search results than "narrower-but-deeper" students. For each search keyword they searched online, the participants also merely viewed on average 1.02 website. The "Narrower-but-deeper" prior knowledge students, on average, viewed 6.7% less websites (0.98 websites) than the "wider-but-shallower" prior knowledge structure

students who viewed 1.05 websites for each search keywords. However, interestingly, while the students in the "Narrower-but-deeper knowledge structure" group averagely generated 15.7% less search queries than the student in the other group, they read more webpages for each search query. The "Narrower-but-deeper" knowledge structure students on average viewed 1.34 web pages for each search query 7% more than the "Wider-but-shallower" knowledge structure students who on average viewed 1.25 web pages for each search query. In other words, the participants' online searching and reading behavior demonstrated similar structure to their prior knowledge structure. The students who have exhibited narrower-but-deeper prior knowledge structure in their concept maps also exhibited narrower-but-deeper structure in their online searching and reading behavior. Likewise, the participants who have exhibited wider-but-shallower knowledge structure online also showed wider-but-shallower knowledge structure in their online searching and reading in this study.

Writer's Prior Knowledge Structure and Uses of Web Information. The comparison of the writers' actual uses of web information in the final essays between these two groups of participants also showed interesting results. Table 15 presents statistics of students final uses of web information including the average number of sentences that incorporated web information, average number of words in the sentences that incorporated web information, and percent of web information in written essays from the "Narrow-but-deeper knowledge structure" group, and the "Wider-but-shallower" knowledge structure group.

Table 15: Writers' Prior Knowledge Structure and Quantitative use of Web Information

	Perspectives	Average number of sentences that incorporated web information	Average number of words in the sentences that incorporated web information	Average number of words of the written essay	Percent of web information in written essays
Narrower-but Deeper Prior Knowledge Structure (n=7)	Yes	7.14	180.71	622	29.14%
Wider-but-shallower Knowledge Structure (n=5)	No	6.4	175	682	24.4%

 As shown in Table 15, the "Narrower-but-deeper prior knowledge structure" group managed to use web information in more sentences than the "Wider-but-shallower prior knowledge structure" group. Averagely, the students who showed a narrower-but-deeper knowledge structure incorporated web information in 7.14 sentences. The students who presented a wider-but-shallower prior knowledge structure incorporated web information in 6.4 sentences In terms of the total number of words in the identified sentences that incorporated web information, the narrower-but-deeper knowledge structure group, on average, produced 180.71 words, slightly more than 175 words produced by the students in the "Wider-but-shallower prior knowledge structure" group. A noticeable difference surfaced when the average numbers of words in the essays were compared. The narrower-but-deeper prior knowledge structure students,

on average, produced 622 words in their essays, The wider-but-shallower prior knowledge structure students, on average, produced 682 words in their essays, 9.64% longer than the essays produced by the students in the other group. When the percentages of incorporating web information between two groups were compared, it was observed that on average, the students in the narrower-but-deeper prior knowledge group managed to incorporated web information in 29.14% of the essays, 4.74% more than the students in the wider-but-shallower prior knowledge structure group. That is to say, the students who showed a narrower-but-deeper knowledge structure produced shorter essays, however, managed to find more places to integrated web information into their essays than the students who showed a wider-but-shallower prior knowledge structure. The students who presented a wider-but-shallower knowledge structure managed to produce longer essays, however incorporated web information in less sentences of their essays.

The Nature of Prior Knowledge and Varied Priorities of Checking One's Prior Knowledge

   The Vague and Inadequate Nature of Prior Knowledge. During the interviews, the students pointed out the vague and insufficient nature of prior knowledge. Prior knowledge, according to the participants' responses, comes from their past experience and past readings, based upon which the students developed a general sense of the writing topic and came up with real-life examples such as historic buildings names and personal stories.

   Using Prior knowledge to search on the Internet, for the students, means to use *segments of* prior knowledge, or key points, or keywords about the topic to find more information on the Internet. By doing so, the students believed that they will be supplied with a new set of relevant information that will allow them to read and select what they would like to include in their essays based on the particular needs of a writing task.

The students indicated that their prior knowledge was hardly sufficient to complete the essay writing task. While prior knowledge provided a starting point for online searching, the needed topic knowledge for writing an essay, in their views, should result from a good combination of prior knowledge and web content.

However, two varied views were identified among the students regarding the approaches of combining prior knowledge and web content.

Nana expressed a view of looking for supplemental detailed information online:

"If I have to be asked to write about certain events that happened like I know this war happened, but I might have to look up on the Internet to know when it happened, the states it happened, and the country it involved and that kind of things. So it (i.e. using prior knowledge) really just means (searching for) details I don't remember about the topic."

In the participants' minds, the web contents were selected and included, only when they are anchored to and supplement the existing knowledge.

The other view of combining prior knowledge and web information emerged in their interview was to treat prior knowledge only as a starting point of online exploration, from which they can start exploring a "true" answer for the writing topic on the Internet. Those participants acknowledged the possibility of incorrectness of their prior knowledge in terms of perspectives and opinions. Instead of treating their prior knowledge as primary base of topic knowledge, they regarded web information as essential as their primary knowledge during the decision making processes. In their beliefs, an informed decision about a debating topic should be arrived by a careful study of online information and a comparison with their prior knowledge. As Delaney reasoned for her approach of online searching,

Although I have to think about my past experience about building new buildings because I have somewhere to start, reading online and reading other people's opinions make me think in a different way and work on the answers about what you need to do to make a decision

 As another example, Monica said:

 Like on the writing that I did for the topic if a city should preserve old buildings or not, but I think prior knowledge comes in hand because you can use examples from your prior knowledge. Entering what you think to the search engine on the Internet will come up with other people's opinions too. From that and other examples, I can make my decisions based on that.

These two varied views of using prior knowledge were supported by the earlier findings from the participants' actual online searching and reading that prior knowledge served the roles of references, of anchors, and of spring boards to orient students' online searching.

Varied Priorities of Checking One's Prior Knowledge. When the participants were asked about their priorities of checking their prior knowledge when searching on the Internet, the writers expressed three levels of priorities of knowing what they have already known about the topic when searching on the Internet: (1) low priority, (2) medium priority, and (3) high priority.

 The participants who gave the rating of "low priority" emphasized on a novel aspect of online information searching. They indicated that the primary purpose of online searching is to find new knowledge. The distinctions between the new knowledge and old knowledge seemed unnecessary to them, as they merged together to support an argument.

The participants who gave the rating of "medium priority" pointed out the difficulty of distinguish between new information and one's prior knowledge. They further indicated that because the rich supply of the online information, one can always instantly learn basic information from the Internet and then track down to the targeted information based on the previously found information. This opinion was well expressed by Delaney*:*

Because the Internet is sort of like another brain on the web, like an extension of brain in a way, because I will start reading something, but I remember that information becomes ingrained into prior knowledge. It is because very difficult to distinguish what was prior knowledge versus what was new. So in a way it is kind of important as a jumping point, it is not terribly important because you can find general information like wikipedia and you can narrow it down to more specific sources like academic sources, journals...

The participants who gave the rate of "high priority" focused on the foundational importance of prior knowledge in defining online searching and understanding online information. One interesting metaphor was given by the participant Nana, she compared searching on the Internet to conducting an experiment, and prior knowledge is the source of hypothesis and web information served as data that permit writers to make their own observations. Also checking one's prior knowledge, as pointed out by the writers, saves them from being overwhelmed by the large number of search results and help them to identify the materials that they would like to read more carefully.

The students' ratings of their priorities of prior knowledge concurred with their real-time online searching behavior. The students were found to use global-oriented approach that emphasized on the importance of online information in supplying knowledge about the writing

topic. The students also depended on prior knowledge to search online and stressed on the fundamental role of primary knowledge in defining the path of online searching.

Summary of Results for Research Question 1

This section investigated the role of prior knowledge in orienting and performing online searching. The result in this study showed that prior knowledge, in conjunction with the writing prompt and web content, contributed to the orientation of the writers' online searching. Among them, prior knowledge was identified as the most significant source that the writers used to search online, based on which, the writers search online to verify existing information, to justify their perspectives for the writing topic, and expand their knowledge on the writing knowledge. The writers' prior knowledge accounted for 69% of their online searching. The deeper-but-narrower prior knowledge structure group showed a similar deeper-but-narrower online searching and reading behavior. The students in the "Wider-but-shallower prior knowledge structure" group showed a consistent wider-but-shallower online searching behavior. When being interviewed about the meaning of using prior knowledge of online searching, the writers pointed out the vague and inadequate nature of prior knowledge. Using prior knowledge to search online, for them, is to use a segment of prior knowledge to conduct online searching, which they believe will give them a starting point of exploring new information online.

Research Question 2: What are the Strategies the Writers Used to Manage Cognitive Load?

The second research question explored the strategies that the writers used to manage cognitive load during the time of searching for and reading online information. After analyzing and corroborating the data from the participants' Internet searching and reading video clips and think-aloud protocols, four distinct strategies were identified. These four strategies included: minimal online reading strategy, deep online information engagement strategy, off-loading

useful web information strategy, and searching and reading behavior self-monitoring strategy. By applying these strategies alternatively and iteratively, the participants navigated through information on the Internet and collected information for essay writing.

The research results for this question are arranged in the following five sections. The first second presents the writers' overall online searching and reading behavior, analyzing the behavioral pattern of the writers' online searching and reading. The second section presents each of the four identified strategies, highlighting the characteristics and process of applying these strategies among the participants. The third section reports the findings from the participants' survey responses regarding managing information load and keeping track of searching goals. The fourth section reports the participants' self reflections on the meaning of keeping track of searching goals and the priorities of keeping track of searching goals during online searching and reading. The fifth section summarizes the research findings for the second research question.

Patterns of Online Searching and Reading

In this study, every participant searched online, evaluated online information and selected the information that they thought useful for the completion of the writing task. In total, the 12 participants generated 85 search queries and viewed 87 search result pages, 86 websites, and 110 web pages. The time they spent on Internet searching varied from 8 minutes 3 seconds to 35 minutes, with an average of 18 minutes and 11 seconds. The very close numbers among search queries, search result pages viewed, and websites viewed revealed a distinctive pattern of "one search keyword--one search result page--one selected website", meaning that for each search keyword being entered into Internet search tools, the participants typically only viewed the first search result page generated by the search engine, and only selected one website from the first

search page for further reading. Table 16 reports the essential online searching and website

viewing behavior for each individual participant.

Table 16: Writers' Online Searching and Website Viewing Behavior

	Name	# of search keywords	# of Search result page viewed	# of Website viewed	# of web Pages viewed	Time spent on online searching
1	Anne	11	10	8	14	00:34:21
2	Yaira	4	3	5	5	00:13:25
3	Kaitlyn	9	9	9	10	00:15:31
4	Emma	3	3	3	8	00:15:01
5	Keen	3	3	3	7	00:08:03
6	Kathy	7	9	7	8	00:21:52
7	Matthew	9	9	10	10	00:20:28
8	Delaney	7	7	9	13	00:35:00
9	Monica	14	15	11	11	00:29:13
10	Jon	7	8	9	11	00:12:48
11	Nana	4	4	5	5	00:13:31
12	Gail	7	7	7	8	00:14:07
	Total	85	87	86	110	03:38:20
	Average	7.08	7.25	7.17	9.16	00:18:11

As shown in the above table 16, for the given writing topic in this study, the participants

on average generated 7 search inquires, viewed 7.25 search result pages, selected 7.17 website

for further viewing, and viewed 9.16 web pages. The numbers showed that the participant

typically viewed one search result page for each search keyword and also selected only one, at most 2 websites within the first search result page to explore. However, with each selected website, the participants on average read more than one webpage in order to find the intended information. This suggested that generally the participants were more likely to explore and read further within a website than between websites for each search keyword. In addition, the very limited number of web page visited for each search keyword indicated that the participants performed a "one-stop shopping" search strategy to reduce the amount of the information they were reading from the Internet so that they can save time and won't be overwhelmed by the vast amount of information available online. Beneath these rapid sear

Four Strategies to Manage Cognitive Load

To understand the cognitive strategies that the participants undertook to manage cognitive load, the participants think-aloud protocols during online searching were coded based on the nature of the statements. After the step of direct coding, the codes were combined and confirmed with the participants' screen movements. As a result, four strategies were identified as the participants were selecting and reading online while trying to monitor information loads: minimal online reading strategy, deep online information engagement strategy, meta-memory strategy, and searching and reading behavior self-monitoring strategy.

Minimal Online Reading Strategy. Minimal online reading strategy was found in this study as a prominent strategy that the participants applied to reduce cognitive load online. During the process of searching and reading, the writers went through a series of filtering and evaluating processes to make sure that only the most relevant information were clicked and read. Table 17 presents the identified processes involved in the minimal online reading strategy, followed by the detailed explanation of the use of the strategy among the participants.

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Table 17: Coding Scheme for Minimal Online Reading Strategy

Category	Codes	Definitions	Examples
Minimal Online Reading Strategy			
	• Stating online searching and reading goals	Participants stated the purpose of online search for a search query	I am trying to looking for some more historic buildings on campus. I would like to learn their names
		Participants stated the purpose of reading when reading a web page	I am looking for to find an example of the second point.
	• Setting expectations of online Information	Participants stated their expectation of the online information	Fundamentals hopefully it tells what kind of things required for actually being part of a preserved historical building, which probably be the goal why the building is renovated, instead of building a new one.
	• Evaluating the potential match between the preview snippets and the online searching goal	Participants evaluated the usefulness of a website based on the excerpts of information presented on search result page	I see a lot of good words here in the Google search page. They are talking about my reasons

Table 17 (Cont'd)

	• Evaluating the credibility of a website	Participants evaluated the credibility of a website	Oh, it is the government that is telling me. That's good. That's reliable
	• Previewing text before reading	Participants commented on the genre and contexts of web information	This is a technical paper about carbon dating. It a pdf document.
	• Locate focal sentences and paragraphs to read on a webpage	Participants located the focal sentences and paragraph to read on a web page	Oh Here it is…

Six specific activities were identified in the minimal online reading strategy: stating online searching and reading goals, setting expectations of online information, evaluating the potential match between the preview snippets in a search result page and the writing task, evaluating the credibility of a website, previewing the text before reading, and locate the focal sentences and paragraphs on a webpage to read. Although a large amount of information was brought up by the internet search tools, the participants were found to engage themselves in a series of rapid information filtering and evaluating activities that helped them manage the amount of information to be processed in mind.

Among the 6 activities associated with minimal online reading strategy, stating online searching and reading goals was the most frequently used one. The participants constantly stated their searching goals and defining what they were looking for on the Internet in terms of the nature of information.

Immediacy was the essential characteristic of goal statements found in this study. First, when the participants were stating their goals of online searching and reading, it was observed that they expressed a strong sense of immediacy. The participants started defining their goals of searching by using similar pattern of thinking "I am looking for…"or I am thinking…" In their think-aloud protocols, present time indicators such as "currently", 'right now"; "at this time", "at this moment" were found to be closely associated with their goal statements. By trying to stating their searching and reading goals when executing searching, the participants defined their targeted information, which helped them to direct their central attention to locate only the needed information and overlooked other information.

The explicitness of the goal statements varied greatly from searching episodes. When the participants were searching for verifying prior knowledge or looking for particular information, or detailed information of an event and historic place, their goals statements were specific and targeted. The participants were very clear about the information to be found. For example, Matthew stated "so I am currently looking for the cost of renovate historic buildings" Similarly, Delaney explained her reason of searching "I am trying to looking for some more historic buildings on campus. I would like to learn their names."

When the searching goals were to fulfill a particular function in the writing task, the participants' goal statements became generic. Examples of such a generic searching goal are that

I would like a quote to support my second argument.

They have some articles, I am going to look at one of those articles to see if there is something good for me to use, like a quote or something.

This type of statements was expressed by the type of information in terms of its ultimate use in a written essay. By stating a goal from its functionality in a final essay, the participants

challenged themselves to tailor web information into an appropriate example or a quote in the written essay.

When the searching goals were to find a solution for conflicting points listed in concept maps or to justify an opinion, the searching goals were found vague. The participants even expressed the difficulty of articulating the searching goals in their think-aloud protocols when searching online for this type of information. Emma expressed her difficulty in articulating her goal of searching.

> *"I am going to research; I don't really know how to word it. So I am going to research basically like if they could rehabilitate the buildings that would still support of both my main points and reserve the national character of the city. Like a compromise. So I am going to research "architecture rehabilitation".*

During the course of online searching and reading, the participants constantly made statements of the goals of current reading and searching, which helped to maintain their focuses on locating the information that met their current writing needs and skip irrelevant information on a webpage.

Furthermore, the participants also purposefully selected which websites to read further based on meta-website information presented on the search result pages. When landing on a search result page, the participants estimated: (1) the potential match between a preview snippet of web content and a search goal; and (2) the credibility of a website.

The potential match between the web information and the search goal were evaluated by the number of similar words between the web information and the search goal. As Kathy stated when hovering her mouse on the first website on the search result page, "I clicked on the first link because it has a lot of words I am looking for." As an opposite example, when Katelyn

searched "historic houses lead paint", on the search result page, she commented that "I don't want to click on the first two (websites), as I am looking for an example instead of dealing with lead paint. These two (websites) look too practical for me." The websites she skipped were named "Appropriate Methods for Reducing Lead-Paint Health Hazard" and "Lead-safe Processes for Old Historic Buildings". Evidently, by judging from the names of the websites, Katelyn estimated the potential mismatch between the website information and her search goal.

In addition, the participants evaluated the credibility of a website by observing the names of websites presented in a search result page. Based on the name of a web address, the participants estimated the quality of the website such as whether it is a government website, or whether it is company website, or whether it is a public forum. For instance, when Jon clicked on a government website, he immediately acknowledged that by commenting "it is a government website, so the information is more neutral." Likewise, when other students clicked on a company website, they commented "It is .com, not .edu, or "it's not pull from a search engine you normally used for academic things." In another case, when Matthew moved the mouse over a forum website, he commented: "There is lots of stuff just people talking. So that's no really anything. It is nothing concrete, just opinion." Then he skipped the website.

Within a content web page, the participants first made an overview of the web page commenting on the overall genre, structure, document type, and the context of the web page before engaging in deep reading. It is observed that the participants scrolled the web content screen up and down while commenting on the web page. For example, when Gail was reading the "historic preservation" Wikipedia page, she first read the structure of the web page out loud to get an overall sense of the organization of the article. Anne commented on a pdf document she

was reading, "It is a technical paper about carbon dating; it is a pdf document, maybe too technical for me."

Rather than reading the web page from the beginning, it's also found that participants started from the sentences that contained their search words and focused their attention only on reading the topic sentences and the sentences around the search keyword sentence. Following Gail's overview of the Wikipedia structure, she clicked on the link "historic preservation effort" to read just that section of the article.

By constantly stating searching and reading goals, evaluating online information in terms of its credibility and potential use for the writing topic, and locating focal sentences of reading, minimal online reading strategy functioned to reduce online information to a minimal set of information. The strategy directs the participants to focus their attention on interpreting and comprehending information that is most relevant to their searching goals.

Deep Online Information Engagement Strategy. Deep Online information Engagement strategy was another essential strategy that the participants used to manage cognitive load on the Web. Once the participants identified the texts to read, they engaged themselves in actively comprehending, interpreting, re-interpreting, and questioning web information. Together, the participants were found to use 5 different activities to engage themselves in active intellectual conversations with online information: comparing online information with prior knowledge, interpreting online information, resolving conflicting information, identifying further information to be searched or read on the web, and updating current knowledge and knowledge structure. Table 18 presents the codes and examples of these 5 activities, followed by a detailed explanation of each of these activities.

Table 18: Coding Scheme for Deep Online Information Engagement Strategy

Category	Codes	Definitions	Examples
Deep Online Information Engagement Strategy			
	• Comparing online information with Prior Knowledge	Participants compared online information with their prior knowledge	I know we always have home that can be sold by 200,000 and 300,000, so okay, let just go with that statistic
	• Resolving conflicting information	Participants resolved conflicting information when reading online	I see some point here which argued with what I wrote in my concept map, which is the construction will give jobs to a ton of people, which is good, but I said (in the concept map) that the replacing will take up money, which was bad. But I see I can argue with it. If you preserve it, it will be the icon of the city, which will make money, because a lot tour people will come. So I can cover that part.
	• Interpreting online information	Participants made inferences based on online information	It means the demolition of a house costs more according to the census bureau.... So in the long run, you basically save more money. That's cool."

Table 18 (Cont'd)

	• Identifying further information to be searched or read on the web	Participants identified additional information to be searched on the web	According to the Environmental Protection Agency, nine out of 10 homes built before 1940 have lead-based paints. … and then I will find where is the lead paint and health hazard.
	• Updating current knowledge and knowledge structure	Participants updated their knowledge structure based on newly-search online information	At this point, my health hazard is most developed of my points. I have three points, health hazard, not profitable, and lowering property values, and my health hazard is definitely the most developed, and probably, I need more examples to house this.

Comparing Online Information with Prior Knowledge. The participants constantly compared online information with their prior knowledge when reading online information. They used their personal experience and prior opinions to evaluate the usefulness of online information and making meaning of online information. By constantly comparing online information with their prior knowledge, the participants acknowledged the consistency, inconsistency, redundancy, and novelty of the online information. For example, When Gail was reading the sentence "The first historic effort was Washington headquarter state historic site" on the Wikipedia page, she immediately checked her prior knowledge and noted: "I don't know

what it is." Also as Delaney read an online paragraph about potential problems of an old house, she carefully analyzed the information by relating it to her prior knowledge."

> *So it is kind of appealing because it talks about the energy prices in 1870s and, this is one of the benefit I have on my concept map which related to power swift of older buildings, like electricity, heating, air conditioning, etc. So this looks like interesting because it has stuff about insulation that I haven't even considered.*

Similarly, when Katelyn was reading an article online, she found the consistency between the article's opinion and hers, she commented: "These guys are saying something about lowering property values. That is one of the reasons I want to destroy it, lower property values." Later on in her another search, she found an opposite opinion, she again referred to her prior opinion "okay, this is about the tax benefit, but I am on the con side." By the same token, Matthew when reading a historic preservation website, commented that "This is on my side about it, but doesn't really say anything more than I have already known."

As illustrated from the above examples, comparing online information with prior knowledge not only helped the participant to establish connections between online information and prior knowledge, but also informed the further decision the participants would make, for example, to leave the webpage, or to search further, or to save the information for later use.

Interpreting Online Information. When reading online information, a great amount of the participants' efforts went to interpret online information. An examination of the participants' thinkalouds pertaining to the activity of interpreting online information found that an interpretation of online information contained two components: (1) summarizing online information/ paraphrasing online information; and (2) extending online information by adding additional rationale to the information or making inferences.

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An illustrative case of extending online information was found in Katelyn. She was reading online trying to find information that supports destroying historic buildings because historic buildings do not bring profits. She arrived at a webpage discussing tourist attractions, and she found the information that supported her point. She commented: "Here is tourist attractions. Yes, see, it is expensive to make the building come to code with the health regulations with today's real estate's project. So I might include that in the profit." Then she started extending the information by giving the rationale behind it:

> Building something new is more profitable because if you keep it, you have to invest a lot of money in it anyway. If you are investing money, you can make safe, livable, buildings. With historic buildings, you have to be compliant with the building code. That can be a financial nightmare, not profitable.

As another example, Jon was trying to search information about the cost of renovation. He summarized the online information:

> This page is from engineering association, it is talking about renovating old buildings. This one is supporting new buildings because they could be more expensive to renovate the building than replace it with the entire thing.

Later on, in another web page, he found a piece of similar information, this time he summarized and explained the information.

> So government uses tax credit for property owners for renovating historical buildings. So it is not tax, it is credit, you pay less, which can help the service to drop their prices on their service, and also an incentive to keep the new buildings instead of old ones, because those would have the same taxes, and that's 20 percent off and that's everything except for the land. That's pretty much everything.

The above examples showed how the participants engaged themselves in interpreting online information and trying to make sense of online information. By doing so, the participants comprehended online information and established the link between online information and the writing task.

Resolving Conflicting Information. Three participants were found to resolve the encountered conflicting information by supplying more examples and rationales online or of their own to argue back. Yairain her reading of an essay discussing destroying historic building would create jobs, she reasoned in her thinkalouds that preserving historic buildings can promote tourism, which would be equally good for the economy. Emma was reading an article that holds an opposite opinion to hers, she used personal examples to prove that preserving historic buildings can create a sense of community. Delaney encountered a conflicting point arguing that historic buildings were not energy efficient, which was opposite to her opinion. However, in another article, she found that historic buildings can be renovated and go green without comprising historical value and restructuring buildings does not necessarily do harm to historical buildings. By linking information from two website, Delaney reached a fuller understanding of reserving historical house and energy efficiency.

Identifying Further Information to be Searched or read on the Web. The activity of identifying further information to be searched or read on the web occurred after the participants identified an information gap between prior knowledge and online information and determined that information gap would ultimately help the writing task. The participants either followed the provided link within a webpage to read further or initiated a new search to find the information.

Katelyn was reading the web sentence, 'According to the Environmental Protection Agency, nine out of ten home built before 1940 had lead-based paints. " Based on the

information, Katelyn started questioning about the particular health risk associated with the lead paint. Then she initiated a new search "Lead paint, health hazard" to find the information.

After Gail noted that she didn't know about the "Washington headquarter state historic site", she clicked on "Washington headquarter state historic site" hyperlink to learn more about the historic site. Other examples are those presented in the research question one under the section of online searching oriented by web content. The activity of identifying further information to be searched or read online enabled the participants to reach a fuller understanding of online information and find the needed information.

Evaluating Current Knowledge and Knowledge Structure. The participants constantly evaluated their current knowledge and knowledge structure as they searched and read on the Web. The activity of evaluating current knowledge and knowledge structure served three functions in managing cognitive load online: (1) allowed the participants to assess the strongest and weakest points in the essays; and (2) helped the participants to determine the sufficiency of details by comparing their current knowledge with the items listed on their concept maps; and (3) helped the participants to recognize the sufficiency of online information searching and determine the points of discontinuing online searching.

During the course of online searching, by evaluating both the structure and the content of topic knowledge, the participants determined the weakest points in their argument and clarified the goals of next step of online searching. As a representative example, Katelyn, when reading her concept map, discovered that she need more examples to back up her claims.

> *"At this point, my health hazard is most developed of my points. I have three points,*
>
> *health hazard, not profitable, and lowering property values. And my health hazard is*
>
> *definitely the most developed (point), and probably, I need more examples to house this.*

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This lowering property values is just sort of opinion thing, I know this is the least developed point of everything. As far as building something more profitable....I don't know. I probably look into statistics about how new shopping centers bring profits to an area like more jobs. "

Followed her evaluation of her topic knowledge and knowledge structure, Katelyn carefully evaluated the sufficiency of information for each individual points that she was trying to argue with and identified the needs of information for next Internet searching. Then she typed in the "new shopping center increase community value" on Google search.

The participants also reviewed their topic knowledge to remind themselves of the sufficiency of information at the end of Internet searching to see whether they would need more information for the writing task. Like Gail indicated in her think-alouds "I look over my concept map to see if I have anything missing, if I have enough" as she read her concept maps. Then Gail concluded that she had enough information from the Web for her to start writing the essay. "I think I am ready to write the essay." The concept maps served as an essential tool for this activity as they provided an immediately-accessible visual representation of the prior knowledge and prior knowledge structure. In this way, the participants evaluated and reviewed their knowledge and knowledge structure to identify the gaps between prior knowledge and needed information, and to assess how successfully they were in finding needed information for the given writing task.

As it is mentioned, the participants' concept maps served as an important tool for them to evaluate and review their knowledge and knowledge structure. Worth of mentioning, the participants' concept maps were updated and modified as they were searching and reading online. This phenomenon was examined in the strategy to be presented next.

Off-Loading Useful Information Strategy. The third strategy that the participants used to manage information loads was to offload useful web information to external artifacts. The participants applied this strategy to prevent themselves from being overwhelmed by the increasing amount of newly-gleaned online information in their memory. This strategy also helped the participants to retain and reorganize the useful online information for later references. It was observed that the offloading useful web information strategy was naturally applied after the participants identified the focal reading segment on a web page and engaged in reading and evaluating the identified texts in terms of their potential uses for their writing.

Table 19: Coding Scheme for Off-loading Useful Online Information Strategy

Category	Codes	Definitions	Examples
Off-loading Useful Online Information Strategy			
	Recording Web Information	Participants recorded web information by using different artifacts	I basically like that article, so I am copying and pasting it so that I can have it for later.
	Using Online Information immediately in the essay	Participants integrated online information in the written essay immediately after reading	When driving by we often see a house selling at 200,000 to 250,000, so let's just go by that statistics.

Two approaches of offloading useful web information to external artifacts were adopted by the participants in this study: (1) recording web information to external artifacts; and (2) using online information immediately in the essay.

Recording Web Information to External Artifacts. Two approaches were found to record web information to external artifacts in this study: (1) direct copying the useful online information and pasting it to a Word document; and (2) associating the keywords, phrases, and key points of online information with the existing concept maps and adding to the concept maps. Using copying-and-pasting note-taking strategy resulted in extended note documents that ranged from 2 pages to 4.5 pages. These newly created notes would require the participants to digest and interpret the copied information for the use of the essay. By comparison, using adding-to-concept-map strategy resulted in succinct add-ons to the participants' concept maps. By determining where to add the online information in their concept maps, the participants were challenged to tie the piece of online information to the existing concept items.

From the participants' think-aloud data, it was also found that when adding-to-concept-map approach was used, the participants focused on particular words and phrases of the online information that the participants determined can either enrich their prior topic knowledge or improve their language uses in writing. Similar uses of the strategy to record the previously unknown information were identified in other participants' think aloud protocols. The notes that the participants added to their concept maps included new facts, statistics, and specific buildings names that they searched and collected from the web resources. One participant Yairaused adding-to-concept-map note-taking strategy to collect nice words and phrases in the online articles that she was reading for essay writing. During her online reading, Yairacame across phrases that arrested her attention. She said "I keep reading and see some words that I can use such as unique city." Then she wrote down the word "unique" in her concept map. Later she continued "And I keep reading, and see more words that a city could present the vitality and

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characteristic, so I can use that too." With that being said, Yairawrote down the words "vitality" and "characteristic" on her concept map.

Interestingly, it is also found that when direct-copying-and-pasting note taking strategy was adopted, the participants' attention centered on the idea level of the text segments. The participants first evaluated the potential usefulness of the copied texts. In their think-alouds, the participants made the decisions of the potential usefulness of the text by making comments such as "I like it", "would be helpful", "might be worth bringing up later" , " it says a lot what I am going to say". Just as expressed by Monica "I basically like that article, so I am copying and pasting it so that I can have it for later." Direct copying and pasting served as a strategy to collect the roughly-selected online information.   Delaney said "I am just collecting the data right now, and not really thinking about anything in particular. (I am just collecting) anything that might be interesting to note later." By contrast to the brief add-on notes on the concept maps, the copied texts were extensive, including paragraphs that expressed opinions that a writer either agreed or disagreed with, website address, author's' information, definitions of historic places, and background information of a particular historic place.

Once the texts were copied and pasted to the notes, an ensuing activity of note reading and interpretation was found among the participants to determine the author's standpoint and to make connections between the copied text and the writing task. In the second round of text reading on a word document, the participants tried to summarize the gist of the paragraphs, the basic standpoints of the author, and potential problems. Emma, for example, after pasting a paragraph from a web article to a word document, gazing at the text, and started summarizing and commenting on the meaning of the text vocally " what she said is to strengthen what is around Detroit instead of destroying them and building new things. You know, she said suburban

strict mode doesn't support a sense of community." By engaging in the second round of note digesting, the participants distilled the essences of the texts that they copied over, and by doing so, they reduced the cognitive load that a lengthy notes would pose on them into a few manageable sentences.

Worth of mentioning, both of the enhanced concept maps and the copied-and-pasted notes served as information sufficiency references for the participants to determine needed information to start text generating process. By referencing to their enhanced concept maps and notes, participants mentioned that they felt they had "enough" information for writing, just as Delaney commented, "Looking at my note, I have 4 pages, and I am ready to write."

Using Online Information Immediately in the Essay. In this study, only one participant, Anne, used online information in the final essay immediately after online searching. Anne took a blended approach of online searching and writing. Anne started the composing process at the very beginning and searched online when she felt the need during the writing process. As soon as she found the intended information, she integrated the information in her essay and continued writing. The case of Anne is presented fully in the later part of this chapter to allow a close-up examination of Anne's detailed online writing, searching, and reading process.

Either by taking notes for later references or using online information immediately, the strategy of offloading useful information reduced the information load for the participants and allowed the participants to move forward with more free cognitive memory.

Searching and Reading Behavior Self-Monitoring Strategy. In addition to minimal online reading strategy, deep online information engagement strategy, and offloading useful web information strategy, the participants also managed their online information load by consciously monitoring their own online navigating and reading behavior. During the course of online

searching and reading, participants from time to time made comments on their locations on the web and their navigational and reading behavior to remind themselves of the current status of online searching. In other words, besides focusing on the content of the web, the participants also paid close attention to their own searching and reading behavior. Table 20 presents the coding scheme for the searching and reading behavior self-monitoring strategy.

Table 20: Coding Scheme for Searching and Reading Behavior Self-Monitoring Strategy

Category	Codes	Definitions	Examples
Searching and reading behavior self-monitoring strategy			
	Being aware of the location on the web	Participants mentioned their locations on the web	I am going back to Google. I am on the Wikipedia page
	Distinguishing between different reading strategies such as skimming and deep reading	Participants commented on their reading strategies	I am just skimming through the text now. I am just collecting the data right now, and not really thinking about anything in particular. (I am just collecting) anything that might be interesting to note later.
	Adjusting search approach based on search results	Participants evaluated the quality of their online searching based on search results and determined on the next search approach.	Now I am going to start a new search for this method does not work well for me so far.

Table 20 (Cont'd)

	Trying to stay focused on reading	Participants reminded themselves to stay focused on the relevant web content	I am just side-tracked, and I am looking at the pictures now

Being Aware of the Location on the Web. As the participants navigated through websites, their think-alouds revealed that they were well aware of their locations on the Web and made clear distinctions among the search engine home page, search result page, website home page, internal links to another webpage within a website, and external links from a webpage to external websites. In other words, they were very sensitive about every move they made on the Web. Propositions were used in the participants' think-alouds to capture the relationships between their current web locations and the linked web locations. For example, participants constantly said "I am going **back** to Google" as an indication of finishing the current episode of searching and returning to the search engine for another round of searching. When Anne clicked external reference links on a wiki page, she commented, "There are little references 4 and 5, or 3 and 4, and I hit the little button to go **out**." Evidently, she noticed that the reference links will take her to another website and she will be leaving the wiki page she was reading. Throughout their Internet searching processes, they monitored the paths of their searches by determining where they were and where they were to be linked via hyperlinks.

In addition, the participants acknowledged the different search engines that they were using to search information. In every round of online searching, they mentioned the name of the search engine that they were using. "I am going to Google.", "I open up bing.com", "I open up yahoo." Particularly, when the participants used search engines other than Google, they pointed

it out in their think-alouds as an acknowledgement of potential differences in search results yielded by different search engines. Jon searched the same term in Google, Yahoo, and Wikipedia at the same time, and Emma intentionally used Bing.com for her search.

Adjusting Search Approaches based on Search Results. The participants showed the flexibility of adjusting search approaches based on the search results, especially when they could not find intended information. It is observed that the participants used three approaches to adjust search approaches: (1) adjusting the range of idea being search, (2) using similar terms; and (3) searching from a different perspective.

Matthew's online searching process was a good example of adjusting the range of idea being searched. Matthew started his first online search episode by entering one of his claims listed in the concept map into the search engine "historic buildings create a sense of history", when the first search result page loaded, he expressed the dissatisfaction " well, I guess they do not help." Then he revised his search keyword to "historic buildings and their impacts on citizen" Still, he was not happy with the search results. "It doesn't seem like it." Again he revised the search keyword to "reasons to preserve historic buildings."

It can be seen that every time Matthew revised the search keywords, from "historic buildings create a sense of history" to "historic buildings and its impacts on citizens" to "reasons to preserve historic buildings', the idea being search became more and more generic and less personalized.

Gail was observed to search from different perspectives about advantages of new buildings. During her online searching, she adjusted her "reasons to demolish historic buildings" , then she used a similar phrase "reasons to tear down old buildings" as search keywords.

Unhappy with the search result, Gail tried a different approach by typing in "advantages of modern buildings" "demolition of old buildings"

Like Monica mentioned "Now I am going to start a new search for this method does not work well for me so far."

Distinguishing between Different Reading Strategies. During the course of online reading, participants were found to adjust their rates of reading based on different purpose of reading. Although it is not specifically articulated in the participants' thinkalouds, it was observed in the video clips that when the participants first arrived at a webpage, they scrolled the screen up and down to skim the web content and to locate the focus of reading. When they engaged in active interaction with online information, they moved the mouse around the text, or highlighted the focused text, repeated online information and made comments. The speed of their utterances slowed down. One participant, Delaney, specifically pointed out the different reading strategies she used on the web in her thinkalouds regarding her strategy of reading:

> *Right now, I am skimming through the review, but it seems the article is too long to read*
>
> *through......*
>
> *Right now I am just skimming through the article, just reading every few lines of the*
>
> *paragraph to get what it is saying and see how it might be helpful.*

When time became a concern to read a long article, Anne came up with the strategy of reading only the abstract of the article. "I don't actually have time to read the entire paper, so I am just going to read the abstract." Distinguishing different reading strategies allowed the participants to optimize the time spent on online information.

Trying to Stay Focused on Reading. When reading a content web page, occasionally, the participants were attracted to read irrelevant information on a web page. However, they

immediately recognized this and reminded themselves as Emma did: "I am just side-tracked, and I am looking at the pictures now. When the participants found the information that they were reading were not helpful for the writing task or too technical to comprehend, they acknowledged the challenge of reading and decided to leave the reading. For example, when Anne was reading a technical article about Carbon Dating, she commented, "It is not really telling if they used any (carbon dating) technology, so, I guess, that a lost, better leave it there." So she decided to leave the webpage and started a new search. In another interesting case, Katelyn during her search of black mold health hazard, found other problems such as foundation problems, toxic, and chemicals were also factors to destroy historical buildings. However, she reminded herself, "I need to focus on black mold."

By constantly monitoring their own online navigating and searching behavior, the participants reduced the amount of the information intake from the Internet and focused on seeking, reading, and interpreting the information that they intended to find on the Internet.

Findings from Survey Responses

The participants' survey data revealed the participants' usual searching and reading on the Internet for writing purpose. Overall, the survey result showed consistent findings as the above identified strategies for monitoring online information load (see Table 21) and keeping track of searching goals (see Table 22). In terms of overall feelings about information load, as shown in Table 21, the participants indicated that they rarely felt overwhelmed by the amount of information on the Web (mean score =1). Sometimes, they felt they were easily distracted by advertisement, images, videos, and other irrelevant information when searching online (mean score =2). Between sometimes and frequently, they know whether they had enough information for a writing task and need to stop (mean score = 2.58). Regarding the strategies of managing

online information load, more than frequently, the participants took notes on the ideas that were

inspired by online contents (mean score = 3.33). Sometimes, they copied and pasted information

from webpage into a word document for their writing (mean score = 1.83). The participants also

reported that they revisited websites to find useful information for their writing (mean score =

2.5).

Table 21: Managing Online Information Load from Survey Responses

# of participants	When searching and reading online information, I know when I have enough information and need to stop.	I am easily distracted by advertisements, images, videos, and other irrelevant information when searching online.	I feel overwhelmed by the number of search results brought up by the search engine.	I copy and paste information from a webpage into a word document for my writing.	I take notes on the ideas I have that are inspired by online searching	I revisit websites to find information that I find useful for my writing.
Never (0pt)	0	1	4	2	0	2
Rarely (1pt)	3	2	4	2	0	0
Sometimes (2pts)	2	6	4	5	1	2
Frequently (3pts)	4	2	0	2	6	6
Always (4pts)	3	1	0	1	5	2
Mean Score	2.58pts	2pts	1pts	1.83 pts	3.33pts	2.5pts

In addition, the survey results also revealed that the participants did not often keep track of their searching goals (see Table 22. Less frequently than the findings in their actual searching and reading that the participants constantly made explicit goal statements, the participants' survey responses showed that they only sometimes keep searching goals clear in their mind when using a search tool (mean score = 2.66). The participants also reported that they frequently updated searching goals in response to the needs of writing (mean score =. 2.83).Concurrently, the participants reported that they frequently changed search topics when the current one does not generate desirable information (mean score = 2.91).

Table 22: Keeping Track of Searching Goals from Survey Responses

	When I use a search tool, I keep my goal for searching clear in my mind.	I update my search goals in response to the needs of my writing.	When my first search does not lead me to the information I need, I quit.	I change search topics when my search does not lead me to the information I need
Never (0pt)	0	0	7	0 participants
Rarely (1pt)	2	2	3	0
Sometimes (2pts)	3	2	2	4
Frequently (3pts)	4	4	0	5
Always (4pts)	3	4	0	3
Mean Score	2.66pts	2.83pts	0.58pts	2.91pts

Value of Keeping Track of Searching Goals

At the end of the study, the participants were invited to contribute their insights of meaning of keeping track of searching goals. Congruent to the survey results, the participants commented that they didn't think that they purposefully kept track of searching goals in their daily internet searching and reading. The meaning of keeping track of searching goals, according to the participants, consisted of two components. First, the participants considered remembering and retrieving the keywords that they have used for online searching as a way to keep track of searching goals. They agreed that it would be challenging for them to recall what they have already searched from memory; however, they seldom felt the need to go back to the list of already search keywords. In case that they would like to have more information on the topic, at any time, they can conveniently conduct another search on the Internet without referring to what has already been searched. In other words, the flexibility and powerfulness of Internet search engines allow students to retrieve any needed information without depending on particular information collected earlier. According to the participants, keeping track of searching goals becomes "peripheral" for student searching and reading on the Internet. In addition, it is also mentioned that browser technology helped to retrieve the webpages that they have visited by using the "History" function of the web browser. Also, Google search keyword memory function that have the capability of retaining all of the search keywords that have been recently typed into the search engine was mentioned as a way that allowed the participants to review their search keywords.

In their responses, the participants confirmed that the notes that they took during online searching process gave them a comprehensive overview of the information that they have gathered from the Internet. Therefore, instead of going back to the Internet to revisit the

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information, they preferred to use either concept maps or notes as a guide to review the processes of searching.

Secondly, keeping track of searching goals, in the participants' minds, also refers to refining search keywords when the initial searches did not generate satisfactory results. In their responses, accuracy and flexibility were the most important features of search keywords. When the initial searches did not bring up desirable information, the participants would consider either to narrow or to expand search keywords. Accuracy of search keyword were achieved by putting a quotation on the search keywords and adding more search terms to the search engine, and vice versa. As Anne explained,

"… for instance, I am searching for a peripheral fact for Demosthenian Society, I will put the main thing in quote to make sure that the page I am looking for has that. And the dates of meetings will be outside of the quote, because that would be lower priority. Similarly, Gail gave an example:

So you know, if I am searching for a cat adoption shelter or a dog adoption shelter, I realize that my search terms will be as rigid as it can be, it is sort of back and forth thing, you can say, where do I find the cat in GA, and expect them to say oh there is a dog shelter five blocks away from you, because you were thinking that, but Google don't know that."

Varied Priorities of Keeping Track of Searching Goals

When being asked about the priority of keeping track of searching goals during searching and reading online, the participants expressed varied views on the priority to keep track of searching goals. The majority of the participants rated keeping track of searching goals as a low to medium priority when they were searching and reading on the Internet.

Two major reasons were identified for giving low to medium priority to keep track of searching goals. First, the participants indicated that they simply seldom keep track of searching goals when they were searching and reading online. When they would like to look up information that they have searched, the notes that were taken during the searches would be helpful. Second, the participants maintained that for them, it is more important to focus on actual information that they were reading on each websites than to keep track of the search keywords and web pages that they have visited.

> *"It is a low priority, if I find a page that links to another page, and one organization that links to another, by having all these information together and see how they fit into each other is more important to me because as I go from one-page to another, finding information is more important for me than making sure I have remember the website and webpage."*

Two participants rated keeping track of searching goals as a high priority and they separately presented two reasons for giving high priority to keeping track of searching goals. One reason is that during the process of searching, keeping track of searching goals could avoid searching for the same information over and again. The other reason is that keeping track of searching goals would allow one to go back to track the sources of information that being used for a given task. Keeping track of search keywords would allow one to trace back to the visited websites to evaluate whether the website is trustworthy or not and allow appropriate citation of the information.

> *…Very important. Most of my teachers have enforced the need for credible sources and useful sources, but you know when I get useful information, I need to keep track of that so*

that I need to show that I got my information from certain sources. I keep all of my

sources up, usually on different windows. So I make sure I have them to cite back.

Summary of Research Question 2

The second research question investigated the strategies the participants used to manage information load while searching and reading on the Internet. The data revealed that behaviorally, the participants adopted a "one search keyword-one search result page—one website-and a couple of web pages" strategy of online reading to reduce information loads on the Internet. By doing so, the participants reduced millions of search results presented by the search engine to a very limited number of websites and web pages that most possibly contain useful information for the writing task and focused on interpreting and digesting information on the selected web pages.

Cognitively, the participants executed four strategies to manage online information load, which included: minimal online reading strategy, deep online information engagement strategy, off-loading useful information strategy, and searching and reading behavior self-monitoring. These four strategies enabled the participants to be engaged in active interactions with information on the selected web pages and directed their focuses on interpreting and collecting the useful information for the writing task. The participants' survey and interview data confirmed that above findings. In addition, the participants reported in their interviews that they did not purposefully track their goals of online searching and depended on browser technologies and notes to retrieve information that they have searched when needed.

Research Question 3: How did the Writers Write Given the Online Information They Searched?

The third research question investigated how the writers wrote given the online information they have searched. Based on the data from students' think-aloud protocols, written essays, and post-writing concept maps, multiple results were found. They are presented below in

the following four sections: (1) quantitative and qualitative contributions of the sentences that incorporated web information to the written essays; (2) the strategies to reappropriate online information into written essays ; (3) importance of web information in writing and the priorities of using web information effectively, including the meaning of using web information effectively, the importance of using web information effectively, and the role of web information; and (4) the summary of research question 3.

Quantitative and Qualitative Contributions of Web Information to Written Essays

   Quantitative Contributions of Web Information to Written Essays. As a result, all of the 12 participants completed the essay between 40-60 minutes. During this period of time, they wrote up argumentative essays based on their prior knowledge and the new information they have searched online. From time to time, the participants made intermittent pauses, checked the notes they have taken, and resumed writing. Remarkably, the lengths of their essays ranged from 426 words to 1105 words, with an average of 647.3 words (SD= 187.6). Altogether, a total of 82 sentences were identified as sentences that incorporated web information. To capture the quantitative and qualitative contributions of these 82 sentences, descriptive statistics are reported regarding the numbers of the identified sentences in each participant as well as their percentages in the essays (see Table 23).

Table 23 : Quantitative Contributions of Web Information to the Written Essays

	# of sentences that incorporated web information	total number of words in the sentences that incorporated web information	Total number of words of the written essay	percentage
Anne	6	155	649	24%
Yaira	8	227	600	38%
Kaitlyn	6	150	590	25%
Emma	8	187	530	35%
Keen	6	127	631	20%
Kathy	7	213	733	29%
Matthew	9	206	625	33%
Delaney	11	330	1105	30%
Jon	7	224	871	26%
Monica	3	66	426	15%
Nana	4	107	432	25%
Gail	7	148	576	26%
Average	6.83	178.33	647.33	27%

As shown in Table 23, all participants managed to incorporate web information into final essays. The number of sentences that the participants managed to integrate web information into varied greatly from 3 to 11, with an average of 6.83 sentences. (SD= 2.19).The lengths of the participants' written essays ranged from 426 words to 1105 words, with an average of 647.33

words. With regard to the percentages of these sentences in the essays, the percentage of the sentences that incorporated web information accounted for 15% to 38% of the total length of each individual essay, with an average of 27%. In other words, of all the sentences that the participant produced, on average, approximately one third of them utilized web information as a result of online searching and reading. Also interestingly, a strong correlation between the lengths of the written essays and the numbers of identified sentences that incorporated web information was identified. The Pearson correlation coefficient equals to 0.702 (p= 0.05), suggesting that students who produced longer essays have a strong likelihood to incorporate web information in more sentences.

Qualitative Contributions of Web Information to Written Essays. When the total of 82 sentences that were identified as sentences that incorporated web information were examined to determine their contributions to the structure of an argument, it was found that 0 of the sentences served as theme, 32 (39.02%) of the sentences served as claims, 46 (56.10%) as evidences, and 4 (4.88%) as counterarguments.

As can be seen above, using web information as evidences was the most-frequently used type of using online information. Three specific types of evidences were identified in these 46 sentences where web information was integrated. The first type of using web information as evidence involves using web information as example evidence. For instance, Keen in her essay used web information as a direct example to illustrate her point that preserving historic landmarks can change the attitude of a city. Four sentences she wrote a paragraph in her essay together served as an example of the evidence that she was trying to argue:

The Castle Museum in Saginaw, Michigan is one such town. At one point in time, the castle was used as a post office for the city. However, as time passed, the town required a

larger establishment to fulfill the functionality requirements of a post office. There was

uproar in the city, as no one could bear to have their historic structure demolished. The

desire to preserve the Saginaw Post Office brought the town together, demonstrating the

unifying effects of preserving old, historic buildings.

In this example, all the detailed information about the castle museum came from her earlier online searching and reading about the history of the museum on a wiki page.

The second type of using web information as evidence involves citing web information as statistical evidence to support the point. As Kathy cited in her essay, "The *first legitimate*

preservation effort was in 1961, in Newburgh, New York." Similarly, Anne stated in her essay:

House demolition can average around $12, meaning the demolition of an average house

according to the Census Bureau is about $24,000. Also used a statistic from the web,

Katelyn wrote "In two-thousand and ten construction jobs decline in eighty-five percent

of cities in the United States.

These specific dates and statistics resulted from the students earlier online searching and reading.

The third type of using web information as evidence involved using web information as a testimonial evidence to strengthen arguments, for example, to enhance her argument, Emma quoted an article that she read earlier during her online searching "In an article in opposition to the construction of modern buildings, author Anne Zobel writes, "it ignores the integrity of the built environment… it does not promote community or a sense of place."

In addition to using web information as various types of evidences, it is also found that the participants incorporated web information to construct claims, counterarguments, and themes,

which requires higher-level, more complex thinking skills and more dynamic, deeper interactions between prior knowledge and web information.

Out of the 12 participants, 9 participants used web information in the claims of the essay in a total of 32 sentences. Web information influenced the participants' knowledge on the writing topic in the conceptual level. For example, Delaney, during her search for the benefits of keeping historic buildings, found additional reasons to preserve historical buildings that she has not thought of. In her writing, she included this new information as additional claims. One of her claims in the essay came from web information that she found earlier:

While one might be concerned with loss of potential value from businesses, new residents, etc., one must first consider the cost of demolishing and reconstructing a new building.

By the same token, after reading about online articles about government regulations on restoring historic buildings, Jon used that information as a claim in the open sentence of the second paragraph, "When determining if a historic building should be renovated, it is important to check which local, state, and governmental ordinances are to be met, and which ones can be waived." Then he continued using web information he found in another webpage as an evidence to support the claim.

Three participants incorporated web information as counter arguments to the opposite opinions, suggesting that during the online searching and reading processes, the students did not merely take the web information as it is, they also critiqued the web information and exercised higher-level critical thinking skills by refuting the arguments brought up on the Internet. For example, Yaira, in her essay, she wrote:

Even though construction of a new building would give jobs to people, if the old building itself is a monument and icon for the city, people would come and economy would be flourished anyways.

Earlier in her online searching process, when she was reading an article about economic benefits of modern buildings, she disagreed and commented:

I see some point here which argued with what I wrote in my concept map, which is the construction will give jobs to a ton of people, which is good, but I said (in the concept map) that the replacing will take up money, which was bad. But I see I can argue with it. If you preserve it, it will be the icon of the city, which will make money, because a lot tour people will come. So I can cover that part.

The identified students' frequent uses of web information at *granular level as evidences* suggests that the rich supply of web information empowered by the Internet search technology permits instant retrieval of very detailed information which used to escape from human memory or be constrained by the limited findability of printed resources. The observed inclusions of web information in higher-level of claims and counter arguments suggested that web information did influences students' decision making processes in this study. When the task was assigned, the students were capable of searching, selecting, linking, and adapting web information to represent an expanded and integrated knowledge of a topic. From writing perspective, the varied use of web information substantiated both the content and the structures of the argumentative essays, which ultimately enhanced the persuasiveness of the intended arguments. Table 24 presents an overview of qualitative contributions of web information to each student's written essay.

Table 24: Qualitative Contributions of Web Information to the Written Essays

	Theme	Claim	Evidence	Counterargument	Total
Anne	0	0	6	0	6
Yaira	0	4	3	1	8
Kaitlyn	0	2	4	0	6
Emma	0	4	2	2	8
Keen	0	0	6	0	6
Kathy	0	3	4	0	7
Matthew	0	7	2	0	9
Delaney	0	2	8	1	11
Jon	0	5	2	0	7
Monica	0	1	2	0	3
Nana	0	4	0	0	4
Gail	0	0	7	0	7
Total	0	32	46	4	82

As can be observed in Table 24, 46 (56%)of the identified sentences that incorporated web information were used as evidences to back up the claims in the essays for the purpose of enhancing the persuasive power.

Strategies to Reappropriate Online Information into the Written Essays

During the course of essay composing, the writer actively applied various strategies to incorporate web information into essay texts. After comparing the sentences that integrated online information with their associated web pages, specifically, six web information

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incorporating strategies were identified in their essays: information restating, information summarizing, direct quoting, factual information picking, and information synthesizing. The first three strategies—information restating, information summarizing, and direct quoting—have been widely discussed in writing-from-offline-sources research literature. The other two strategies—information picking and information synthesizing--have been less discussed but are exclusively afforded to be applied in web-based composing environment.

Information Restating. Information Restating was the most-frequently used strategies in this study. Information restating refers to the participants used their own words to restate the information presented on the web page. When the information restating strategy was used, the writes restructured and restated the web information by using their own words. The participants used their own words to restate a particular act, a particular history of a historic building, or a cluster of facts associated with a historic building. Information restating was identified in both a single sentence and in a cluster of sentences. Among all of the strategies applied, information restating strategy was applied 25 times, accounting for 31% of total strategy uses. When the purposes of applying information Restating strategy were analyzed, it is found that the participants adopted this strategy for two particular purposes: (a) to serve as an example evidence of a claim; and (b) to enhance credibility of evidence. Noticeably, the web information that was paraphrased for the use of written essays contained more of definitive factual information than conceptual information such as claims and ideas. Table 25 presents three examples of using information restating strategy in this study.

The first example came from Nana's essay. In her essay, she made the claim that "old, historic buildings are considered to be the "birth" history of the many towns or cities. To support her claim, she presented an evident in the paragraph: "Due to the huge amount of pride and love

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many communities possess for their town, many will display the housing of past, impactful individuals i.e. Martin Luther King Jr." Followed the evidence, she cited the National Historic Preservation Act to confirm the legitimacy of the acts of displaying old, historic buildings. In her essay, she restated the establishment of the Act and the purpose of the Act by using the information she found earlier on a Wikipedia page. The web information enhanced the credibility of the evidence she presented here.

Web information was restated in a sentence or a cluster of sentences as an example evidence to support a claim. Keen, in the second paragraph of her essay argued that "The mere presence of a historic landmark or historical structure can change the attitude of a city." Then she used the history of Castle Museum in Michigan as an example to support her claim. The history of the museum was restated to support her claim. In the same way, Delaney restated the web information about Robert Toombs as an example evidence for her claim that "it is possible to rezone areas to make them commercial or residential and it is also possible to construct a business within a historical building without destroying.

Table 25: Examples of Information Restating Strategy (For Interpretation of the references to color in this and all other figures, the reader is referred to the electronic version of this dissertation)

Example Essay Sentences	Original Web Information	Essay Text Level
These acts are considered legal according to the document Congress signed in 1966 called the National Historic Preservation Act, stating that the town is authorized to use the old building for "public benefits" and to preserve our national heritage.	Realizing the need to protect America's cultural resources, Congress established the National Historic Preservation Act (NHPA) in 1966, which mandates the active use of historic buildings for public benefit and to preserve our national heritage. (http://www.wbdg.org/design/historic_pres.php)	Sentence

Table 25 (Cont'd)

At one point in time, the castle was used as a post office for the city. However, as time passed, the town required a larger establishment to fulfill the functionality requirements of a post office. There was uproar in the city, as no one could bear to have their historic structure demolished. The desire to preserve the Saginaw Post Office brought the town together, demonstrating the unifying effects of preserving old, historic buildings.	The Castle Museum was designed by William Martin Aiken, the Supervising Architect of the US Treasury, and built in 1898 as a United States Post Office.[1] In the 1930s, the post office was becoming too small and a movement was started to get the post office out and into another building. An uproar arose because no one wanted their beloved castle to be torn down. The building was remodeled by local architect Carl Macomber, who enlarged the building, tore down one of the three turrets, and added a large sorting room on the back of the building (by Hoyt Library). In the 1970s, a new post office was built and the building was almost demolished once again, but local citizens and the Saginaw County Board of Commissioners took steps to list the building on the National Register of Historic Places to ensure the preservation of the building and the local heritage it represents.[2] (http://en.wikipedia.org/wiki/Castle_Museum_%28Saginaw,_Michigan%29)	A cluster of sentences

Table 25 (Cont'd)

As an example, the house of Confederate statesman Robert Toombs in Washington, GA has been converted into a museum to teach visitors about not only Toombs himself, but about life in the late 1800s and in the American Civil War era.	Robert Toombs House Historic Site in Washington, Georgia, was the home of Robert Toombs, who was a U.S. representative and U.S. senator from Georgia as well as a Confederate general and Confederate secretary of state. Operated as a state historic site, the 19th-century period historic house museum also features exhibits about the life of Toombs. (http://en.wikipedia.org/wiki/Robert_Toombs_House)	Sentence

Direct Quoting. Direct quoting was identified when a participant used phrases and sentences in their written essays as they were in the original web page. In this study, three distinctive purposes were found when the participants applied direct quoting strategy: (a) to improve word choices and language aesthetics; (b) to adopt a particular claim found on the Web, and (c) to cite a person's speech as a counter-argument. Table 26 presented three examples of direct quoting along with their original texts from the web pages for each of the three purposes. Among the 82 sentences that incorporated web information, direct quoting strategy was used for 11 times, accounting for 13% of total strategies used to incorporate web information in this study. Besides, the lengths of the quotations were limited as the quotations were largely confined at word and phrase levels.

Yaira, when reading the webpage, acknowledged that she liked the word "vitality and characteristics", and took a note on these words. Like she planned, she used the word in the opening sentence of her second claim. "A city with a monumental iconic old building becomes a unique city of vitality and characteristics.

Kathy directly quoted the claim sentence that she came across in her early online searching and used it as one of the claims in her essay "Welcoming tourists a city can get many benefits including money, which can be spent on preserving historical buildings as well as on improving roads and facilities." Following the quoted claim, Kathy supplied additional explanations of her own to support the claim she quoted:

> *Outside revenue can provide money for many municipal projects within the city. If the city had destroyed all of it's older buildings there wouldn't be this extra source of income for the city. This money could also be used to preserve older buildings bringing in even more money for the city.*

Emma, in her final claim, she stated in her essay that "…it (building modern structure) creates a new, cleaner urban landscape of which people can be proud." Following the argument, she cited an article with an opposite opinion: "In an article in opposition to the construction of modern buildings, author Anne Zobel writes, "it ignores the integrity of the built environment… it does not promote community or a sense of place." The quote of the author Anne Zobel' s article was included as a counter-argument to Emma's claim. By doing so, Emma acknowledged the existence of the opposite opinion.

Table 26: Examples of Direct Quoting Strategy

Example Essay Sentence	Original Web information	Purpose	Essay Text Level
A city with a monumental iconic old building becomes a unique city <u>with vitality and characteristics.</u>	<mark>Furthermore, the old historic buildings and structures could present the vitality and characteristic of a city.</mark> As a travel lover, I might look forward to visit the historic spots of cities. When staying in Shanghai, which is a famous city in China, I found that the city has a rich collection of buildings and structures of various architectural styles, including the areas of the former foreign architecture in early 20th century. During decades, Shanghai , where can be found for not only Western architecture but also traditional Chinese buildings, displays an even greater array of its particular type of architecture. It was the most commemorative part of the trip :when I strolled along the streets, it seemed to tell a story in the past. Consequently, I think that people should preserve the old buildings of a city in order to keep its cultural qualities. (from: http://www.essayforum.com/writing-feedback-3/essay-preserve-old-buildings-modern-buildings-4341/)	Improving Language aesthetics on an existing claim	Word and Phrase
<u>Welcoming tourists a city can get many benefits including money, which can be spent on preserving historical buildings as well as on improving roads and facilities."</u>	Second of all, by preserving historical buildings a city can attract many travelers. <mark>Welcoming tourists a city can get many benefits including money, which can be spent on preserving historical buildings as well as on improving roads and facilities.</mark> (http://www.btcpakistan.com/83.aspx)	Adopting a particular claim newly found on the web	Sentence

Table 26(Cont'd)

Anne Zobel writes, "it ignores the integrity of the built environment… it does not promote community or a sense of place."	Some of the shortcomings of the suburban strip-mall model include: that it does not promote community or a sense of place; it discourages pedestrianism by catering to an automobile-dependent consumer base; it ignores the integrity of the built environment; and it sets a design precedent that is ultimately unattractive. The result: a generic development that neglects the city's urban fabric and oftentimes destroys existing buildings. (http://www.cityscapedetroit.org/articles/Retail.html)	Serving as a counter-argument	Sentence

Information Summarizing. Information summarizing was identified as another strategy that the participants used to incorporating web information. Summarizing strategy refers to the participants transformed web information by condensing the original web information to its essence. In this study, the participants were using summarizing strategy to transform web information for 8 times, accounting for 9.75% of total information transformation strategy uses. Unlike in other previously-mentioned strategies where the associations between the essay texts and the specific sentences in the original web page can be directly identified, in summarizing strategy, the links between the written text and web page were loose. The essay texts summarized the crucial idea on the source web page by using brief sentences. Brevity was identified as a nominal feature of the students' summaries of web content. In the participants' essays, web information was distilled into merely one sentence or even several words. The brief nature of summarizing web information may be resulted from the very nature of the writing task that nudged the participants to transplant web information in a new writing context. The participants were more oriented by the ultimate goal of distilling useful information for the purposeful use of the essay rather than focus on summarizing the web content in its own root. When the purposes of using summarizing strategy were analyzed, it was found that the summarizing strategy was applied to integrate the gist of claims in the original web page and to contextualize the current argument in a broader context. Table 27 presented three examples of the participants using information summarizing strategy.

In his opening paragraph, Jon argued that consultants should be hired to determine the cost and timeframe of a renovation project. This statement came from his reading of an article debating whether a historic school should be renovated. The article presented a checklist of

professional decisions that should be made by consultants. Jon summarized the gist of the article and used it as a claim in his essay.

Emma summarized an author's opposite opinion on replacing historic buildings in her article and used it as a counter-argument in her essay. In a more detailed manner, Katelyn summarized the health risks of lead paint presented on a portion of a long webpage and used it as a claim.

Table 27: Examples of Information Summarizing Strategy

Essay Sentences	Original Web Information	Purpose	Essay Text Level
When addressing the problem, first, <u>consultants should be hired to determine the approximate cost and time frame of a renovation project: both in phases and in whole.</u>	Entire article (http://www.preservationnation.org/information-center/saving-a-place/historic-schools/new-schools-pages/resources-for-advocates-and-policy-makers/school_feasibility_study.pdf)	to integrate a claim from a web page into an essay	Sentence
<u>While she thinks that destroying old buildings also destroys the sense of community,</u> it will in fact do quite the opposite.	Entire article (http://www.cityscapedetroit.org/articles/Retail.html)	to present an counter-argument	Phrase

Table 27 (Cont'd)

<u>The United State government's health regulations have obviously tightened in recent years. In 1978, a mere 30 years ago, the government put a health restriction on lead paint- a known toxin. Any building built before that is at risk of having dangerous lead pipes and paint that make historic buildings a very scary prospect to young families trying to raise children. Lead has been known to cause behavioral and learning disabilities.</u>	The Entire Web page (http://www.epa.gov/lead/parents.html#older)	To integrate a claim summarized from a web page	A cluster of sentences

Factual Information Picking. Factual information picking is the second most-frequently used web information incorporation strategy that was identified in this study. Factual information picking refers to using a particular piece of factual information such as buildings names, statistics, and name of a government authority to enhance the accuracy and credibility of the argument. Among all the strategies applied, factual information picking was adopted 20 times (23.8%) among the participants. Unlike direct quoting which focuses on the ideas of original texts, informational picking lays its emphasis on the accuracy and authority of a piece of factual information. The information that was being picked dispersed in varied place of a web page such as names of the websites, title of an article, or sentences. Factual information picking occurred at word and phrase level. Table 28 presents three examples of factual information picking. Anne

picked the name of the Pertersen House from the webpage; Keen picked the year and place of the

Washington's Headquarters State Historic Site; Matthew picked the statistical number of job

creation as an evidence of preserving historic buildings.

Table 28: Examples of Factual Information Picking Strategy

Essay Sentences	Original Web Information	Purpose	Essay Text Level
A very frequently visited location in Washington, D.C. is the Petersen House, the location where Abraham Lincoln died	Attendants including Charles Leale and Charles Sabin Taft examined Lincoln in the box before having him carried across the street to the Petersen House, where boarder Henry Safford directed them inside. (http://en.wikipedia.org/wiki/Petersen_House_%28Washington,_D.C.%29#Lincoln_assassination)	to convey a sense of accuracy of the information presented in the argument	word and phrase
The first legitimate preservation effort was in 1961, in Newburgh, New York.	Washington's Headquarters State Historic Site is a historic site in Newburgh, New York, USA. It consists of the Hasbrouck House, the longest-serving headquarters of George Washington during the American Revolutionary War, and three other structures. It is also the oldest house in the city of Newburgh, and the first property acquired and preserved by any U.S. state for historic reasons. For both that and its historic value it was designated a National Historic Landmark in 1961. (http://en.wikipedia.org/wiki/Washington%27s_Headquarters_State_Historic_Site)	to convey a sense of authority of the information	word and phrase
Immediately there are 400 jobs created and another 369 annually.	Historic Preservation Activities Create Jobs - Preservation activities directly create 400 jobs and another 369 indirectly on an annual basis as a result of historic preservation construction activity. (http://www.carterarch.com/historic5.htm)	to use as a statistical evidence	Word and phrase

Information Synthesizing. Information synthesizing was identified as the 6th strategy that the participants applied to incorporate web information into essay texts. Information synthesizing refers to using information from multiple web pages to reach a conclusion or to construct supporting evidences. In this study, the participants applied web information strategy 6 times, accounting for 7% of total web information incorporation strategy uses. In this study, information synthesizing occurred for two purposes: (1) to construct evidence from multiple sources of web information; and (2) to deduce a conclusion from multiple sources of web information. Information synthesizing strategy was applied when supporting evidences was needed, but were not immediately available on a particular web page. By combining information from two or more web pages, a participant constructed the needed evidence. Table 29 also presented an example of information synthesizing strategy.

Table 29: Examples of Information Synthesizing Strategy

Example Essay Sentences	Original Web Information	Purpose	Essay Text Level
Additionally, house demolition can average around $12, meaning the demolition of an average house according to the Census Bureau is about $24,000"	The range for residential demolition cost per square foot is usually ==between $4.00 per foot to $15.00 per foot==. Here are a few examples for context http://www.census.gov/const/C25Ann/sftotalmedavgsqft.pdf	to construct a definitive fact evidence	sentence

Table 29 (Cont'd)

Examples of these are the walk in tour of Alcatraz Prison in Alcatraz Island, California and the Atomic Bomb Dome in Hiroshima, Japan.	<mark>Alcatraz Island</mark> is located in the San Francisco Bay, 1.5 miles (2.4 km) offshore from San Francisco, <mark>California</mark>, United States. (http://en.wikipedia.org/wiki/Alcatraz_Island) Hiroshima Peace Memorial (広島平和記念碑 *Hiroshima heiwa kinenhi*[?]), commonly called the <mark>Atomic Bomb Dome or *Genbaku Dōmu*</mark> (原爆ドーム[?], A-Bomb Dome), in Hiroshima, Japan, is part of the Hiroshima Peace Memorial Park and was designated a UNESCO World Heritage Site in 1996. (http://en.wikipedia.org/wiki/Hiroshima_Peace_Memorial)	To construct an example evidence	Sentence

In sum, in order to incorporate web information in the written essay, the participants applied direct quoting, information picking, information restating, information summarizing, and information synthesizing strategy. Among them, information restating and information picking are the two most frequently used information incorporation strategies, accounting for 52.36% of total strategy uses. Information synthesizing accounted for 5.58% of total strategy uses. Table 30 presented an overall picture of the strategies used by each of the participants.

Table 30: Web Information Transformation Strategies used by Individual Writers

	# of Direct Quoting	# of Information picking	# of Information Restating	# of summarizing	# of synthesizing	Total # of strategy uses
Anne	0	5	0	0	1	6
Yaira	2	4	1	1	1	9

Table 30 (Cont'd)

Kaitlyn	0	3	2	1	0	6
Emma	1	2	3	4	0	10
Keen	0	0	6	0	0	6
Kathy	5	0	2	0	0	7
Matthew	0	2	1	6	0	9
Delaney	0	2	7	1	1	11
Jon	0	2	0	3	2	7
Monica	2	1	0	0	0	3
Nana	1	0	3	0	0	4
Gail	0	3	4	0	0	7
Total	11	24	29	16	5	85
	12.94%	28.24%	34.12%	18.82%	5.88%	100%

It can be observed from Table 30 that after online searching and reading, the participants were capable of restating online information and selecting facts and statistics in support of their arguments. Direct quoting was used moderately among the participants. One participant, Kathy was found to use direct quote heavily in her essay. A review of her final essay found that she quoted 5 sentences directly as claims in her essay. The case of Kathy's uses of web information raised an alarm of possible undigested uses of web information as it is. The participant didn't take effort to transform the web sentence in her own words. The high-level information transformation strategies such as information summarizing, and information synthesizing,

although presented in the participants' essays, they only constituted a modest amount of

information transformation. Information synthesizing, which resulted from the participants'

efforts of linking two or more pieces of online information together, only represented 5.88% of

the total strategy uses.

Post-Writing Concept Maps as Evidence of Change

Consistent with the findings in the participants' essays, the coding of participants' post-

writing concept maps showed change on the writing topic. Table 31 presents the results from the

participants' post-writing concept maps. Table 32 shows changes in the knowledge and

knowledge structure among the participants after searching and reading online. In their post-

writing concept maps, they only focused on one side of the argument and thus took one

perspective on the writing topic. Overall, the number of supporting points for the perspective

they selected decreased from pre- to post-map. For the students who adopted a perspective prior

to their online search about the writing topic, the data indicates that some of their supporting

points listed in the pre-writing concept maps weren't listed in the post-writing concept maps.

Table 31: Results from Post-Writing Concept Maps

	Pseudo Name	Perspectives	# of Supportive points	# of Additional interpretations	# of Specificity	Total
1	Anne	Yes	3	5	8	16
2	Yaira	Yes	3	6	7	16
3	Kaitlyn	Yes	4	7	3	14
4	Emma	Yes	4	7	3	14
5	Keen	Yes	3	5	2	10
6	Kathy	Yes	3	6	1	10

Table 31 (Cont'd)

7	Matthew	Yes	2	5	4	11
8	Delaney	Yes	3	10	7	20
9	Jon	Yes	6	9	6	21
10	Monica	Yes	2	3	4	9
11	Nana	Yes	3	4	3	10
12	Gail	Yes	4	8	2	14

Based on Table 31, Table 32 compares the changes of the participants' knowledge on the writing topic before and after searching online.

Table 32: Comparison between Pre-Writing Concept Maps and Post-Writing Concept Maps

	Pseudo Name	Perspectives	# of changes in Supportive points	# of changes in Additional interpretations	# of changes In Specificity	Total
1	Anne	Yes	-1	5	8	12
2	Yaira	Yes	0	-3	4	1
3	Kaitlyn	Yes	1	-1	3	2
4	Emma	Yes	1	7	3	11
5	Keen	Yes	-1	5	2	6
6	Kathy	Yes	-1	1	1	1
7	Matthew	Yes	-1	1	3	3
	Prior-Perspective Average		-0.29	2.14	4	5.14

Table 32 (Cont'd)

8	*Delaney*	No to Yes	-2	7	7	12
9	Jon	No to Yes	2	9	6	17
10	Monica	No to Yes	-8	3	4	-1
11	Nana	No to Yes	-5	4	2	1
12	Gail	No to Yes	-4	8	2	6
	Non Prior-Perspective Average		-3.4	6.4	4.2	7.2

Table 32 shows an insight of reshaped knowledge and knowledge structure among the participants after searching and reading online. Overall, the number of supporting points to the perspective reduced. In the pre-writing concept maps, the participants who didn't take a prior perspective on the writing topic list both pros and cons of destroying historic buildings. In their post-writing concept maps, they only focused on one side of the argument and took a perspective on the writing topic. For the students who took a prior perspective on the writing topic, it was found that some of their supporting points listed in the pre-writing concept maps weren't listed in the post-writing concept maps. A review of the students' online searching and reading video show that the students' either didn't search these supporting points online or didn't find satisfactory information on the supporting point. As other supporting points were developed more fully, the ones with least information were unrepresented in the post-writing concept maps. The participants showed increased knowledge of additional interpretations and specificity of the supporting points. The result of the students' post-writing concept maps were consistent with the results shown in their written essays.

Overall, after online searching and reading, the students' post-writing concept maps and the students' essays both showed the concrete evidences of students' increased knowledge and substantiated knowledge structure on the writing topic.

Value of Internet Search Tools for Writing

Importance of Internet Search tools during writing process. The participants' survey results revealed the importance of Internet search tools and supported the earlier finding in this study that Internet web information contributes to the participants' writing in various degrees. The participants agreed that writing tasks are easier for them when they use Internet search tools (mean= 3.41). Five participants agreed and 7 participants strongly agreed that using Internet search tools can help them include lot of details in their writing. Although agreed, the participants showed less certainty about the helpfulness of using Internet search tools in improving their vocabulary (mean = 3.08). The survey results also showed that more of the participants reported a neutral view about the helpfulness of using Internet search tools to generate new ideas for their writing (mean = 2.91). Similarly, four out 12 participants reported a neutral view about using Internet search tools to help organizing ideas (mean =2.91). Overall, the survey results (Table 33) showed that the participants all recognized the importance of Internet search tools for a writing task.

Table 33: Importance of Internet Searching Tool from Survey Responses

	Writing tasks are easier for me when I use Internet search tools.	With Internet search tools, I can come up with great ideas for my writing	Organizing ideas is easier for me when I use Internet search tools.	Using Internet search tools helps me to include precise and interesting vocabulary words in my writing.	With Internet search tools, I can include lots of details in my writing
Strongly Disagree (0pt)	0	0	0	0	0
Disagree (1pts)	0	0	0	1	0
Neutral (2pts)	1	4	4	2	0
Agree (3pts)	5	5	5	4	5
Strongly Agree (4pts)	6	3	3	5	7
Mean Score	3.41pts	2.91pts	2.91pts	3.08pts	3.58pts

Steps to use Web Information Effectively. When the participants were asked about the steps of using web information effectively, in their responses, they together mapped out three iterative steps to take in order to incorporate the searched web information in an argumentative essay: evaluating, de-contextualizing, and re-contextualizing.

Evaluating The participants reported that one of the major concerns of the web information is its non-guaranteed information quality, as the very nature of the Internet allows all

individual to freely publish information on the web without being reviewed for trustworthiness and accuracy of the published information. The participants mentioned that in order to use web information effectively, one must evaluate the trustworthiness of online resources by first investigating the nature of the hosting website, (i.e. whether it is from a government website, or from a forum, whether the information is biased or not).In addition to evaluating the credibility of websites, cross-researching (i.e. to check information from multiple websites to make sure the information is consistent) is another way to evaluate the credibility of web information. Just as Monica pointed out *"So it is important for you to get the information, double check the information some places else, rather than just the concrete piece at the first place."*

The other identified dimension of evaluating web information was to evaluate the relevance of web information in light of the given writing task. As claimed by the participants, the snippets of web information on every Google result page gave them the first impression of the relevance between the web information with the writing task. If the sentences around the search keywords seemed to discuss the similar topic, they would more likely to click on it and explored further. When on an individual web page, the students would evaluate the information to determine whether the information can be used as an example to illustrate a point or as additional points to be included in the writing. The minimal online reading strategy found in the participants real-time online searching and reading confirmed the participants' active uses of evaluating strategy.

De-contextualizing   In addition to evaluating web information for its credibility and relevancy, the participants further indicated that they need to de-contextualize the information from its original written context, dissecting the needed information from its original writing purposes and writing style. As Jon explained, "It means dissect bits of information out of

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paragraphs." By the same token, Gail suggested "if you see a word or phrase that you would like to use, take it out. If you see a point, take it out." The participants also reasoned that taking the needed information out of it is original context would communicate succinct and intuitive points for the audience.

> *People want short, intuitive points writing. People don't want to read a novel when they*
>
> *find out information; they just want to know what they need to know.*

Re-Contextualizing The most important part of using web information for a writing task is to actual use the web information for the purpose of improving writing. The students in their responses gave two criteria of re-contextualizing web information effectively. (1) To make a piece of information usable, one needs to give an opinion to the information. The students indicated that the information such as data, dates, years, history does not have argumentative meanings in itself; it is the interpretation of the information that gives it meaning. To use web information effectively, means to students, to be able to interpret the information in a way that enhance the argument. (2) Furthermore, the participants mentioned that in order to re-contextualize web information effectively, an author needs to figure out the appropriate place of the information in the essay so that the web information blends with prior knowledge, together, they should make the essay flows. As Kathy explained

> *"If it answers the prompt if I can stay on track with the prompt, and answer the question*
>
> *and put my own idea in there too, I consider that effective."*

> Similarly, Gail pointed out:

> *"It depends on the topic, if it flows well. Like all papers obviously need flow and if you*
>
> *look at it, you feel this part is really good and you can compare it to another part. Or,*
>
> *really, that paragraph is fluffy, they need more examples."*

High Priority of Checking One's Use of Web Information. When the participants were

inquired about the importance of checking whether they have used web information effectively,

the majority of the participants agreed on the high level of importance of checking whether they

are using web information effectively. The participants reported that spending time to check

whether they have used web information effectively was at the very high priority, as it is the

ultimate goal of searching online and using online information to strengthen the argument. "I

think it is the most important thing you can do, because it is taking the information you find

related to someone else." However, two students mentioned relatively low importance of

checking one is using web information. For one participant, the reason behind the limited

necessity of checking web was that the question of whether one is using web information

effectively has already been answered at the time of conducting Internet search.

> *"I think when you beginning on the Internet, you know how you are going to use the*
>
> *information already, like when I search for the thing about India, I know how i will use it*
>
> *within the scope of my essay. What is being important to me is to find the information fast*
>
> *and find the information that I needed fast."*

The role of Internet search tools and web information for a writing task. At the end of the

interview sections, the students were asked about their perceptions of the role of web information

in their writing. First, the participants reported the unique characteristics of web information. The

participants pointed out two primary elements of web information: (1) vastness, and (2) its

ability to bring to students the information that they have never encountered before or the

information they were unaware of before searching on the Internet.

The participants acknowledged that when being exposed to a large amount of

information, they are possibly to be led to unexpected information. Nana referred that the targeted

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information as "a grain of sand in a desert". Yairapointed out the possible shift of writing direction from the original plan after the intervention of web information in the thinking and decision-making process:"It can take your writing to a direction that you have never expected to go, it can provide you the information you would have not been aware the existence ." Very similarly, Jon commented on the interactive nature of the web information: "You have to allow web information to stir the thought." he stated. Likewise, Anne gave an example of being led away by web information, "Before, I was on the web, and I was reading about Helmet, and Helmet will lead to how people analyze (the character). Then, it really gets away from what kind of argument that I am trying to make."

Despite of the uncertainty that web information might bring, the students still appreciate the convenience as well the importance of using online information for a writing task. The speed of the Internet was mentioned by the students. "There is no reason to refuse more information to make an informed decision", like Matthew, other students commented on the convenience of accessing to large amount of information. "(With the web information) I am able to write up an essay with least amount of effort". "Useful", "helpful", "fast", "huge help", and "easier" were the words in the students' responses to describe the role of the web information for a writing task. The students further stated that the Internet is such a useful tool to expand knowledge on the writing topic, and the writing task would be "very difficult" and "more fluffy", and "take longer" without the aid of the Internet and web information.

In addition, the participants reported that using online information had become an integral part of their writing process. The experience provided by the participants suggested that web information allows them to have new information to support their argument, and make their arguments sound "less opinionated" and "more factual".

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Regarding the relationships between web information and prior knowledge, four types of relationships between online information and prior knowledge emerged in the participants' answers. (a) Addition-- online information adds to their prior knowledge. Together they provide more evidence for the argument they are making. Katelyn explained how web information helped her understand the economical impact of replacing historic buildings. *"Like I talked about the cost and economically, I probably would not write about that, because I don't know much about that*." (b) Revision, online information revised the students' prior knowledge about the topic and gave them new information that modified their prior knowledge. Based on the revised information, the students reconsidered the stance of the argument that they would take. Jon explained how the web information changed his knowledge about renovating a building

> *"I was thinking it was easier and cheaper to tear down a building than to renovate it. But the information I found say it is cheaper to preserve historical buildings. It is something faster to preserve them than to rebuild them. Yes, because I started thinking it is cheaper to tear down the building than to renovate them, then I do research, and I found the opposite."*

Noticeably, when having more information, the students differed in their tendency to revise their stance. For other students, they would skip different opinions and only take in the congruent ones. The major function of web information in their words is to "provide more evidences". (c) Activation. Several students noted that online information would remind them of the related personal experience or knowledge about the writing topic that they could not have thought of without searching on the Internet. (d) Articulation. One student mentioned that reading web information helps her think clearer on the writing topic.

"Sometimes I just look up information on the Internet and don't even use it, but it is just giving me ideas by looking at what other people thinks. So I think it is on the Internet, it elicits your own opinion like bring it out. "

Summary of Research Question 3

The third research question investigated the strategies the participants applied to transform online information into essay texts. It is found that the participants successfully incorporated web information into their written essays and online information on average account for 27% of the participants' final essays. They served as evidences, opinions, counter-arguments, and themes to strengthen the arguments. During the process of writing, the participants applied the strategy of direct quoting, factual information picking, information restating, information summarizing, and information synthesizing to transform online texts into essay texts. The students reported that to make sure they used online information effectively; they went through the process of evaluating, de-contextualizing, and re-contextualizing. The students' regarded effectively use of online information as very important. While acknowledging the uncertain nature of online information, the students appreciated the convenience of online resources that can bring to enhance their knowledge. In their reports, four types of relationships were reported regarding the relations between online information and prior knowledge: (1) addition; (2) revision; (3) activation, and (4) articulation.

Research Question 4: What are interstitial moments from searching to writing?

The fourth research question explored the interstitial moments from searching to writing. Specifically, the question examined how the participants switched their roles as a searcher, reader, and writer during the course of online searching, reading, and writing. The data from

video clips and think-alouds showed that in this study the participants went through two distinctive phases of online searching/reading and writing. Out of the 12 participants, 11 participants adopted the two phases approach: first searching and reading online, and then composing the essay. During the online searching and reading phase, they performed the role of a searcher and reader, collecting information for essay writing. During their essay writing phases, they performed the role of writer and did not go back to the Internet for additional searching and reading. Only one participant, Anne, adopted a blended approach. She started from writing the essay and then searched and read online as she felt needed during the course of writing. Thus, the data for answering this research question came from (1) Anne's think-alouds and video clip; and (b) all participants' interview and survey responses. The findings for this research question are presented in the following five sections: (1) the case of Anne; (2) the meaning of the connections among searching, reading, and writing; (3) the approaches to connecting searching, reading, and writing; (4) high priority of connecting searching, reading, and writing; and (5) summary.

The Case of Anne

Anne is a female participant in this study. She was about 19 years old when participated in this study, majoring in English and Russian. She scored 730 in her SAT writing test in the year of 2010. In her survey response, she reported that she has been using Internet search tools on daily basis for about four to five years. She used Internet search tools for 60% to 80% of her high school writing assignments, and the number increased to 100% for her college writing assignments. She also reported that she has received instructions in how to use Internet search tools for more than three times and was familiar with the advanced features of Internet search tools such as how to conduct Boolean searches.

In her concept map, Anne clearly stated her position on the writing topic that "Older historic buildings must be preserved." Followed by her statement of position, she presented four supportive points for her argument:

Having better idea of how people live and learn in the past

Modern buildings will be built anyway. Why not keep the old building too?

Generation realize how technology has improved

Don't want to deprive the future to the same finding (no way to know)

No additional explanation points and details in her concept map besides these four supportive points for Anne's stance of the writing topic,.

After Anne finished drawing her concept map, she opened up a Word document and started writing. She started her writing by first developing the supportive points given in the concept map into full sentences the Word document.

If buildings are still functional with minor upkeep, then there is no reason to spend money, time, and effort in replacing them"

If historic buildings aren't preserved, then future generations will have difficulties picturing how life in the past was lived.

It is important to consider that scholars will continue making advances in science, which will potentially unlock new knowledge and undiscovered facts about the historic places to be preserved.

Maintaining historic properties and the areas around them allows for the protection of relevant evidence for future discoveries

As she explained while typing these four supportive points, "I am just typing my main points in first to build up the structure of my essay."

As she re-read her first supportive point out loud—"If buildings are still functional with minor upkeep, then there is no reason to spend money, time, and effort in replacing them", she explained the reason to search online, "right now I am looking for a statistics." She opened up Google search engine and typed in "cost of building a house". In the first Google search result page, she selected "about.com" as she determined it is a non-commercial website. "Oh, about.com", she commented, "It seems like a great place to go, as it is not something like 'hey, let us sell you a home."

On the about.com, Anne found a statistic about the cost of building a house. It stated on the webpage "For example, if the home is selling for $230,000 and the land costs $30,000, then the construction cost is around $200,000." She decided to use the statistic after comparing the statistics with her prior knowledge "when driving by we often see a house selling at 200,000 to 250,000, so let's just go by that statistics." Then she continued her writing on the Word document "building a completely new home costs around $200,000."

After obtaining the statistics of the cost of building a house, she identified the need to confirm her argument by finding out the cost of demolition of a house online. "Actually, I am wondering how much it would cost to demolish a house." Following that, she searched "demolition cost for a house" online. Unhappy with the search results, she revised her search keyword by adding her location. "GA". Again from the first result page, she opened up a contractor's website where she found a piece of indirect information about the cost of demolishing a house is 10 to 15 per square foot. Anne switched back to her essay and continued writing "Additionally, house demolition can average $12," Here Anne identified the additional need to find out the average house square footage so that she can calculate the total cost of demolishing a house. She went back online and searched "average square footage of a house".

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"Oh, it is the government that is telling me. That's good. That's reliable", she was excited when opening up a government report from Census Bureau about average square footage of a house in different areas of the United States. In the document, she located the state of Georgia and found that in the state of Georgia, the average square footage of a house is 2000. She was satisfied with the finding and continued her writing, "meaning the demolition of an average house according to the Census Bureau is about $24,000. In this sentence, she synthesized the information she found from two different searches and cited the Census Bureau" as an authority to back up her argument.

Thus, by conducting four searches online, Anne found the statistics about the cost of building a house and the cost of demolishing a house to support her first supportive point for her argument.

Similarly, as Anne continued to argue for her second and third she searched online for verifying the details of the examples used in her essay, for finding additional examples and statistics. For her second supportive points about historic values of historic buildings, she searched online for the location of Abraham Lincoln's death place and the identity of Robert Toombs, also for the statistics about the number of historic places preserved by the National Register of Historic Places. For her third argumentative point, she searched for a piece of recent news about how new science technology helped revealing historical myths in India.

As the result of her online searching, Anne managed to integrate online information in 6 places throughout her essay:

1. *Building a completely new home costs around $200,000. This price, of course, is paid over a period of 30 years with a mortgage.*

2. *Additionally, house demolition can average around $12, meaning the demolition of an average house according to the Census Bureau is about $24,000.*

3. *A very frequently visited location in Washington, D.C. is the Petersen House, the location where Abraham Lincoln died.*

4. *There are over 80,000 properties maintained by the National Register of Historic Places in order to connect the present with the past.*

5. *Another example of this is the Robert Toombs House in Washington, GA. Robert Toombs was a prominent statesmen, the first Secretary of State for the Confederacy, and an important member of the Demosthenian Literary Society.*

6. *For example, the erection of Baldwin Hall covered up a significant portion of Old Athens (Jackson Street) Cemetery, the original cemetery in Athens.*

As can be observed from Anne's online searching and writing process, the moments of online searching were stimulated by the situations of writing when Anne detected an information gap between her knowledge and writing. The gaps were detected by Anne's knowledge as a writer on how to rhetorically make an argument: by comparing the cost of building a house with the cost of demolishing a house, by citing an authoritative source, by relating to one's personal experience, and by presenting statistics. The gaps required her to search online so as to consolidate her argument. Every time during her online searching, she completed the fast switch of the roles of writer, searcher, reader, and writer. Figure 3 presents the model of the role switching found in Anne.

Figure 3: Anne's Model of Role Switching
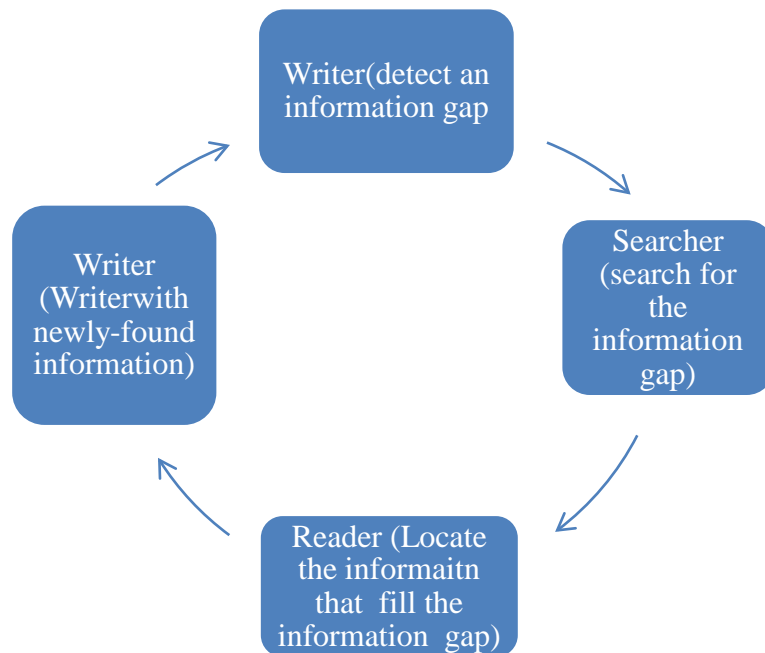
Consistent to her process of online searching and writing, Anne reported in her survey that when she searches on the Internet, she usually keeps her goal of searching clear in her mind and she updates her searching goals in response to the needs of writing. She also agreed that Internet search tools helped her to included precise and interesting vocabulary in her writing and she can include lots of details in her writing with the help of Internet search tools. But she felt neutral to the statement that she can come up with great ideas for her writing with Internet search tools.

Comparing Anne's step-by-step evidence building search approach with Kathy's straightforward use of topic sentences as search keywords showed that when writing with the Internet and Internet resources, not only topic knowledge played a role in online searching and reading. Equally important, a writer's prior knowledge of rhetorical strategies of building an

argument also played a role in the writer's online searching. Combining the writing prompt with rhetorical strategies opened up Anne's scopes of searching with limited topic knowledge.

Moments of Connecting searching, reading, and writing

From the interview responses from the 12 participants, two themes emerged regarding to the moments of connecting searching, reading and writing. The first theme involved with evaluating online information based on writers' prior knowledge and the given writing task. The participants reported that when they were searching and reading online, they evaluated the usefulness of the web information from the lenses of their prior knowledge and the given writing task. The evaluation process serves two purposes: (1) narrowing down information online to a manageable amount of information. Like Emma expressed,

 " The biggest thing about reading information and connecting it to what I write is that I can't use all the information that I read so I have to make sure I narrow down what I read to information that would be useful for a paper, which requires time and knowledge about what I write about and what I am trying to go for. "

And (2) determining the meaningfulness of online information by linking them with prior knowledge and the given writing task. Specifically, the writers indicated that when searching and reading online, they were looking for explanations of the existing bullet points. Search keywords, or keywords from a given writing prompt, or familiar words from the writer's prior knowledge served as suggestive indicators of possible linkages between prior knowledge, web information, and the writing prompt at hand. One participant, Matthew, particularly indicated that if the number of such keywords in a web page reached a threshold of five, he will consider the online information to be particularly relevant and useful for the writing task.

The second theme of connecting online information emphasized on building a cohesive argument by coordinating both prior knowledge and online information for the purpose of writing. The participants reported that when they searching and reading online, they were trying to build a cohesive argument by picking the information that is consistent with each other and can be pieced together to paint a picture. Another identified notion of connecting searching, reading, and writing was to add and amend prior knowledge. The participants acknowledged that expanding their knowledge online and discover the knowledge that they were unaware of about the writing topic is a direct way of connecting online reading and writing. Also, when the conflicting information occurred, checking the accuracy of prior knowledge by using multiple web resources is also an approach to establish the link between online reading and writing. As important as building a cohesive argument, the participants also indicated that connecting reading and writing also means to look for counter arguments to existing arguing points and try to argue back to establish a solid argumentation.

Interestingly, the point was brought up that connecting online information with the given writing task involved a process of remixing the piece of online information in a new text. It was acknowledged that that online information also contains multi-media materials, which require an additional step to transform the visual and audio- contents to texts. In this sense, connecting online information means taking the information out of its original media context and transforming the message for the purpose of writing. Just as Delaney said,

> *" It is actually pretty easy, because most of what I used as reference was text-based already, it is writing a song off the CD and then turning it into a mixed CD, it is shifting information, not any sort of conversion."*

Approaches to connecting searching, reading, and writing

The data from the participants responses indicated that the process of establishing the linkages between searching, reading, and writing involved in every of the three stages of the search-and-write processes: searching, reading, and writing.

The participants reported that during the phase of online searching, the connections between online searching and the writing began with the selection of search keywords. The participants reported that they have used keywords in the writing prompt as search keywords or used the most important points in their concept maps as search keywords to conduct online information searching. *"I used main points I think most important and I go searching around them"* Kathy indicated. Also as Yaira expressed:

> *"...based on what I already know about the topic and then insert the key points and keywords that I remember about the topic and I will go search for them and because it always leads me to another set of information....."*

By searching prior knowledge online, they expected a new set of information will be brought up to them and open their scopes of thinking on the writing topic. This finding was confirmed by the finding in the first research question that the participants' online searching was dominantly oriented by their prior knowledge and the given writing prompt.

In addition, the participants reported that during the course of online reading, they were often engaged in a series of connecting activities. During the course of reading online information, the participants engaged in evaluating and selecting online information for the needs of the writing. The establishments of connections between online reading and the writing task, on their accounts, occur when they "skim", "identify", "pick", "combine" , "study" "took notes of", and "highlight" online information. In their responses, the participants particularly emphasized that they were not reading an entire webpage; instead, they used textual cues such as

topic sentences and textual connectors to locate the intended information on the web page. "..,
not the whole thing, just topic sentences", Delaney explained, "I was looking for key words, I
read the sentences around those keywords". Other participants indicated that they looked for
textual indicators such as "for example" and statistical numbers to establish linkages between
online information and the writing task on a web page.

In addition to textual connections, the participants also reported that they were engaged in
establishing deeper conceptual connections between online information and the writing by
combining multiple sources of online information, taking notes, and making outlines of the
collected online information. These additional activities allowed the participants to gain intimate
insights of the usefulness of particular information. As well captured in Anne's response:

> *I try to take notes from each website, if I go to next website, I start taking notes, but I still*
>
> *looking at the notes I took from the first website, and if I see something that is said twice,*
>
> *I would like to bold it or highlight it or something that I can really use this.*

These findings were also consistent with the research findings in the research question 2
where the participants were found to actually the activities in minimal online reading strategy,
deep online information engagement strategy, and offloading useful web information strategy
during the actual process of searching and reading. These strategies, not only helped the
participants to reduce information load while reading online, also helped them to connect online
information with their prior knowledge and the writing topic.

Last, the participants reported that during the phase of essay writing, they connected
online information with given writing task by "blending" online information with their prior
knowledge. Blending involves "making the essay read smoothly with the online information",
which refers to integrating online information into an essay and making it work in concert with

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prior knowledge to support the intended points. The specific strategies of blending, mentioned by the participants included: "picking a tone to restate the selected online information", "analyzing (online information) by taking perspectives", "relating (online information) with personal experience". In the research findings for the research question 3, the participants were found to use 6 specific transforming strategies to blend online information into their essay texts.

High Priority of Connecting Searching, Reading, and Writing

All of the participants indicated that connecting searching, reading, and writing was a high priority for them when they were searching and reading online. Three reasons were found for the importance of connecting online information with the writing task.

First, connecting online information with the writing task helps students to expand their knowledge on the writing topic. "Online information", according to one participant, "triggers your own thought, and pushes you to think in more depth." Also the participants regarded connecting online information to the writing task as important because they "have no sufficient prior knowledge" and can expand their knowledge by reading the opinions from those who agree and disagree with them.

The second identified reason of the high priority of connecting online information is to increase incredibility of the arguments. The credibility of argument comes from accuracy of information in the argument. When making connections between online information and the writing task, the writers thought it was very important to verify information to be used in the essay, and to enhance the credibility of an argument by more factual information, and making personal opinions became factual.

The third identified reason for the high priority of connecting online information and the writing task is because doing so can help to make arguments more effectively. By connecting

online information with the writing topic, the participants reported that they can comment on the events and facts and thus can "transfer information into points" and "formulate information into opinions".

Consistent Findings from Survey Responses

Congruent to the findings in the participants' interviews that connecting searching reading, and writing was a high priority when writing with the Internet, in their survey responses the participants reported that they frequently think about their opinions when reading online information (Mean = 3.08). Out of the 12 participants, 9 participants reported that they either frequently or always think about their own opinions when reading online information. Equally frequently, the participants also reported that when reading search results, they think about how to integrate new information into their writing (Mean =3.08). Table 25 presents the findings in two survey items regarding connecting reading and writing.

Table 34: Connecting Reading and Writing from Survey Responses

# of Participants	I think about my opinions when reading online information (# of participants)	When reading search results, I think about how to integrate new information into my writing (# of participants)
Never (0pt)	0	0
Rarely (1pt)	1	1
Sometimes (2pts)	2	1
Frequently (3pts)	4	6
Always (4pts)	**5**	**4**
Average (5 pts)	3.08pts	3.08pts

Summary of Research Question 4

The fourth research question investigated the interstitial moments from searching to writing. The case study of Anne showed that the switches from the role of writer to the role of searcher and reader occurred when she identified specific information needs during the process of writing. Anne searched online and located information to fill the information gap. As soon as she found the information, Anne resumed her role of a writer and continued writing.

The data from the students' interview response suggested that connecting between searching, reading, and writing means: (a) to search and evaluate online information based on one's prior knowledge and a given writing task; (b) to coordinate online information and prior knowledge so as to support an intended argument. The participants reported that they were engaged in connecting online information with prior knowledge during the stages of searching, reading, and writing. During the stage of searching, the participants used their prior knowledge and given writing topics to orient. During the stage of reading, the participants were engaged in skimming and locating textual indicators and developing conceptual connections between online information and prior knowledge. During the stage of essay writing, the participants focused on blending the searched information and their prior knowledge by selecting a tone for reporting online information; analyzing online information by taking a perspective; and relating online information with personal experience. The participants all regarded connecting online information and prior knowledge important for three reasons: (1) to expand prior knowledge; (2) to enhance the credibility of a written essay; and (3) to make their arguments more effective.

CHAPTER 6: DISCUSSION

The Internet resources, empowered by Internet search engines, have been increasingly utilized for students' academic learning (Anderson, Boyles, & Rainie, 2012; Gillingham, Molinari, 2012). Particularly in the areas of reading and writing, more and more students have situated their reading and writing activities online and depended more and more on online resources to expand and deepen their intellectual understanding of content subjects (Leu, Coiro, & Kulikowich, 2012). Timely, educational researchers have acknowledged the exclusive affordances of Internet search tools and Internet resources for new opportunities of learning. Yet, the cognitive processes involved in searching, reading, selecting, and tailoring online information for a given writing task need to be articulated for the benefits of classroom instruction .

This multiple–case study was driven by such a broad question: what are the cognitive processes that first-year college writers apply to search for, read, and utilize online information for a given essay writing task? The searching, reading, and writing activities performed by the participants in this study allow insights into the roles of prior knowledge, the supportive strategies involved in online reading to manage cognitive load, and the strategies to transform online information into essay texts. In this chapter, the findings are contextualized and discussed in light of existing research literature. The chapter is organized in the following six sections: (a) understanding the role of prior knowledge in online searching, reading, and writing, (b) cognitive strategies applied to manage cognitive load on the Web, (c) strategies to transform online information into essay texts, (d) the meaning and approaches to connect online searching, reading, and writing, (e) limitations of the study; and (f) implications and future study.

RQ 1: Understanding the Role of Prior Knowledge in Online Searching, Reading, and Writing

The findings in this study firstly highlight the importance of prior knowledge in online searching. Research data in this study showed that prior knowledge constituted of 69% of online searching orientation, meaning that the majority of online searching inquiries were originated from the participants' prior knowledge about the writing topic. In other words, the writers' prior conceptual model of the writing topic, to a large extent, shaped the writers' information needs and the directions of online searching. Prior knowledge gave each student individualized starting points of online searching, as well as unique focuses to learn more about the given writing topic online. This finding supports the previous research findings regarding the role of prior knowledge in online searching.

In earlier studies, researchers consistently found that prior knowledge on content areas influenced the learners' online searching and reading behavior. For example, Potelle and Rouet (2003) found that prior knowledge influenced users' ability to navigate on the Internet and understand online information. Similarly, Coiro (2007) found that successful online reading required similar and more complex uses of prior knowledge. This study suggests that in the fluid open web searching and reading environment, the relationships between online searching and prior knowledge are mutually dynamic—while prior knowledge equipped students with personal online searching terms to start searching online, online searching technology allows each individual student to select reading materials that are tailored to their prior knowledge and to expand their prior knowledge.

Three roles of prior knowledge in orienting online searching were identified in this study: (a) as references; (b) as springboards; and (c) as anchors. These three roles of prior knowledge prescribed the writers' intentions of online searching and reading. Previous studies have shown

that prior knowledge can increase the effectiveness of information seeking by helping learners

formulate appropriate search query words, judge the relevancy of web information, and prepare

for the Internet search (Bilal, 1998; Hsieh-Yee, 1993; Marchionini, 1989; McDonald &

Stevenson, 1998; Shute & Smith, 1993; Vakkari, Pennanen, & Serola, 2003; Wildemuth, 2004).

Adding to the prior literature, this study suggests that not only the amount of prior knowledge,

but also the different uses of prior knowledge to orient Internet search also influenced students'

online searching behavior. When a participant's prior knowledge served as a reference, his/her

online searching purpose was to verify prior knowledge, and his/her online searching approach

exhibited a distinctive pattern of "search-grab-and-go-or-leave". At the time of searching, the

writers have already figured out the fit between the searched information and the writing task.

Therefore, their online searching approach was found as rapid, non-iterative cycles and their

search queries were specific and targeted. When a participant's prior knowledge served as

springboards, his/her online searching purpose was to expand prior knowledge, the writers

utilized specific names as well as generic high-level concepts as search queries. When a writer's

prior knowledge served as an anchor and a writer was trying to search online to justify prior

knowledge. In this case, the writers frequently expressed the difficulty in composing efficient

search keywords and were found to use different strategies to generate search keywords such as

summarizing and abstracting. Adding to the challenge of generating efficient search keywords,

the web information generated by these search inquiries turned out to be less helpful than the

information brought up by other search results, partly because the claims being used as search

keywords were rarely used by other users and new to the search engine database, and thus cannot

generate information as accurately as the popular terms that are frequently clicked and referred.

The third finding in this study reveals the differed information searching behavior between the participants who has adopted a prior perspective on the writing topic and the participants who has not adopted a prior perspective. Previous studies have not explored influences of a prior perspective and prior knowledge structure on students' online searching approaches. In this study, it is found that the participants who have adopted a prior perspective on the writing topic used prior knowledge to orient online searching more frequently than the participants who has not adopted a prior perspective. However, the participants who have not adopted a prior perspective used the writing prompt two times more frequently than the participants who adopted a prior perspective. In addition, those participants who did not adopt a prior perspective also conducted more online searching inquiries than the participants who did. It is important to point out that the participants who have adopted a prior stance on the writing topic have showed a narrower-but-deeper understanding of the writing topic in their concept maps: they listed less claims, but were capable of offering more interpretations and specificities to support the arguments. This interesting observation suggests a possible relationship among a student's prior perspective, the structure of prior knowledge, and online searching orientation. The current study identified suggestive associations between these three dimensions of online searching, nevertheless, however, given the small sample size of this study, more research is needed to explore the interplays among the particular components of prior knowledge and online searching.

It is also suggested in this study that the writer's prior knowledge structure and prior perspective might influence their online searching behavior as well. It is found in this study that the participants who presented a narrower-but-deeper knowledge structure also explored fewer websites but on average read more webpages within a website. The participants who presented a

wider-but-shallower knowledge structure, although explored more websites, but on average, read less webpages within a website. Future studies with a larger sample size are encouraged to explore the relationship between prior knowledge structure and structure of online searching.

RQ 2: Managing Cognitive Load during Online Search and Reading

The data in this study revealed that although the students searched a variety of search keywords, for each search keyword, the students only selected one website to explore, and within that website, the students typically read only a couple of web pages. This one search-one searchr result page-one website searching and reading strategy found in this study ultimately helped the students to reduce information load from the Internet. Researchers in previous studies have repeatedly expressed the concern of web disorientation and information overload of online searching and reading, especially for lower-grade students (Eveland & Dunwody, 2001; Hill & Hannafin, 1997; Webster & Ahuja, 2006; Shih,Huang, Hsu, & Chen, 2012). The study showed that the students in this study have applied four additional cognitive strategies to reduce the information intake to a manageable level. Information overload and web disorientation were not shown in this study as roadblocks to searching and reading online.

In addition to the one search keyword-one search result page-one website searching and reading strategy, during the process of online searching and reading, the students constantly applied four additional strategies to manage cognitive load. They include minimal online reading strategy, deep information engagement strategy, offloading useful web information strategy, and searching and reading behavior self-monitoring strategy. Out of these four strategies, offloading useful web information to external artifacts was a well recognized strategy in offline reading to storage information (Kiewra ; DuBois; Christian; McShane; Meyerhoffer; Roskelley, 1991). In

their experiment, they identified 3 functions of note-taking: encoding, encoding plus storage, and external storage. The frequent uses of the strategy in this study showed that even in online reading environment, students continued using the information storage strategies that has been developed in offline reading context to help them retain information collected from the Internet. Students in this study used the "adding-to-concept-map" approach, the "copying and pasting" approach, and using web information immediately approach to storage information external to their memory. Future studies can further explore the respective advantages of each approach in online searching and readings.

Stating searching and reading goals was identified in this study as an essential activity in minimal online reading strategy that the participants applied to manage information load. When reading a web page, the students constantly constructed a goal of reading to help them locate the information they were looking for. Given the nature of online reading, clarifying searching and reading goals may become a particularly important strategy in online reading writing environment. When students are presented with a range of documents, it is critical to know the nature of the intended information and what to look for in a particular website or web page. In this study, since the students were required to think out loud during their searching and reading process, it might be possible that the think-aloud process itself would promote the students' awareness of the searching and reading goals. In their everyday searching and reading online when thinking out loud is not a nature activity in their online searching and reading, it is concerned that whether the students will state searching and reading goal as often as in this study. Additional instruction might be helpful to teach students how to define their goals of searching and reading in an information-rich environment.

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Deep online information engagement strategy was found crucial for the participants to interact with online information. The participants compared online information with their prior knowledge, resolved conflicting information, interpreting online information, identifying further information to be searched on the web, and evaluating current knowledge and knowledge structure.

Concept map were deployed in this study as an instrument to measure students' prior knowledge. However, it turned out to be an important tool that the participants depended on to evaluate their current knowledge and knowledge structure during online searching and reading. By constantly evaluating their current topic knowledge and knowledge structure, the students updated their knowledge about the writing topic and checked their status of online searching to determine which argument as fully supported by the evidence they have found on the Internet, which argument was less supported and needs more information from the Internet, and whether they had sufficient information to start generating essay texts. The finding suggests that concept maps could be a useful instrument, not only before online searching and reading as an overview of one's prior knowledge, but also during searching and reading as a checkpoint to help students manage their information load and keep track of searching goals. Future studies can be carried out to determine the effect of concept maps as an online reading instrument to enhance the connections between online information and one's prior knowledge.

Furthermore, the participants in this study actively monitored their online navigating and reading processes. They showed strong awareness of their web locations and paid close attention to their navigating and reading behavior. They recognized different levels of text engagements during online reading such as skimming, browsing, and reading closely. Such awareness of different levels of text engagement might be part of their metacognitive awareness of reading

online. Although studies on online metacogntive awareness are yet to be conducted to determine definitive components of online metacognition, this study suggested that awareness of one's online location , awareness of one's online information reading strategy, adjusting online searching approach based on search results, and trying to stay focused on reading can be part of the elements. Future studies will be needed to further explore the metacogntive awareness and metacognitive strategies that student s apply when reading online.

In terms of online searching strategies, previous studies have identified that students use three broad Internet search strategies: "dot-com formula", "shopping mall approach," and "search engine approach."((Bilal, 2001; Eagleton, Guinee & Langlais, 2003; Hill & Hannafin, 1997; Fidel et al, 1999; Guinee, Eagleton, 2002; Leu, et. al, 2004; Coiro, 2003). In this study, "search engine approach" was the only approach that the participants used to found information. The fading of "dot-come formula" and "shopping-mall approach", on the one hand, reflects the dominant popularity of search engines in online information searching. Students depended more deeply than ever on search engines to find useful information and regarded search engines as efficient and reliable vehicle to find intended information.

Although focusing on the strategies of managing cognitive load, this study also confirmed the findings in previous studies that at sophisticated adult online readers used different strategies when reading online information (Zhang and Duke, 2008; Fitzgearald, 2000). Zhang and Duke (2008) investigated the evaluation strategies used by very skilled graduate-student readers. Their findings showed that effective evaluation strategies that good adult Internet readers used included: (a) constantly evaluate the credibility of the website before they made any judgement on the quality of online information; (b) evaluate website from multiple assess points; and (c) use official websites to retrieve relevant information. The same strategies were

found in this study. In this study, the students constantly evaluated the credibility of the website and tended to retrieve information from well-known website such as wikipeida and government websites. By applying these web evaluating strategies, the students reduced a multitude of websites to a limited number of trustworthy website to read further.

RQ 3: Understanding the Role of Internet Search Tools and Online Information

The fourth research question explored the role of web information in the students' final writing products as well as the transforming strategies that the students applied to transform web information in their essays. Several interesting findings emerged from the study are discussed below.

It was found in this study that web information on average accounted for 27% percent of the participants' final written texts. This number suggested that the participants successfully orchestrated both web information and their prior knowledge to produce essays. However, the moderate number of percentage of web information in their final essays suggested that prior knowledge was still the major content source in their writing products. In addition, even in the small sample size of 12, strong correlation was found between the length of essays and the number of the sentences that incorporated web information. Students who were able to produced longer essays were found more likely to utilize more online information in their written essays. Future studies are needed to determine the relationship between students' offline writing ability and their ability to transform online information into written essays. Although writing with immediately-searchable online information adds a brand new component to the 21st writing processes, it is still unclear to what extent the students' existing writing ability will influence their successes in orchestrating online information for better completion of a given writing task.

Second, in this study, web information contributed to the writing topic in both micro and macro levels, varying from evidences, claims, to counter-arguments. The varied structural levels of integration of online information indicated that the good writers in this study managed to effectively use web information and apply the newly-acquired information to reach a better-informed argument. Direct Quoting, factual information picking, restating, web information summarizing, and information synthesizing were the 5 strategies identified in this study that the participants applied to transform online information into essay texts. Among them, direct quoting, information restating, and summarizing have been identified in offline writing-from-sources research literature as strategies of integrating external information resources. However, information picking, and synthesizing were the strategies that were newly afforded by the instant availability of abundant online information. Only on the premises of availability of instantly searchable online resources, the students are provided the opportunities to pick desirable information and synthesize several information sources.

Furthermore, the identification of these varied strategies in this study suggests that the processes of incorporating web information into a written essay is indeed an interactive process of learning from and negotiating with online information. When transforming online information into their written essays, students actively engaged in a process of information integration, reconstruction, critiquing, and assembling. Nevertheless, the varied frequencies of using each transforming strategy with information picking and information restating to be the highest and information synthesizing to be to be the lowest suggest that more instruction is needed to engage students in deep learning on the Internet. While the internet and online resources afford opportunities for students to enhance their understanding and develop cognitive flexibility, it is still on the part of our students and instructors to use the web information not only for the

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purpose of information gathering, but also for the purpose of developing conceptual flexibility and complexity of the content subject.

Fourth, using web information, according to the students, was the ultimate goal of searching online. Although the uncertainty of being shifted away by the large amount of information and alternative opinions existed, the students unanimously acknowledged that web information grants them the fastest access to the needed information. Using web information effectively in this study means to the students a process of evaluating web information, de-contextualizing, and re-contextualizing web information. Most interestingly, the students in this study reported that web information becomes an integral part of their writing processes: web information adds to, revises, activate, and articulate their prior knowledge on a writing topic.

Lastly, the findings of the study also provide valuable information for the relationships between online information searching and learning that is worth of discussion below.

Differing perspectives about the relationship between searching and learning have been proposed (Budhu and Coleman, 2002; Marchionini, 2006; Tang, 2002; Halttunen, 2003; Tsai and Tsai 2003). From a pragmatic perspective, Internet search *tools* allow learners to access to a theoretically unlimited number and type of information sources. The *design* of the Internet itself permits learners to follow or create the dynamic indexing of these vast resources (Williams, 1995). And the *speed* by which the tools and access work enables learners to iteratively generate problems or needs, develop and refine search strategies, and locate related documents. Thus, from a pragmatic perspective, affordances made possible by the tools, design, and speed function as a working or grounded perspective theory for the relationship between searching and learning. The data from this study supports this claim. The participants in this study demonstrated and acknowledged unprecedented affordances of Internet search technology including its design,

tool, and speed. On average, within 18minutes and 11 seconds, the students made 7 searches on the Internet, visited 7.17 websites, and read 9.16 webpages. Ultimately, online information were found to accounted for on average of 27% of their written essays as evidences, opinions, counter-arguments, and themes. The result of the study provides an important evidence of the pragmatic use of Internet search tools for academic learning.

From a theoretical perspective, learning is understood as an exploratory interaction (or 'doing' of something) with the environment. The interactive nature of online information seeking environment is consistent with this constructivist "learning-by-doing" perspective (Budhu and Coleman, 2002). Three aspects of constructivism parallel online information seeking. First, Wittrock (1974) connects the process of knowledge construction--in which the learner relates new information to old--to the building of enhanced new knowledge structures. Second, Kuhlthau (1993) characterizes the uncertainty that occurs during any active information seeking process as a prime factor in motivating a learning to seek new information that will resolve or contribute to the conflicts that the uncertainty of new online knowledge can create with one's existing prior knowledge. And third, Marchionini (2006) applies the pattern of constructivist learning to the multiple search cycles and iterative search behaviors of online information searching. In sum, the process of refining searching paths and understanding the value of the retrieved information and its links to prior knowledge make information seeking an active, constructive learning process. The findings in this study also supported the theoretical relationship between learning and online searching. The participants in this study sought to verify, justify, and expand their prior knowledge by searching actively online. The participants also engaged in evaluating, summarizing, synthesizing online information construct an effective argument.

From an empirical perspective, researchers have identified relationships between online searching and learning. Budhu and Coleman (2002) found that Web search technologies that create interactive learning environments can foster an increased understanding of science and engineering concepts. Wood et al. (1996) found that comprehension learners used a greater number of searches, more new terms, and more unique terms. These students were also more aware of search techniques for broadening or narrowing the search keywords. Similarly, Halttunen (2003), when investigating the relationship between learning style and information searching strategies, found that learners of different learning styles exhibited differences in their conceptions of information retrieval. Reflective learners viewed successful information retrieval as gathering information that needs analysis and assessment. Concrete learners placed more emphasis on computer skills and information search methods in their understanding of successful learning through online information searching. In a more recent study, Zheng, Morsink and Hartman (2011) investigated how teenagers learn health-related information on the Web and found that students' online search behavior is closely related with their offline reading proficiency. In sum, the studies that contribute data to an empirical perspective suggest that students' online searching skills and knowledge learning are closely related with their offline learning styles and abilities. The results in this study support the previous findings. Particularly, this study adds to the existing research literature by suggesting the possible relationship between students' offline writing ability and the ability of transforming online information into their essay texts.

RQ 4: Connecting Searching, Reading, and Writing

In this study, the participants' searching, reading, and writing are shown as consecutive rather than iterative events. The participants accomplished the online searching task in two steps: (1) searching and reading; (2) writing. While each of these three activities of searching, reading and writing required different nature of cognitive effort, they were linked by a central focus to locate and utilize online information for the purpose of constructing an effective argument. The fourth research question investigated how the participants defined the meaning of connecting searching, reading, and writing.

It was found in this study that connecting searching, reading, and writing means to the participants to evaluate online information from the lenses of prior knowledge and a given writing prompt and to orchestrate online information and prior knowledge to make an effective argument. This brings up an interesting question about writing from online resources versus writing form offline resources. In the past studies of writing from offline resources, the writing tasks were mainly focused on either summarizing or synthesizing external reading materials. The focus of reading thus was laid on understanding and developing the interconnections between given materials. The writing-from-online-resources task, as designed in this study, focused on locating online information to support an argument. The nature of online reading was to locating and identifying information that would connect with one's prior knowledge and support one's argument on the writing topic. It can be suspected that the availability of the abundant search-engine-powered online information would greatly shift the nature of online reading from understanding of the text in its original context to identifying and interpreting useful online information and situating the information in a given context. Future studies are encouraged to explore the impact of the shift on students' learning.

Limitations of the Study

There were limitations to this study that should be discussed. First, the good writing defined in this study by using the participants' SAT scores. First-year students whose SAT writing score exceeded 650 were deemed as good writers and invited to the study. It should be acknowledged that SAT writing score is a reliable measurement of students' writing ability in a standardized format, the score itself cannot represent for a student's writing ability as a whole. In this study, variations of writing ability did exist among the participants as good writers. The participants' SAT score varied from 650 to 760, indicating the inclusion of good writers and really excellent writers. In addition, the greatly varied lengths of the generated written essays also confirmed the varied writing abilities among the participants.

Second, due to the nature of the study, including the small sample size, findings from this study cannot be generalized to a larger population. The patterns and strategies identified in this study need to be confirmed with future studies with larger sample sizes.

Third, in this study, each research session with an individual participant took approximately 2-2.5 hours from beginning to end. During this time, the participants finished drawing concept maps, searching and reading on the Internet, and writing an argumentative essay. The research time was relatively limited to allow participants to use all of the strategies that they can use in everyday searching and reading. Thus the strategies identified in this study might not be a comprehensive list of the strategies that the participants might use when given longer time. It could be suspected that if longer time is given for a more complicated task, other strategies may present.

Fourth, the study was designed to investigate the students' nature search and reading online. The study used concept maps as an instrument to assess students' prior knowledge and

the participants were asked to think out loud during the searching, reading, and writing processes. In an individual searching and reading situation, the students might not draw concept maps and think aloud to themselves. Thus it could be suspected that the strategies of evaluating and reviewing current knowledge structure and stating searching and reading goals might not occur as frequently as found in this study when the students are on their own.

Fifth, the design of the task may have constrained the activity of participants in unanticipated ways. In one sense, the task design in the current study intended for the participants to search online, learn new information, and then represent their newly-learned information in their essays, thereby constraining their activity to a searching-and-writing task rather than a more general learning task. In another sense, the task design constrained students because it explicitly required them select a particular perspective on the writing topic. In another sense, the task design constrained students because it explicitly required them select a particular perspective on the writing topic. By requiring students to subscribe to one particular stance on the given topic could have unintentionally constrained the participants, particularly those who had already adopted a prior perspective on the given topic (because they would not have searched broadly on the writing topic as a whole and then considered the validities of the counter opinions).

Furthermore, because the findings in this study suggests that the participants' online learning had more to do with the nature of online knowledge gathering and accumulation and less to do with knowledge transformation and synthesizing, the findings should be interpreted with caution. Because the design of this study made use of a writing task, the results might be the result of the specific task used rather than of a learning task more generally. By designing the writing task as it was used in the current study might have suppressed the participants inclination

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or interest to search and learn extensively for different opinions and reasoning processes. One could speculate that a different task design—which specifically encourages participants to learn deeply online about a given topic and then synthesize their updated knowledge in a written form—might result in different findings. Further study is needed to examine how various types of learning tasks shape the searching-to-learn experience and outcomes online.

Implications and Future Study

This study serves an initial effort to explore the process and strategies of utilizing information search technology and online resources for essay writing. Although the findings yielded from the small sample size of 12 good first-year college writers are limited in its power to generate the findings to a larger group of college students, several major implications that were derived from this study are proposed below for consideration of future research.

Firstly, the study found prior knowledge continues to be a dominant component of online searching. Writing topic and web content, as two other components that oriented the students' searching online, only consisted of 31% of online searching orientation in this study. Thus when students are searching online for a particular writing task, it would be important to guide students to understand both of the content and the structure of their prior knowledge, and to identify the gaps between the prior knowledge and information needed for the completion of writing task. A clear understanding of student's prior knowledge model of the writing topic will not only give students an individualized approach to online searching, but also allows writing instructors to diagnose the online information needs for each individual student. Besides, it was found in this study that the students used a fragment of prior knowledge to conduct online search for three purposes: expand prior knowledge; verify prior knowledge, and justify prior knowledge. These

identified purposes would equip classroom writing instructors with a way to help students to clarify their purposes of online searching and make online more targeted and effective.

Second, the study suggests that a prior perspective and prior knowledge structure may influence the students' online searching and reading behavior. Future study will be needed to determine that impact of prior knowledge structure on online searching and reading.

Third, the study found that minimal online reading strategy, deep online information engagement strategy, offloading useful web information strategy, and searching and reading behavior self-monitoring strategy helped the students to manage information load while engaging in intellectual conversations with online information. The finding suggests that the digital writing era, these online information connecting and processing strategies are of particular importance. Future research needs to investigate the effectiveness of these instructional approaches on improving online searching and reading, particularly for struggling readers and writers.

Fourth, the study found that the web information on average accounted for 27% of students' final essays. Once the needed information is located and gathered, the good writers used the searched information in different levels with their essay texts including claims, evidences, and counter-arguments. The different level of integration of web information in the final essays suggested that the good writers are not only engaged in looking for factual evidences online to support their argument, but also engaged in deep intellectual interactions with online information. They developed arguments to refute claims that they found and disagreed online; they synthesized online information to derive new conclusions. This finding suggests that deep learning, although less frequently than desired, did occur online. Writing, as an important way of articulating oneself and developing intellectual complexity, welcomes the opportunities that

online information bring to enrich students' knowledge and intellectual flexibility. Writing instructors should therefore encourage students to extend the effort beyond gathering evidential information and engage in deep interactions with online information. Future research is needed to explore the ways to promote students' deep interactions with online texts to develop not only a comprehensive model of content knowledge, but also the intellectual flexibility and complexity.

APPENDICES

APPENDIX A: The Concept Map Drawing Guide

Your task is in the next few minutes is to make a concept map. A concept map is a visual sketch of what you already know about the writing topic. It is a brainstorming technique. You will write as many different terms and phrases that you can think of about the writing topic onto a sheet of paper and then link these words together into a "map" or "web" of what you know. You can by randomly writing or drawing key terms and phrases on the page. Then you can create some order out of it by adding lines, arrows, or other connecting symbols. There is no right or wrong way to make a concept map. Try your best to jot down as many terms and phrases you know about the topic and try to link them together. Some of the words or phrases may not be connected to others, that's totally fine. Do you have any questions? Let's get started. Now draw a concept map showing all you know about whether a city show preserve its old, historic building or destroy them and replace them with modern buildings.

In the next couple of hours, you will be writing an essay on the following topic.

"Should a city try to preserve its old, historic buildings or destroy them and replace them with modern buildings? Use specific reasons and examples of your own and from the web to support your opinion."

There are two steps to complete this essay writing task.

1) First, draw a "concept map" based on your prior knowledge about this topic, guidelines about drawing a concept map will be provided in a separate sheet.
2) Then you can start searching on the Internet for any relevant information. After Internet searching, you will compose an essay on this topic on a Microsoft Word document. During this process, try your best to use the information you have found on the Internet. You can still use the Internet if needed.

Please note that there is no right or wrong answers; just try your best to compose a really good essay. Your essay will be rated for:

- support of a main idea (thesis)
- good use of online information
- clarity/coherence
- syntax, grammar and usage
- organization and development
- word choice
- vocabulary

APPENDIX C: The Post-Writing Concept Map Drawing

Now that you have searched on the Internet and completed the writing task, please draw a

concept map showing all of your knowledge about whether a city show preserve its old, historic

building or destroy them and replace them with modern buildings.

Questions about using prior knowledge

1. What does it mean to you to use your prior knowledge on a writing task to help you search on the Internet?
2. How do you go about deciding how to use your prior knowledge to help you search on the Internet? How do you do that?
3. How important is it for you to use your prior knowledge to search on the Internet (Follow-up: When you are on the Internet, is checking your prior knowledge on the writing topic a low priority or a high priority for you? Why?)

Questions about connecting between searching, reading, and writing

1. What does it mean to you to connect online information to your writing task when you are searching and reading online?
2. How do you connect online information to your writing task when you are searching and reading online? How do you do that?
3. How important is it to you to connect online information to your writing task? (Follow-up: When you are on the Internet, is connecting online information to your writing task a low priority or a high priority for you? Why?)

Questions about monitoring search goals

1. What does it mean to you to keep track of searching goals when you are searching and reading on the Internet?
2. How do you keep track of your searching goals? How do you do that?
3. How important is it to you to keep track of your searching goals? (Follow-up: When you are on the Internet, is reminding yourself of your search goals a low priority or a high priority for you? Why?)

Questions about using web information

1. What does it mean to you to use web information for your writing task?
2. How do you know if you use web information efficiently for your writing task?
3. How important is it to you to use web information for your writing task? (Follow-up: is spending time thinking about how to use web information a low priority or a high priority for you?

APPENDIX E: Survey Questions

Thank you for taking the time to complete the Internet Search and Writing Survey. Information from the survey will be very helpful to develop better training for future undergraduate writing class. I appreciate your response and opinions.

1. What is your gender?   Male   Female

2. What is your age? __Under 18, __18-20,   __21-23,   __23-25,   __over 25

3. Status at MSU: __ Freshman ___ Sophomore ___ Junior ___ Senior, ____ Graduate Student

4. Race/Ethnicity:(optional) __Black   __Asian   __White   __Native American   __Hispanic
other (please specify)

5. What is your major? ____

6. How long have you been using Internet search tools?

__ 0–1 year __ 2–3 years __ 4–5 years __ over 5 years

7. How often do you use Internet search tools?

__ never__ monthly __ weekly __ daily

8. How often did you use Internet search tools for high school writing assignments?

__ never __ less than 40% __ between 40% and 60% __ more than 60%

__every time

9. How often do you use Internet search tools for college writing assignments?

__ never __ less than 40% __ between 40% and 60% __ more than 60%

__every time

10. How often have you received instruction in how to use Internet search tools?

__ never __ once __ twice __ three or more times

11. Which search engine do you use most often?

Google   Yahoo,   MSN, Other (please specify)_____

12. For the search tool you used most, please circle the advanced features of Google search you use to obtain better results?

"" 	- 	+ 	~ 	* 	OR

13. I come up with my search keywords based on the writing prompt.

__never __ rarely __sometimes ___ frequently ___always

14. I come up with my search keywords based on the ideas and knowledge I already have in my mind.

__never __ rarely __sometimes ___ frequently ___always

15. I refine my search keywords based on results from the first few searches I do.

__never __ rarely __sometimes ___ frequently ___always

16. I refine search keywords when online information activates something in my mind.

__never __ rarely __sometimes ___ frequently ___always

17. I integrate online information with something in my mind to come up with better search keywords.

__never __ rarely   __sometimes   ___ frequently ___always

18. I use synonyms of my search keywords to see if I can get better results.

__never __ rarely   __sometimes   ___ frequently ___always

19. I think about my opinions when reading online information.

__never __ rarely   __sometimes   ___ frequently ___always

20. I connect different sources of online information by comparing and contrasting their similarities and differences.

__never __ rarely   __sometimes   ___ frequently ___always

21. I try to organize online information in a logic order.

__never __ rarely   __sometimes   ___ frequently ___always

22. When reading search results, I think about how to integrate new information into my writing.

__never __ rarely   __sometimes   ___ frequently ___always

23. I take notes on the ideas I have that are inspired by online searching.

__never __ rarely   __sometimes   ___ frequently ___always

24. When searching and reading online information, I know when I have enough information and need to stop.

__never __ rarely   __sometimes   ___ frequently ___always

25. I am easily distracted by advertisements, images, videos, and other irrelevant information when searching online.

__never __ rarely __sometimes ___ frequently ___always

26. I feel overwhelmed by the number of search results brought up by the search engine.

__never __ rarely __sometimes ___ frequently ___always

27. I copy and paste information from a webpage into a word document for my writing?

__never __ rarely __sometimes ___ frequently ___always

28. I bookmark a webpage that I think useful for my writing.

__never __ rarely __sometimes ___ frequently ___always

29. When I use a search tool, I keep my goal for searching clear in my mind.

__never __ rarely __sometimes ___ frequently ___always

30. I update my search goals in response to the needs of my writing.

__never __ rarely __sometimes ___ frequently ___always

31. Once I start writing, I find that I keep returning to the Internet to find more information.

__never __ rarely __sometimes ___ frequently ___always

32. I can't help going to the Internet during my text-generating process.

__never __ rarely __sometimes ___ frequently ___always

33. When my first search does not lead me to the information I need, I quit.

__never __ rarely __sometimes ___ frequently ___always

34. I change the search topic when my search does not lead me to the information I need.

__never __ rarely __sometimes ___ frequently ___always

35. Internet search tools are very important to me during writing processes.

__Strongly disagree __disagree __(don't know/neutral) __agree __strongly agree

36. I would not do a good job on my writing assignments without the Internet search tool.

__Strongly disagree __disagree __(don't know/neutral) __agree __strongly agree

37. Writing tasks are easier for me when I use Internet search tools.

__Strongly disagree __disagree __(don't know/neutral) __agree __strongly agree

38. With the Internet search tools, I can come up with great ideas for my writing.

__Strongly disagree __disagree __(don't know/neutral) __agree __strongly agree

39. Organizing ideas is easier for me when I use the Internet search tools.

__Strongly disagree __disagree __(don't know/neutral) __agree __strongly agree

40. Using Internet search tools helps me to include precise and interesting vocabulary words in my writing.

__Strongly disagree __disagree __(don't know/neutral) __agree __strongly agree

41. With the Internet search tools, I can include lots of details in my writing.

__Strongly disagree __disagree __(don't know/neutral) __agree __strongly agree

42. With the Internet search tools, I can find mistakes and confusing or weak spots in my writing and change them to improve my work.

__Strongly disagree   __disagree   __(don't know/neutral)   __agree   __strongly agree

Greetings/General Introduction
IRB Form
Concept Mapping
Internet Search Thinking aloud Practice
Internet Search for Essay writing
Essay Writing
Post-Writing Concept Map
Interview
Survey

Greetings/General Introduction:

Hi, my name is Jinjie.
Thank you very much for participating in this study!

In the next two and half hours, I'd like to ask you some questions about how you use the Internet to help your writing.

In our time together we'll do three things. First, in **Part I** I will give you a writing topic for you to search for and write about, and I'll invite you to sit at this computer, here, and actually show me how you go about finding useful information on the Internet and write up an essay with the information you've found. **Part II** will be a interview, where I'll ask you some questions about how you think and feel about using the Internet to help your writing. And **Part III** will be a short survey with some more questions about how often you received instruction on search tools, and things like that. These note cards [refer to cards] will help keep me on track.

IRB Form

Before we actually start, here is a form for us to look at together.

It says the purpose of the study here (to find out college writes use the Internet search tools and free resources to help their writing), it describes what you will do, it describes risks and benefits, and here, under "Privacy and Confidentiality," it explains that we will protect your privacy and we will not publish your name or tell anyone what answers you in particular gave us. And here at the end it explains that your participation in this study is completely voluntary, and that you're free to say no if you don't want to participate and if you decide to quit .

It also says your screen activities and your answers to the interview questions, which allows us to go back later when needed.

Do you have any questions for me, about any of these things? you can ask me anything you'd

like me to explain. [Answer all questions.]

Okay, then. If you don't have any more questions, and if you would like to participate in the study, then please go ahead and sign here at the end of the form.

Thank you. I think we're ready to get going with the first part, Part I, which we'll do on the laptop.

Concept Mapping

In this first part, I will give you a writing topics that I'd like you to draw a concept map, search on the Internet, and write.

let's start from the concept map first and then we will go to the search-to-write part.

[students work independently on a sheet of blank paper]

Search and Think aloud Instruction

(When the student completes the concept map). Good. Thank you. I think we are ready to go to the search-to-write part.

While you search on the Internet, I would like you to tell me what you are thinking while you are doing it, this is called, "thinking aloud" and it involves talking a bit like a sports commentator on TV--only you will be describing yourself and what you're thinking or doing, as you're doing it.

For example, it might sound something like this: " Right now, I am going to search more information about "dinosaur" because I think I will need this information in my essay, and I open the firefox and go to the Google page and type in "dinosaur ". Something like that. It may feel a bit odd at first, but once you get started it will get easier and easier. The point of doing it is to help me follow what's going on in your mind as you search for information for your writing.

Let's practice "search and think aloud" for a minute. Have a seat at the laptop here. Let's put on the headset here so that you voice could be better heard by the computer and let's look quickly here (The researcher should double check the Morae software to make sure it is recording). Okay the machine is ready. (The laptop is turned on) and you can see the icons here for two browsers, Firefox and Internet Explorer. What I'd like you to do in a moment, is to open one of the browsers and find some information [Show practice task card]. Imagine that your mom has asked you to use the Internet to find out the weather forecast for tomorrow. Use the internet to find this information. And while you do that, I'd like you to practice doing "thinking aloud". where you tell me what it is you're doing and everything that's going through your mind.

[students practice search and think aloud]

Search and Think aloud

Good, now that you have warmed up, I would like you to search on the Internet for information and resources you think would be helpful to produce a good essay on this same topic.

You can use the concept map as a starting point to help you decide what you would like to search for your writing.

When you have found information you'd like to have, you can bookmark them, copy-and-paste them, or use any other techniques that you usually use that will help you revisit the information later during writing. Here is the Microsoft word icon.

Also, one last thing: it will help us if, while you're reading and thinking aloud, you move your cursor over the words you're reading or over whatever you're looking at.

Good, go ahead and search for the information you would like to have for your essay. Once you feel like you have enough information to write a good essay, please tell me so, and we can move on to the writing part.

[students work independently on the computer]

[In between, if the student pauses for more than 10 seconds. prompt: " keep talking", or "what are you thinking now?", or "tell me what you are thinking when you're looking at these words".]

[In case it takes long to load a webpage and the student asks "what's going on? the researcher says: "yep, it looks like something is happening, just do what you usually do.]

Would you like to take a break to stretch legs a little bit and have some drink here? (offer snacks and drinks)

Essay Writing and think aloud

Great, seems you've found information for the essay. Now, it's time to write the essay. You are about to write an essay about the topic on a Microsoft word document. There is no time limit. Here is the task card.

During this process, I would still like you to practice "thinking aloud" while you' re writing. It may sound "now I am opening a word document, and type in the title of the essay, maybe I will change it later but for now I just put it here it as my essay title." something like this, just tell me what you are thinking and doing.

You can refer back to the bookmarks and/or the notes you've just taken. Do you have any questions?

Good. I think we are ready to start.

[students work independently on the computer]

Take another rest.

Post-Writing Concept Map

Good. Now that you have finished the writing task. I would like you to draw another concept map based on the knowledge you currently have on the writing topic.

[students work on the post-writing concept map]

Interview

Closing questions (broad and "fishing" questions, checking whether we've missed something, giving the subject a chance to bring up new ideas/information):

Is there anything else that we haven't talked about in terms of **how** you--or other first-year college students--use the Internet to help writing?

Is there anything else that we haven't talked about in terms of how you--or other first-year college students--**feel** about finding information on the Internet to help writing?

If you are about to say a few words about the role of the Internet in your writing, what would you say?

Do you have any other thoughts about using the Internet during the writing process?

Survey

[The researcher clicks to the welcome page of the online survey.]

[At the conclusion of the session:] Thank you very much for your time today and for participating in this study. Thanks to you and others participating in this study, we will (1) expand what we know about how college students use online information for their writing thereby (2) be in a position to improve the design of writing instruction to teach first-year college students how to find, evaluate, and transform information on the Web for better writing. Thanks very much!

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