

SUPPORTING THE STUDENT RESEARCH-PAPER WRITING PROCESS:
ACTIVITIES, TECHNOLOGIES, AND SOURCES

by

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DALHOUSIE UNIVERSITY

SCHOOL OF INFORMATION MANAGEMENT

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ABSTRACT

Students use a myriad of disparate technologies and information sources to conduct a variety of activities during the research-paper writing process. While this process is considered a complex task, there is no “information appliance” that provides support. Using established frameworks of the research-paper writing process, an online survey was conducted to describe how activities, sources, and technologies used by students during the process are related to the various phases of that process. Connections were made between activities and technologies to show how an information appliance may support the process from onset to completion. Results show that the activities conducted during the process are iterative. The design application is that some technologies, such as those that support searching, need not be *viewable* at all times, but must always be *available*. These connections provide further insight into the student research-paper writing process and provide an example of how design may support task.

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CHAPTER 1 INTRODUCTION

1.1 BACKGROUND

Students use many disparate technologies and information sources when researching and writing a paper. They use search engines, such as Google, to find web pages that they may use as a source of background information. They have access to hundreds of commercial online databases to find and access thousands of scholarly journal articles that they use to extract information, theories, or methodologies. They use library catalogues to locate books or reference materials, either for specific or background information. In addition to the tools used to search for information, students also use a variety of tools to collect, organize, and process the information they find. They may read articles using a PDF reader. They may then write notes about their ideas or highlight pertinent information on the document itself, on a separate sheet of paper, or in a text file. They may copy and paste citations using a text editor, handwrite them, or use bibliography software such as RefWorks. They may use word processors or pen and paper to write an outline or their paper. They may also have access to an online learning system, such as Blackboard Learning System or Moodle, to examine course content and syllabuses, engage in online discussions and interact with professors, and submit their work. However, these technologies are not cohesively integrated into a single interactive environment that supports the student research-paper writing process.

Notably, other environments, such as e-commerce, design applications to support specific tasks. For example, Travelocity.com provides users with a single platform to plan their entire vacation, from booking airplane tickets, to hotel rooms, rental cars, and tours. Task-specific information-search options are provided to users; users may search according to type of travel, their destination, time schedule, and number of hotel rooms. Similarly, iTunes allows users to purchase, organize, share, and listen to music through one integrated interface. When searching for music in the iTunes store, users can search for specific items using the media player search box, or browse through a number of different categories, genres, or price-points. Designing an application to support an entire task, and only that task, allows for the job to be completed in a single interactive space, which simplifies the task process.

However, planning a vacation or buying music are highly structured and procedural tasks with a predictable outcome, and thus applications are easier to develop. Less predictable tasks that deal with unstructured information and diverse information needs require a more complex system; as Norman (1998) states: “devices for complex tasks must of themselves be complex, but they can still be easy to use if the devices are properly designed so that they fit naturally into the task” (p.182). While Norman (1998) was referring to the design of a physical apparatus, the same concepts can be applied when considering the design of task-specific applications. The first step in designing a complex user-centric system that supports a specific complex task is to understand how that task is performed and what is needed to support task completion.

The purpose of this research, then, is to take an information rich task and identify what is required of an integrated, cohesive *information appliance* to support that task. The exemplar task used in this research is the student research-paper writing process. This task has been examined from an information seeking perspective; the core aspects of the task have been defined primarily at a conceptual level (see Kuhlthau, 1993; Vakkari, 2001; and Xie, 2009). The intent of this research is to examine within that process: what activities do students conduct? which access tools do they use to find information? what technologies do they use? In essence, what should we be considering in the design of an information appliance to support the student research-paper writing process?

1.2 INFORMATION APPLIANCES

But what is an information appliance? The term information appliance was coined by Raskin in 1978, and popularized by Norman in 1998. It is defined as “an appliance specializing in information... designed to support a specific activity” (Norman, 1998, p.53). By definition, information appliances are designed to support a specific task, and include the features necessary for the completion of that task: they have the potential to support knowledge work from the onset of the activity to the outcome.

According to Norman (1998) designing an information appliance “has two requirements: the tool must fit the task, and there must be universal communication and sharing” (p. 53). Therefore, if the tool is going to be designed to fit the task, then it is imperative that the task and its elements are defined and accounted for in design.

Understanding the elements of a task and how they relate to each other is the first step in the design of an information appliance, and is the step focused upon in this study.

1.3 INTRODUCTION TO TASK

As a general definition, The Oxford English Dictionary (2011) defines task as “[a]ny piece of work that has to be done; something that one has to do (usually involving labour or difficulty); a matter of difficulty, a ‘piece of work’.” Even more simply, Hackos and Redish (1998) define task as “what someone does to achieve a goal” (p. 56). Toms (2011) describes task as a function of a user’s work. A task begins with a goal that requires a series of activities, which in turn requires a series of actions to be performed in order to meet that goal. In addition, internal and external conditions and tools, information, and sources may affect the outcome.

The word task can be used to describe various levels of functions. Information search tasks are tasks carried out to remedy an information problem; information seeking tasks refer to the general information problem; and work tasks are motivated by a more complex goal which is, in turn, motivated by an information problem or problems (Li & Belkin, 2008). Task types are hierarchical; namely, the definitions of different task-types become more specific as the goals of each type of task become more specific. The student research-paper writing process has a single goal and requires multiple information tasks to be performed; it is defined as a work task.

But while the goals or information problems of a task can help identify task-type, they do not define or describe the various requirements of that goal. From Toms’ (2011) definition, tasks are affected by conditions, activities, information sources, and tools; as these elements are a part of the “anatomy of a task” (Toms, 2011, p.3), a specific task cannot be defined without mapping these elements to the phases of the task process. See Section 2.2 for further elaboration on the concept of task.

1.4 THE RESEARCH-PAPER WRITING PROCESS

The phases that comprise the research and writing task have been well articulated (Kuhlthau, 1993; Vakkari, 2001; Vakkari, Pennanen, & Serola, 2003; Pennanen & Vakkari, 2003; and Serola & Vakkari, 2005). Kuhlthau (1993) developed a six-phase

model of the information search process used by high school students who were writing a research paper. To identify the phases, Kuhlthau (1993) focused on the cognitive, affective, and physical elements of the process. The phases included Task Initiation, Topic Selection, Prefocus Exploration, Focus Formulation, Information Collection, and Presentation. In his study of Masters students writing a thesis proposal, Vakkari (2001) concluded that there were three phases of the information search process: Prefocus, Focus Formulation, and Postfocus. Rather than focusing on the cognitive, physical, and affective elements, Vakkari (2001) developed his task-flow model by analyzing the search strategies and tactics of students during the process, as well as relevance assessments, and the topical conceptual models of participants. While the essential aspects of the research-paper writing process are known, the core activities conducted, people and information consulted, and technologies used, are not.

The activities required to complete a task are an essential element of a task and make up much of the work activity of a task (Toms, 2011). The activities conducted during the research-paper writing process are varied. Some may be informational, such as searching, or functional, such as taking notes. Some may require more cognitive activities such as analyzing reports of research. Each activity may be conducted throughout the entire process, or may only be conducted during specific phases of the process. Identifying which activities are performed, and when in the process they are performed indicates the types of informational or technological support that may be needed in a student-centric information appliance. The paper-writing task is conducted within a rich information environment, and is a classic knowledge work task. But the act of finding information is not the primary focus. The focus is on meeting the goals of the task using a myriad of activities that require sources of information and tools to support task completion.

1.5 OVERVIEW OF THE THESIS

Chapter 2 provides a review of prior research related to the study. Three primary subtopics are covered: task and task analysis, task analysis models of the information search processes of students, and examples of three interactive information systems to describe how elements of design may support various task elements. Chapter 2 ends with

the specific research questions posed by this study. Chapter 3 presents the methodological aspects of the research, including the variables used in the research, the survey instrument used to collect data, a description of the respondents to the survey, and data analysis. Chapter 4 presents the results from data analysis in three main sections: activities, technologies, and sources. Chapter 5 provides a discussion of the results, contributions of the research, limitations of the study, and the implications for future research. Chapter 6 summarizes the conclusions of the research.

CHAPTER 2 LITERATURE REVIEW

2.1 INTRODUCTION

As this study focuses on a particular task, namely, the student research-paper writing process, prior literature on three main topics will be reviewed:

- 1) Research related to task and its importance in information search and retrieval will be reviewed to describe the basic elements of task as a concept and to connect these elements to the student research-paper writing process.
- 2) Research related to the specific task in question will be reviewed to describe the information needs of students as they progress through the various phases of the research-paper writing process.
- 3) Research related to how task may be supported through system design will be reviewed. Three systems designed to support three different tasks will be used as examples to demonstrate how systems' features may support various task elements.

Reviewing these three elements will provide a description of the research-paper writing process as a task, and will show how task, generically, may be accounted for in design. Conversely, it will highlight the need for systems-based support of this complex task.

2.2 TASK

As described in Section 1.3, tasks are generally considered to have a goal and a series of actions undertaken to complete that goal. Byström and Hansen (2005) describe tasks as having a practical goal and a meaningful purpose with requirements to fill. These requirements may be conditional and may alter the quality of the results. Marchionini (1995) describes task as the manifestation of a problem that drives information-seeking actions. To solve the problem, users will seek a series of interim outcomes. Each outcome is important because it changes or alters a user's mental model of the problem with each

successive search based on the result of the outcome before it (Marchionini, 1995). This is not unlike Bates' (1989) berrypicking model, which suggests that as information seekers encounter new information, the found information gives them new ideas to follow and changes their concept of the information problem. Because each action can result in a new or altered problem situation, the concept of task can be applied to each successive smaller task. The analysis of task as a topic, then, becomes an understanding of the multitude of task layers, and a distinction between types of tasks, their functions, and the relationships between them.

With the task concept there are several distinctions: task description and task process (Byström & Hansen, 2005); and task as action, and task as objective (Kim, 2009). Task description defines a particular item of work and specifies the requirement for a task, whereas task process focuses on doing a particular item of work that is manifested through its goal (Byström & Hansen, 2005). Task as action is defined as a part of a larger workflow process, whereas task as objective describes that process (Kim, 2009).

Li and Belkin (2008) identify three levels of task: *work tasks* are what people do to fulfill the requirements of their jobs, *information-seeking* tasks refer to the general information problem, and *information search* tasks are the actions carried out to rectify the problem (Li & Belkin, 2008). The difference between these task types is related to the goal of each task. Work tasks have a larger goal; the goal is motivated by a problem or a series of problems (Byström & Hansen, 2005; Marchionini, 1995). Search tasks are carried out to meet the requirements of the problem or problems, i.e., the information-seeking task.

A detailed breakdown of the various concepts of task and task attributes can be found in the faceted classification of task created by Li and Belkin (2008). The authors' conducted a review of research on task and created a classification system that breaks task down into generic facets and common attributes. Generic facets include: the source of the task (e.g., internal or generated); task doer (e.g., individual or group); time (e.g., frequency, length, and stage); product (e.g., physical, intellectual, or factual); process (e.g., one-time or multi-time); and goal (e.g., quality or quantity). Task attributes include: task characteristics (e.g., objective task complexity or interdependence) and a user's

perception of the task (e.g., salience, urgency, difficulty, subjective task complexity, or knowledge of the task procedure).

The classification system can be utilized to better understand the various components of the research-paper writing process. The research-paper writing task could be viewed as an assigned (source) individual task (doer), that is most likely intermittent (time-frequency), short or long term (time-length) and progresses through various stages, from beginning, middle, to final (time-stage). The product is mixed, that is, it requires various types of information to complete; it is a one-time task (process), although similar assignments may follow or be conducted simultaneously. The goal is specific (quality), and singular (quantity). The task has high complexity (objective), and moderate to low interdependence. And, of course, a user's perception of the research-paper writing task depends on the individual. However, while Li and Belkin's (2008) classification system can be used to describe the various elements and components of task, it does little to describe the task-flow process.

Task Complexity

Looking at the research-paper writing process through the lens of Li and Belkin's (2008) classification system, it is apparent that the process deals with unstructured information and requires a multitude of diverse information needs; thus, the research-paper writing process can be considered a complex task. But what is a complex task? The following studies conducted by Marchionini (1995), Byström and Järvelin (1995), Vakkari (1999), and Gill and Hicks (2006) outline the concept of task complexity, and contribute to understanding why research-paper writing is considered a complex task.

Marchionini (1995) associated information-seeking task complexity with the number and abstractness of terms or concepts used to describe the relationship with the task goal. As the numbers and variations increase, so does task complexity. Rather than considering the complexity of the terms which describe a goal, Byström and Järvelin (1995) used the goals themselves to differentiate between simple and complex tasks: "Simple tasks are routine information-processing tasks, where the inputs, process, and outputs can be *a priori* determined, whereas difficult or complex tasks are new and genuine decision tasks, where they cannot be *a priori* determined" (p. 194). Complex tasks may be iterative, and may require multiple information seeking sessions to

complete, or they may never be completed (Byström & Järvelin, 1995). To study the relationship between task complexity and information needs (i.e., information types, channels, and sources), Byström and Järvelin (1995) created five categories of task based on perceived task complexity. The task categories ranged from simple to complex and were labeled: 1) automatic processing tasks; 2) normal information-processing tasks; 3) normal decision tasks; 4) known, genuine decision tasks; and 5) genuine decision tasks. By collecting data from questionnaires and information search diaries, Byström and Järvelin (1995) found that as tasks grew more complicated, so did the information needs of users. General information sources were used more frequently as task complexity rose, and fact-based information sources decreased as task complexity rose. The need for domain and problem solving information increased with task complexity, as did the number of sources used. Indicators of successful task completion decreased as task complexity increased (Byström & Järvelin, 1995).

Vakkari (1999) theorized that there may be a connection between task complexity and task problem: the more that is known about the information problem, the less complex the task. As tasks progress, information needs change and develop. At the onset of the process information needs may be difficult to express. The task may begin with an anomalous state of knowledge (ASK); that is, task-doers know they need information, but their mental model of the information problem is immature and thus, it is difficult for them to articulate their information need to an information system (Belkin, Oddy, & Brookes, 1982). However, a task-doer's mental model grows and develops throughout the information seeking process so that within the process of a single task, problems, and therefore complexity, can change as mental models change. Vakkari (1999) noted that during the pre-focus stages of a task, mental constructs of the problem are less known, and therefore, more complex. After focus formulation, task complexity decreases:

Thus, the process of a task performance is characterized by the increasing awareness of its information requirements. The structure of the task also becomes clearer. The progress in task completion and problem solution is connected to the growth of knowledge on the issue at hand as well as with the decrease in perceived task complexity. During its execution, the task becomes less complex to its performer (Vakkari, 1999, p.827).

In essence, Vakkari's (1999) description of task complexity is based on the knowledge-level of the task performer, which changes according to the performer's stage in the task.

In addition to looking at the task itself and a user's problem space, Gill and Hicks (2006) describe a third element in task complexity: discretion, defined as "the ability of a task performer to choose and/or sequence the activities associated with performing a given task" (p. 4). The authors assert that complexity rises with task discretion. As an example, Gill and Hicks (2006) describe two tasks, the first: bake a cake, has a higher level of discretion and thus is more complex, than the second: bake X type of cake, from X recipe, found on X page, of X book, starting at X time. Complexity rises when the number of options to complete the task rises.

Each definition of task complexity can describe the complexity of the research-paper writing process. From Byström and Järvelin (1995), the output of the research-paper writing process cannot be determined *a priori*. While the physical output is known (a research-paper), the content is not. From Vakkari (1999), the complexity of the research-paper writing process may decrease from the outset to the completion; that is, when students begin the research-paper writing process, the information seeking elements of the task are more complex than when they finish. From Gill and Hicks (2006), task discretion is related to the assignment itself.

Models of task types

As described earlier in Section 1.3, a single task can consist of various task layers, each relating to the goal of the task. These task layers have been modeled in several ways, and at several levels of detail. The models demonstrate the complexity of tasks in general, and highlight the complexity of the research-paper writing process, which is by definition a student's work task. The models described are Marchionini's (1995) model of the information search task process and Toms (2011) adaptation of Byström and Hansen's (2005) model of the work task. Toms' (2011) adapted work task model places the various levels of task within the context of the entire work task. Task flow models of information search and generic task will be first be described to identify how each of these task-types fit into the larger work task model.

The information search task process can be described as follows:

1. A user recognizes and accepts an information seeking problem, then
2. Defines and understands the problem, then
3. Chooses a system with which to find information, then
4. Formulates a query and executes a search, then
5. Examines the results and extracts information from the results, and finally
6. Reflects and decides to either repeat the process or stop (Marchionini, 1995).

The process is iterative, and information searchers may need to engage in the steps multiple times before they stop.

Toms (2011) takes a more general approach when describing task. A task is conducted as part of a larger work function. The specific task begins with a goal and potentially known results. To achieve the outcome of the goal, a series of activities must be conducted. Activities are methods that specifically relate to the outcome of the task. For example, in Marchionini's search task described above, the activities are steps 1 through 6. Activities are influenced both by a set of conditions, some known and some unknown, as well as tools, information, and sources. To carry out activities, a set of physically performed actions are required. These actions lead to the completion of the goal as an outcome.

In a work task situation, the task process model does not stand alone. A work task, essentially, becomes a series of tasks within tasks (i.e., subtasks which support the work task). The work task is hierarchical or multi-dimensional (Toms, 2011): a series of tasks may need to be completed to support a new task. Toms (2011) presents a model of the workflow process, adapted from Byström and Hansen (2005) that encompasses relationships between search task and the generic task, how each relates to the other, and how each relates to the entire work task. In Toms' model, the work task begins with a work function, or larger goal. To complete the goal, a number and variety of tasks may need to be undertaken. Toms' generic task, described above, outlines the process of each of these tasks. Subtasks may be required to complete each task. To complete these subtasks, a unique search task may need to be undertaken. These are Marchionini's (1995) search tasks. In short, work tasks are comprised of layers of search tasks, subtasks, and tasks, each carried out to achieve an immediate goal or objective, which in turn,

contributes to the completion of the larger goal. Similarly, the research-paper writing process involves the completion of series of tasks to complete the paper.

Task in context

A goal or a problem may be used to describe both the complexity of a task and the task types; however, it can also provide information about the context in which the task is undertaken. The importance of context and task in information search and retrieval has been widely acknowledged (Saracevic, 2010; Toms, 2011; Wilson, 2006; Vakkari, 2005). Taylor (1991) describes context as a user's information-use environment. Different environments may dictate the types of information users need to fulfill the types of goals they have. For example, a doctor, an environmental manager, or a student all have different information needs; it is the context in which these information needs occur that dictates the type of support required to meet these information needs (Toms, 2011). In two studies, Saracevic and Cantor (as cited in Vakkari, 2005), and Hersh (as cited in Vakkari, 2005) found that when search experts were asked a reference question, they performed better when they were provided with the problem surrounding the question than when they were provided with the question alone. This implies that context provides additional effectiveness in information retrieval, and thus, context is an important factor in the research-paper writing process.

Toms (2011) describes task in context as a series of layers. The outermost layer is environment. Environment is affected by workplace culture, managerial and organizational factors, and physical space. The second layer is the work task, which varies depending on the objective of the task, the type of task, and the solution. The third layer is the search task. Factors influencing the search task are the situation in which the task is conducted (e.g., timeframe), the user (e.g., a user's knowledge or expertise), and the information repository (e.g., the repository's language or genre). Given these factors, task is not independent from context (Byström & Hansen, 2005).

Summary of Task

There are many layers of task. The layers are hierarchical, ranging from the information search task, to information seeking task, to work task (Li & Belkin, 2008). Each task layer has a goal or objective, and each objective may be part of the process to

achieve a larger goal. The objectives may change or remain the same as more information is found. These objectives help to define task types, task complexity, and the context in which the task is executed. Vakkari (2005) states that “It is not necessary to give a definition of a task that would be applicable in all situations; it is sufficient to characterize it in a way that helps to identify it for the purpose of the analysis” (p. 417). Understanding the models, the layers, the complexity, and context of a task are all means of characterizing specific tasks for analysis, such as the research-paper writing process. The following section uses task-based models to describe that process.

2.3 THE RESEARCH-PAPER WRITING PROCESS

The information search process in the student research and writing task has been examined in two longitudinal studies. Kuhlthau (1993) examined the information search process of high school students writing a research paper, and Vakkari (2001, 2005) examined the information search processes of university students developing a research proposal. Using the results of these two studies, Kuhlthau (1993) and Vakkari (2001) outlined the phases of the student research-paper writing process to describe the changes in information seeking behavior and information needs of students as they move forward through the process.

2.3.1 Kuhlthau (1993)

After formulating the information seeking process, Kuhlthau (1993) tested her framework using a qualitative study of high school students who had been assigned two research papers, one per semester. Information was gathered through a series of search logs, journals, short writings, and questionnaires, as well as case studies of six students that involved interviews, timelines, and flowcharts. Five primary aspects of the students’ experiences during the process were noted, cognitive (thoughts), affective (feelings), physical (actions), strategies, and mood. The most pertinent to the focus of this study are the cognitive, physical, and strategies as they represent the actions of students and motivations for these actions. A model of the process was developed based on commonalities experienced by the majority of the students. Kuhlthau’s (1993) model describes six phases of the research process: task initiation, topic selection, prefocus

exploration, focus formulation, information collection, and search closure. Table 1 summarizes the main findings during each phase.

Table 1: The student information search process (summarized from Kuhlthau, 1993)

Phase	Thoughts/Feelings	Actions/Strategies
Task initiation: preparing to select a topic	-considering topic and options -relating to prior knowledge -apprehension and uncertainty	-browsing -consulting with others -brainstorming
Topic Selection: choosing a topic of interest	-weighing topics against various criteria and predicting outcomes -anticipation	-consultation and discussion -preliminary searches, often for reference material and background information
Prefocus Formulation: Searching for information to find a focus	- becoming generally informed about a topic, and searching for a focus within that topic -confusion and inability to express information needs	-taking notes and citations -looking for relevant information -reading and learning
Focus Formulation	-predicting outcome of focus -identifying ideas from found information -confidence	-reading notes and establishing themes -listing possible foci and combing foci to identify themes
Information Collection: Gathering information to support a focus	-defining and extending the focus -gathering pertinent information -organizing information -increased interest	-searching for/locating specific information/documents -taking detailed notes -making comprehensive searches
Search Closure: Conclusion of the search process	-identifying need for more information -increasing redundancy in information found and exhausting resources	-rechecking/researching for information -confirming information -summary searches

Kuhlthau (1993) found that students' information needs changed as they progressed through the research-paper writing process. They began searching for general background information and progressed toward specified topical information. This finding differs slightly from earlier findings by Marchionini (as cited in Marchionini, 1995), who found that high school students use books and encyclopedias for a number of different information problems. However, it echoes findings that expert searchers researching a

foreign domain often begin the process with a general background search (Marchionini, as cited in Marchionini, 1995).

Kuhlthau's (1993) six-tiered search process model became the basis for later longitudinal studies conducted by Vakkari (2001, 2005), who examined the task-based information search process of university students writing a research proposal.

2.3.2 Vakkari (2000-2005)

Vakkari (2001, 2005; Pennanen & Vakkari, 2003; Serola & Vakkari, 2005; Vakkari & Hakala, 2000; Vakkari, et al., 2003) developed a three-tiered model adapted from Kuhlthau's six stages of the research paper writing process. The first stage, Prefocus, encompasses task initiation, topic selection, and prefocus exploration. The second stage, Formulation, is similar to Kuhlthau's focus formulation. The third stage, Postfocus, includes information collection and presentation (similar to Kuhlthau's, 1993 search closure).

Rather than focus on affective measures, Vakkari's work (2001, 2005) delved deeper into concepts touched upon by Kuhlthau (1993). For example, where Kuhlthau (1993) assessed relevance judgments by degree of usefulness, Vakkari (2001) and Vakkari and Hakala (2000), and Serola and Vakkari (2005) examined relevance by degree of relevance, relevance criteria used, type of contributory information, and precision.

In addition to relevancy assessments, Vakkari (2001), Vakkari, et al. (2003), and Serola and Vakkari (2005) examined the development of search terms and tactics used by students during their search process, and Pennanen and Vakkari (2003) examined the development of students' conceptual models as they are related to problem stages in the task. Conclusions about relevancy, search terms, and conceptual models are described below.

Vakkari (2001, 2005) conducted two similar studies. The first used a small sample of eleven Information Studies Masters students enrolled in a course on writing a thesis proposal to study the information seeking process of students. The results of this study were used to inform a series of hypotheses regarding the process (Vakkari, 2001). The second study used a slightly larger sample of 22 psychology undergraduate students

enrolled in course on writing a research proposal to test these hypotheses (Vakkari, 2005).

Participants in the first study were asked to conduct three searches throughout the thesis proposal-writing process (Vakkari & Hakala, 2000; Vakkari, 2001). Data were collected via transaction logs and search diaries. Participants were asked to think aloud as they conducted searches. Pre and post interviews were conducted for each search. The accepted bibliographic records were printed and the students assessed relevancy. The records were then reexamined at the onset of the next search to determine if and which records were relevant and why. For clarity, this study will be referred to as “Study 1.”

Participants in the second study were observed in two search sessions, one at the beginning of writing a research proposal, and one at the end (Vakkari, et al., 2003, Serola & Vakkari, 2005; Pennanen & Vakkari, 2003). Pre and post search interviews were conducted to evaluate participants’ pre-search expectations, and post-search relevancy assessments. To assess search terms and tactics, transaction logs and think-aloud data were recorded. To assess the development of students’ mental models of their topics, participants were asked to write a short blurb and draw a conceptual map of their topic at the beginning of their search process and at the end. For clarity, this study will be referred to as “Study 2.”

In Study 1, Vakkari and Hakala (2000) found that relevance criteria and document assessment is related to a persons’ stage in their task process. As participants progressed through their research project, they found less relevant documents; the share of partly relevant documents remained the same, and the share of irrelevant documents decreased. This finding indicated that students were more discerning in their relevance assessments as they progressed from the initial stages of the research-paper writing process to the later stages. However, relevance criteria remained consistent throughout the process, the most popular of which was topicality. In the initial stages, participants sought background and theoretical material. Vakkari and Hakala (2000) noted that while a person’s idea of their task may change throughout the task process, the criteria for judging relevance changes little. Based on these findings Vakkari (2001) developed a set of hypotheses regarding information types and relevance (See Table 2).

Table 2: Information types and relevance criteria from Study 1 (summarization of Vakkari, 2001)

Types of information sought
1. Less background information needed to more specific information required
2. Need for faceted background information increases in the middle
Contributing information types
3. Background information and theoretical information declines; use of methods, empirical results, and focused information grows
Degree of relevance
4. Share of relevant references decreases, share of partially relevant references remains the same, and share of non-relevant information increases
Relevance criteria
5. Proportion of information content remains constant
6. Significance of users' experiences grows; importance of information type declines

In Study 2, Serola and Vakkari (2005) assessed the role of information types during relevancy assessment in the research proposal writing process. Similar to the results found in Study 1 (Vakkari & Hakala, 2000), participants expected to find background information at the beginning of the proposal-writing process, and more specific and pertinent information toward the end. Students found less general information than they expected and more specific information than they expected. However, participants assessed the contribution of information based on what they expected to find. As students learned more about their topic, they were better able to recognize the contribution of information to their topic and moved from making relevance assessments based on aboutness to making assessments based on situational relevancy. This finding echoes that of Wang (1999) who found that topical experience was related to document selection: those who knew more about their topic were more selective when choosing documents, but tended to read more of those documents.

In addition to studying relevancy assessments, Vakkari (2000) examined the role and development of search terms and tactics as they relate to the problem stages in the task. Results from Study 1 indicated that generally, search terms and tactics were related to students' problem stages in their task. Search terms changed as students progressed through their task. Participants' topical vocabulary grew, and they made more use of synonyms and narrower terms, and less use of broader terms. However, only some search tactics were related to problem stages: some search tactics were related to students' state of knowledge, while others were related to the size of the retrieved

document set (Vakkari, 2000). A set of hypotheses was based on these findings, and is summarized in Table 3.

Table 3: Search tactics and term choices from Study 1 (summarization of Vakkari, 2001)

Search terms
1. Number of search terms increases
2. Number of synonyms, narrower terms, and related terms increases; the number of broader terms decreases
Operators
3. Amount and variety of operators increases
Search tactics
4. The number of search tactics increases

In Study 2, Vakkari, et al. (2003) tested the hypotheses developed in Study 1. Vakkari, et al. (2003) confirmed the hypotheses regarding search terms (see points 1 and 2 in Table 3). However, unlike results from Study 1, results from Study 2 indicated there was little change in the use of Boolean operators throughout the process (see point 3 Table 3). Vakkari et al. (2003) theorized that this might be because Study 1 subjects were information science students at the Masters level, and thus had a higher level of search expertise than the psychology undergraduate students who participated in Study 2. To compensate for this finding, Vakkari, et al. (2001) suggested that experience level be included as a factor affecting the use of Boolean operators. Because many search tactics rely on the use of Boolean operators, point 4 in Table 3 was found to be valid with the condition that searchers have a high level of experience.

As both Studies 1 and 2 found that relevancy assessments and search terms and tactics changed throughout the research proposal writing process, Pennanen & Vakkari (2003) sought to assess if successful searching was related to students' conceptual models of their topics. Data collected from Study 2 were used in analysis. Results indicated that search success depended on participants' ability to cover their concept with query terms, rather than the number of search terms used. Searches in the latter stages of the process were often successful because participants were able to extract additional relevant query terms from found information sources. Even if students were unable to express query terms themselves, they were still able to execute successful searches if they made these extractions (Pennanen & Vakkari, 2003). However, those students who were less familiar with their topic were also less likely to find queries from relevant information. Pennanen

and Vakkari (2003) concluded that search success was less related to a student's conceptual construct of a topic, but was rather a function of their ability to articulate and construct search terms. Thus, tools that help students create and state queries may be a means of providing search support.

2.3.3 Xie (2009)

Xie (2009) readdressed the student research process in her study on the influences of task dimensions in information seeking and retrieval. She differentiated between the dimensions of work tasks and search tasks. Work task dimensions included: *nature* (routine, typical, and unusual), *stages* (prefocus, focus, and postfocus), and *timeframe* (extremely urgent, urgent, and non-urgent). Search task dimensions included: *origination* (self-generated and assigned), *type* (update information, look for specific information, look for items with common characteristics, look for known items) and *flexibility* (very flexible, flexible, inflexible). While the study reported on two tasks, an academic and a workplace task, only the results from the academic task will be discussed here.

Participants in the academic task were 21 students enrolled in a course in which they were required to write a research proposal for a final project. Participants were asked to complete a pre-questionnaire, an information interaction diary, and a post-questionnaire.

Results for work task dimensions suggested that experience levels have much to do with the *nature* dimension of task. For the participants who had written a thesis or research proposal before, the task was considered typical. For those who had not, the task was considered unusual. All students progressed from prefocus, to focus, to postfocus. The *timeframe* dimension was considered non-urgent for all participants because they all had the same due date.

Results for search-task dimensions suggested that most search-tasks were self-generated. Some students sought advice from librarians and professors. The suggestions from these intermediaries were considered assigned tasks, and accounted for less than 10% of the search tasks. She found that most of the search-task types were looking for items with common characteristics (i.e., topical information), followed by known, and specific item searches. Most search tasks were considered very flexible; none were considered inflexible. Often search-tasks were planned, which was largely due to the progression of task through work stages. Work stages affected information seeking

strategies because each stage had a different information need. These task dimensions elaborate on the research-paper writing process and contribute the overall understanding of the process.

2.3.4 Summary

The student research-paper writing process can be divided into various stages. Kuhlthau (1993) identified six main phases (initiation, selection, prefocus exploration, focus formulation, information collection, and search closure). Within each of these phases, students had different thoughts, feelings, actions, information search strategies, and moods. Using this model, Vakkari and colleagues (Vakkari, 2000, 2001; Vakkari & Hakala, 2000; Vakkari et al, 2003; Pennanen & Vakkari, 2003; Serola & Vakkari, 2005) followed up her work, finding that relevance assessments and search tactics change and develop as the task progresses and the use of search operators and search tactics change and develop if the searcher has a higher level of expertise. Students' conceptual constructs of their topics were found to be less important than their ability to represent that construct in search terms. Xie (2009) deconstructed an academic task according to task dimensions. While this study did not provide the same level of detail as the Kuhlthau and Vakkari studies, it placed high-level components of work-task and search-task dimensions in the context of the proposal-writing task.

While all of these studies provide an extensive analysis of the research-paper writing process, they focus primarily on the information seeking aspects of the process rather than viewing the research-paper writing task holistically. There are also few suggestions in the way of system support. While the Vakkari, et al. studies provide some suggestions for technological support, the focus of their work is not to establish how to provide technological support for the task, but to expand knowledge on the process of the task itself.

2.4 SUPPORTING TASK THROUGH DESIGN

The importance of supporting task through design is a continuing research challenge. It is through a search system's interface that the information seeker interacts with information. An interface can affect the information seeker's performance depending on how learnable, usable, and satisfying it is (Marchionini, 1995). When

considering design implications for a student-centric information appliance to support the student research-paper writing process, the processes and phases as outlined by Kuhlthau (1993) and Vakkari (2001) illuminate design problems. During the pefocus phases, students are engaged in largely exploratory searches, and thus, information gathered from studies on systems designed for exploratory search is relevant. In the postfocus phases, students engage in search-based tasks, and thus, studies on systems designed to support search tasks are relevant. In this section, three systems and their implications for support of the student research-paper writing process are examined. The first is the SearchPal system (Diriye, Blandford, & Tombros, 2010a) designed to support exploratory search, the second is the WikiSearch system (Toms, O'Brien, Mackenzie, Jordan, Freund, Toze, & MacNutt, 2008; Toms, McCay-Peet, & MacKenzie, 2009) designed to support search in the context of different task types, and the third is the PIRA system (Twidale, Gruzd, & Nicoles, 2008), designed to integrate information search and writing.

2.4.1 Exploratory Search: SearchPal

Exploratory search or browsing, is a popularly discussed topic, but has yet to be fully supported by a single search system. White and Roth (2009) define exploratory search:

Exploratory search describes an information-seeking problem context that is open-ended, persistent, and multifaceted, and information-seeking processes that are opportunistic, iterative, and multi-tactical. Exploratory searchers aim to solve complex problems and develop enhanced mental capacities. Exploratory search systems support this through symbiotic human-machine relationships that provide guidance in exploring unfamiliar information landscapes (p. vi).

Préfontaine, Bartlett, and Toms (2001), developed a taxonomy of functions that would support exploratory search, also referred to as browsing. Each of these functions, when incorporated into a search system, would facilitate the various aspects of browsing. These functions include connection (showing relationships between different objects), definition, discrimination (distinguishing between desirable and undesirable areas of exploration), divergence, explanation, organization, orientation, personalization, perspectives (presents information from different viewpoints), simplification, stimulation

(promotes ideas and enhances a user's experience), suggestion, and scope (shows the entire information space in perspective).

Several of these functions are incorporated in the SearchPal system developed by Diriye, et al. (2010a). A preview pane providing information when a user hovers over a suggestion provides definition and explanation functions; suggested queries and related topics features provide suggestion and stimulation functions; a query preview was included to place suggested terms in context, and provides scope.

To test the design of the SearchPal system, 16 participants completed two search tasks, one known-item task, and one exploratory task. Two systems were tested, the SearchPal system, and a baseline system. The baseline system was modeled after popular search engines, such as Yahoo!, Google, and Bing (Diriye, et al., 2010a).

Diriye, et al. (2010a) found that participants who completed the known-item searches using the SearchPal exploratory search interface had a significantly longer task completion time than those conducting known-item searches in the baseline system. However, participants using the SearchPal interface for exploratory search tasks found nearly 50% more relevant documents. During the exploratory search tasks, the added system support features were used throughout the entire task. Participants found that the system was distracting when completing the known-item tasks, but preferred the system to the baseline for the exploratory search tasks (Diriye, et al., 2010a). These findings echo a similar study conducted by the same authors, using a similar search system (Diriye, et al., 2010b). These results (Diriye, et al., 2010a, 2010b) also confirm how important the mapping process is when considering task-based design. While added features might support some search tasks, they may actually impede others.

2.4.2 Search tasks: WikiSearch

The wikiSearch system was designed by Toms, et al. (2008, 2009) to aid tasks by allowing users to see the system behind the system, essentially 'flattening out' the search process as a means to integrate search into a wider workflow process (Toms, et al., 2009). As shown in Figure 5, the interface is composed of three main columns designed to support the natural flow of the search process (Toms, et al., 2009). The first column focuses on supporting the task. The space provided by the task box allows the goal to be ever-present on the page. Beneath the task box is a section called the Bookbag. The

Bookbag functions as a type of bookmark bar that is directly related to the task at hand. Users can store pages they deem relevant, and rank page relevancy. There is also a space for users to take task related notes. The second column focuses on the search that will facilitate the task (Toms, et al., 2009). The column contains a search box, results list, and history box. Rather than include large blurbs in the results list, a mouse-over box provides a brief description of the page contents. The history box has two sections, one section that records search history (i.e., queries), and one that records pages viewed (Toms, et al., 2009). The third column contains the page results and a suggested pages section. See Figure 1 for a screen shot of the wikiSearch interface.

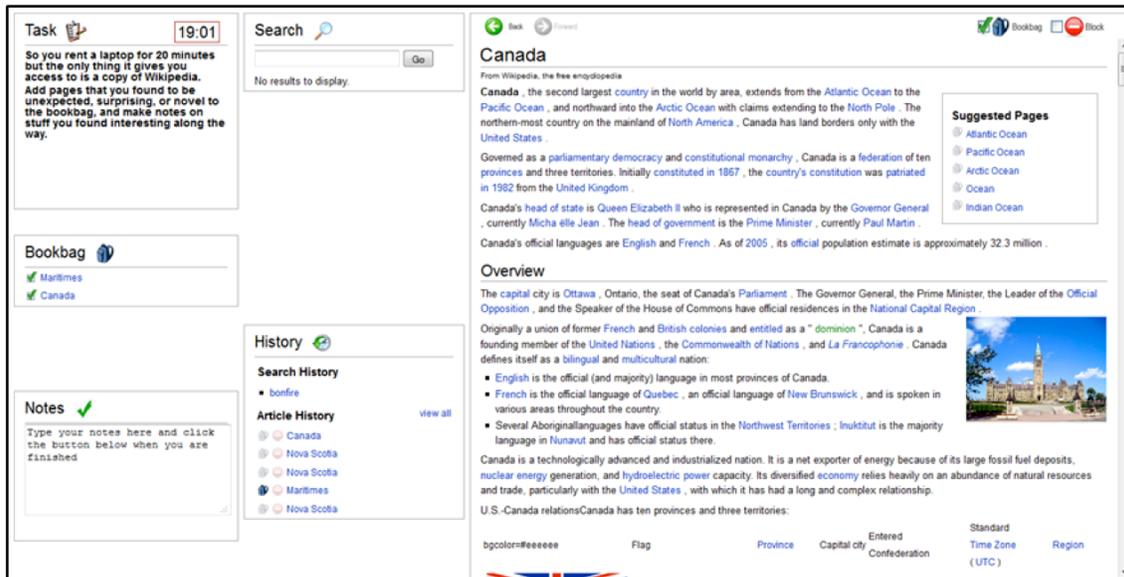


Figure 1: Screenshot of the wikiSearch system

The interface was used to test how various tasks affect interactive search by examining how queries were used (Toms, et al., 2008). 96 participants completed three of 12 tasks, each task representing a specific search task type. The task types were fact-finding (find specific pieces of information), information gathering (collect information about a topic), and decision-making (select a course of action). The task types were then categorized into two task structures, parallel (breadth) and hierarchical (depth) (Toms, et al., 2008). The wikiSearch system included a locally stored version of Wikipedia from which participants gathered information to complete their tasks. By measuring query length, time spent generating queries and examining results, use of self-generated terms,

pages viewed, and articles marked relevant, Toms, et al. (2008) found that task type did have an effect on the effort expended during the search process. Hierarchical tasks required more effort than parallel tasks. Decision-making and fact-finding tasks required more queries than information gathering tasks. To complete fact-finding tasks fewer pages were required than the other tasks, queries were the longest, and garnered the fewest relevant results. Users tended to generate their own keywords, mostly so during information gathering tasks. The bookbag feature was used most frequently during hierarchical tasks, and decision-making tasks.

Using data collected from post-session questionnaires conducted during the same study, Toms et al. (2009) assessed the usability of the interface. While some participants considered the content rather than the interface, response to the interface was generally positive. Participants believed that the collapsed three-tiered structure of the interface helped them stay on task, and keep track of where they were in the task. They found that different features better supported different types of tasks. For example, the bookbag was perceived as most useful for more complex tasks. The mouse-over results blurb was one of the least popular features, and while previous pages could be accessed and reloaded quickly from the query section, the inability to open two pages at once in a tabbed form was a feature some participants would have liked included in the design (Toms, et al., 2009).

Overall, the studies conducted using the wikiSearch interface suggest that a collapsed interface with access to tools such as a history section and a bookbag, could help support the complex search tasks undertaken during the research-paper writing process.

2.4.3 Integrating search and writing: PIRA

Unlike the wikiSearch and SearchPal systems, which were designed to aid users while conducting different types of searches, the PIRA (personal information retrieval assistant) system (Twidale, et al., 2008), was designed to address the problem of providing technological support for the paper-writing task by focusing on integrating the searching and writing processes. The program was based on a study that found that writing during early phases of the search process enhanced learning (Emig, 1977). The intent was to create a system designed for experienced students or researchers who

already had some level of expertise with their topic. As a user wrote in a word processor, an ambient information retrieval agent suggested relevant sources based on what the author wrote. The user had the option of ignoring the reference, viewing it another time, or viewing it at that moment. As the author continued to write, more sources would appear. This was based on recommendations that the suggested references should evolve as ideas evolve (Twidale, et al., 2008). Users also had the option of selecting various digital libraries (Twidale, et al., 2008). See Figure 2 for a screen shot of the PIRA system.

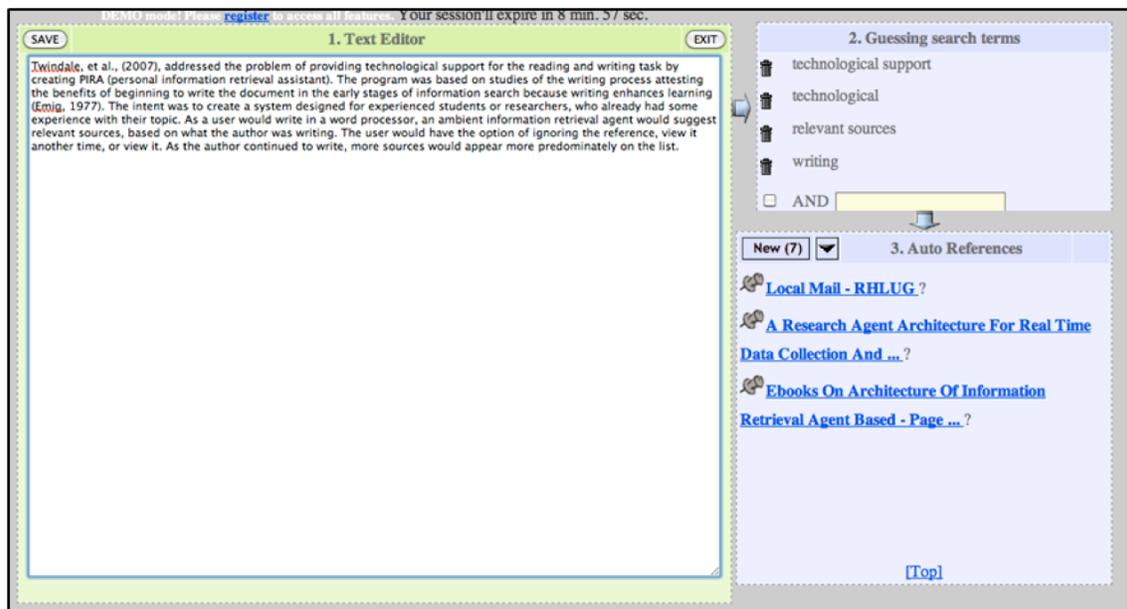


Figure 2: Screenshot of the PIRA system

The system was tested with only three people and thus caution must be taken with the conclusions (Twidale, et al., 2008). However, as the users had different experiences with the system, these experiences highlight usability issues. The first user found relevant sources while using the system. However, these sources were not relevant to the topic on which the user was currently working. Results gathered from the second and third users suggested that database selection was a primary factor in achieving relevant results (Twidale, et al., 2008). While the intent was to integrate searching and writing, the preliminary user studies show no evidence of this integration actually being beneficial to the user. Rather, the ambient search features and high automation removed the action of

searching from the process by conducting searches for the user. Toms, et al. (2009) warn against highly automated information retrieval, as users need to feel “in charge of the interface” (p. 28). However, the authors (Twidale, et al., 2008) acknowledge the system may aid serendipitous discovery of unexpected sources; this aspect of the system may mean that its features would serve best as a recommender system, rather than as a search system.

2.4.4 Summary

The three systems described above illustrate how different aspects of the research paper writing process need to be supported through systems design. The SearchPal system (Diriye, et al., 2010a) provides features that correspond with a portion of the browsing facilitators defined by Préfontaine, et al. (2001). Some of these features were useful for exploratory search tasks, but detrimental to known-item search tasks. The Wikisearch system (Toms, et al., 2008; 2009) provided a more transparent search system that helped participants stay on track, and stay on task. Similar to SearchPal some search features were used more frequently than others during different task types; for example, the bookbag feature had a higher frequency of use when task complexity increased and more sources were required to complete the task. While the PIRA interface (Twidale, et al., 2008) attempted to integrate writing a research paper with searching for information, the high level of automation in the interface limited interactivity and user control. Jansen (2006) suggests that the best way to support a user during information seeking may be to provide some level of automation, as most users rarely utilize added features. However, to avoid cognitive overload, support must only be provided when the user needs it. This is a challenge for design. Existing systems, of which the ones described are representative, do not yet provide all of the support needed for the student research-paper writing process.

2.5 SYNOPSIS AND RESEARCH GOALS

The student research-paper writing task is a cognitively intensive task that may be construed as complex and involves a significant amount of user discretion. At present it is performed using a myriad of independent tools that are used in complex, information rich

environments. We have yet to provide an integrated environment to support the rich interactivity that it needs. Vakkari (2005) states:

If we wish to develop systems to support information needs and searching generated by work tasks, we should model people's tasks and characteristics so that they are connected to those features of systems that can be manipulated to improve the search process and results (p. 424).

The goal of this study is to identify those critical characteristics and needs of the student research-paper writing task. In order to accomplish this, we will respond to the following research questions:

1. Given the research-paper writing process as described by Kuhlthau (1993) and Vakkari (2001), which activities are performed, and which sources are used and which people are consulted? How are these activities, sources, and people related to the various phases of the research-paper writing process?

2. How may various technologies be used to support the research-paper writing process, and how may they be incorporated into the design of a software application, or information appliance, to support that process?

CHAPTER 3 METHODOLOGY

3.1 OVERVIEW

To respond to the research questions, we need to identify key components of the research-paper writing process. Various methodologies could be employed to collect the data that would answer these questions. But considering that the research-paper writing process has been fully described by Kuhlthau and Vakkari (see previous chapter), the focus of this research was on extracting highly structured data about specific components of the process. We were looking for both the range of options as well as a sufficiently large sample to provide magnitude. Interviews and observation could not have generated a sufficiently large sample. Interviews would have provided the opportunity to ask detailed follow-up questions about each component, but would not have enabled the breadth. As a result, a web-based survey was selected as the most effective means of data collection as it would reach a larger participant pool and provide robust evidence to identify activities, tools and sources

3.2 VARIABLES

Two types of variables were used in this study: independent and dependent. The phases of the research paper writing process were used as independent variables to assess when various activities were conducted. Activities, sources, and technologies were used as the dependent variables.

3.2.1 Independent variables

Phases of the writing process

The phases were adapted from Vakkari (2001) and Kuhlthau (1993) and are listed and defined in Table 4. The intent was to represent a process rather than a moment in time. As a result, Kuhlthau's Topic Selection and Focus Formulation, and Vakkari's Focus Formulation were omitted. The resulting four phases represent the process.

Table 4: Phases: definitions & examples

Phase	Image	Definition	Example
Select		Deciding on a topic for research	Your assignment is to write a paper on Halifax. You have many topic options; during the Select phase, you decide that you will write a paper on the history of the city.
Explore		Investigating information so that you can decide on a focus within the topic	Founded in 1749, Halifax has a long history, and you can't include it all! During the Explore phase, you search for information about a specific historic period or incident. During your search, you find a lot of information about the Halifax Explosion, and so you decide to write about it.
Collect		Gathering information that defines, extends and supports the focus	You need to gather information about the Halifax Explosion by consulting books, articles, or other forms of information.
Write		Using information gathered to write the paper	You feel like you have enough information to start writing! You now start composing your paper, using information to review previous research and support your thesis statement.

3.2.2 Dependent variables

Activities

Activities are defined as particular procedures or methods that are conducted while engaging in a task (Toms, 2011). A list of 31 activities was developed from prior research (Kuhlthau, 1993; Taylor, 2003; Vakkari, 2001), the output from a focus group, and a subject expert.

First, the list extracted from prior research was presented to a focus group as a seed list. The participants in the focus group were six members of the iLab at Dalhousie University who were either information studies professionals or graduate students. They were asked to review the list and provide suggestions for additions and revisions for clarity and completeness. The list revised by the focus group was then examined by an

expert on the research-paper writing process who suggested further additions and clarifications. Table 5 contains the final list of activities.

Table 5: Activity List

1. Annotate documents, such as adding notes in the margins
2. Assign tags to webpages on sites such as Delicious or Cite-U-Like
3. Compare and contrast the content of multiple documents
4. Create a reference list of works to be cited in your paper
5. Create diagrams/models to insert as content in your paper
6. Create tables that organize your thoughts/ideas about your topic
7. Create tables to insert as content in your paper
8. Determine if documents are relevant to your topic
9. Edit your paper by conducting a critical analysis of its content
10. Edit your paper by conducting a critical analysis of its evidence (e.g. the sources and arguments used to support your thesis)
11. Edit your paper by conducting a critical analysis of its organization
12. Group documents by subtopic
13. Keep track of documents
14. Learn information about your topic
15. Look at the citation of one document to find other documents
16. Look up definitions
17. Make connections between different pieces of information
18. Read documents
19. Re-find previously encountered information
20. Re-read, review, and clarify the content of your paper
21. Scan/browse the content of documents
22. Search for information about your topic
23. Search for information using tags assigned to webpages or articles
24. Search for specific documents
25. Summarize/organize your thoughts about your topic by creating flowcharts or diagrams
26. Summarize the main point of your paper
27. Write drafts of your paper
28. Write notes to extract information from a document
29. Write outlines
30. Write personal notes to organize your ideas about your topic
31. Write sections of your paper

The list of 31 activities was then classified according to subtasks of the paper writing process. The researcher first developed the schema, which was then inter-rated by her supervisor. Each subtask can be defined as follows:

- Search: conducted as a means to find and gather information that is relevant to the topic of the paper

- Read/Learn: conducted using found information to increase one's understanding of the topic
- Analyze: conducted to critically examine data/information/knowledge etc.
- Organize: conducted to sort and/or clarify information found, tasks to be conducted, ideas, etc.
- Compose: writing, editing and reviewing a paper

See Table 6 below for the subtask schema.

Table 6: High-level subtask schema

High-level subtasks	Activities supporting subtasks
Search	Search for information using tags assigned to web pages or articles
	Look at the citation of one document to find other documents
	Look up definitions
	Re-find previously encountered information
	Search for information about your topic
	Search for specific documents
Read/Learn	Learn information about your topic
	Read documents
	Scan/browse the content of documents
Analyze	Determine if documents are relevant to your topic
	Summarize the main point of your paper
	Make connections between different pieces of information
	Compare and contrast the content of multiple documents
Organize	Annotate documents, such as adding notes in the margins
	Assign tags to web pages on sites such as Delicious or Cite-U-Like
	Summarize/organize your thoughts about your topic by creating flowcharts or diagrams
	Create tables that organize your thoughts/ideas about your topic
	Group documents by subtopic
	Keep track of documents
	Write personal notes to organize your ideas about your topic
	Write notes to extract information from a document
	Write outlines
Compose	Create diagrams/models to insert as content in your paper
	Create a reference list of works to be cited in your paper
	Create tables to insert as content in your paper
	Edit your paper by conducting a critical analysis of its content
	Edit your paper by conducting a critical analysis of its organization
	Edit your paper by conducting a critical analysis of its evidence (e.g. the sources and arguments used to support your thesis)
	Re-read, review, and clarify the content of your paper
	Write drafts of your paper
	Write sections of your paper

Information Sources

Information sources are defined as both the access tools used to find information as well as actual sources of information (see Tables 7 and 8). For simplicity, the term

“information sources” will be used throughout this study when describing these two elements as a whole. A subset of these information sources is specific information objects, as illustrated in Table 9.

Table 7: Access points

Source	Description
WorldCat	Library catalogue that connects collections from participating Universities globally
NovaNet	Consortium library catalogue of participating academic libraries in the province of Nova Scotia
Search Engines	Means through which information can be searched for and accessed from the World Wide Web
Databases	Organized collection of data (such as journal articles), often in digital form
Google Scholar	A specific database; accessible from the World Wide Web rather than through subscription

Table 8: Miscellaneous source types

Source	Description
Personal Collections	The books, web pages, journal articles, etc... owned by a person
Recommendations	Suggestions about information objects from other people or recommender systems
Social Bookmarking Sites	Websites that allow users to create, store, and manage user-generated tags (or bookmarks). In these sites, the tags are shared, not the websites themselves
Government Websites	Websites through which information published online by a variety of government agencies can be found
YouTube	A website used to search for and view user-posted videos
Geographic Websites	Websites, such as MapQuest or Google Maps used to view maps.
Library or Public Archives	Repositories of primary sources of information, such as photographs, correspondence, etc...

Table 9: Information objects

Source	Description
Books or eBooks	Published documents such as monographs or collections of works/articles/etc...
Journal Articles	Scholarly piece that is an independent part of a publication
Newspaper Articles	Piece published in a newspaper, often describing current events, opinions, editorials, etc...
Original Documents	Documents not necessarily composed for publication. Can include diaries or correspondence.
Photos or videos	Images or moving images
Statistics	Mathematical quantities calculated from a set of data
Maps	Representations of land and its features
Government or Corporate Reports	Documents compiled, composed, and published by governments or businesses
Data sets	Collections of raw (i.e., unanalyzed) information
Patents	A set of rights granted to an inventor
Geospatial Data	Data used in a Geographic Information System (GIS) that can be manipulated and analyzed.
RSS Feeds	A standardized web format used to publish frequently updated websites that are subscribed to by a user

People

People may be consulted during the learning process for many different reasons. During the research-paper writing process, they are a type of information source and may be consulted using a variety of means, from in person communication to email. People sources may include:

- Librarians
- Professors
- Classmates
- Subject experts
- Friends
- Family members.

Technologies

Technologies were defined as any tools, applications or instruments that students may use during the research-paper writing process. This list resulted from a brainstorming session between student and professor to create as inclusive a list as possible, recognizing that not all technologies may be used. Please see Tables 10 and 11 below for the complete list of technologies.

Table 10: Technology table

Technology	Definition
Bibliography Software (e.g., RefWorks, EndNote)	Computer programs designed to keep track of information sources and create reference lists
BLS (Blackboard Learning System)	The course management system used by Dalhousie University
Cell phone (not including smart phones)	Mobile technology used primarily a means of verbal communication
Day planner	A physical or digital space to keep track of appointments, assignments, etc. by day, month or year
E-reader/tablet computer (e.g., iPad, Kindle)	A mobile computer, larger than a phone, but smaller than a laptop
Email	A means of digitally communicating via text, often asynchronously
Facebook	A social media website that allows people to share personal information (such as status updates or photos) and found information (such as videos or web links); Provides a means for users to communicate directly with each other, both publically and privately, synchronously and asynchronously
File sharing software (e.g., FileZilla)	Applications that allow people to transfer large digital files
Google Docs	A word processing program that allows users to create documents, store them on an external server (i.e., not a user's computer hard drive), and access and share documents remotely
Instant messaging (e.g., MSN, Facebook chat)	Applications that allow users to communicate synchronously via text
LiveHelp	System used by Dalhousie University Libraries to enable synchronous remote communication between library users and librarians
Online Forums	Web applications that allow users to asynchronously communicate via text
Pen and paper	Physical (rather than digital) tools used to write, house, and disseminate ideas, information, images, etc.
PDF readers (e.g., Mac Preview, Adobe Acrobat)	Applications that allow people to access digital documents
Phone (not including cell phones or smart phones)	A tool used for remote verbal communication

Table 11: Technology Table (Continued)

Technology	Definition
Post-it or other note paper	Small pieces of paper; may also include an adhesive
Presentation software (e.g., PowerPoint, Prezi)	Software programs that allow people to create images, posters, or slide shows
RSS reader (e.g., Google Reader)	Applications that aggregate web information so that users can keep track of and view updates to websites
Scanner/photocopier/printer	Hardware systems that allow users to duplicate information objects
Smart phone	Mobile technology that provides users with a number of service options that range from verbal communication, text communication, Internet access, PDF readers, etc
Statistical analysis tools (e.g., Excel, SPSS)	Software programs that allow data to be stored and manipulated
Texting	Mobile technology that allows users to communicate via text
Twitter	A social media application that allows users to share and read short pieces of information
Video calling applications (e.g., Skype)	Software applications that allow people to communicate verbally and visually
White/chalk boards or flip charts	Places where non-permanent or easily disposable markings can be made
Word Processor (e.g., Word or Open Office)	Software applications that allow users to create and edit documents

3.3 INSTRUMENT

3.3.1 Development

The online survey was developed using the open source software, LimeSurvey. The survey instrument was iteratively developed using a two-phase review process, although multiple versions were developed throughout that process. First, a focus group of six information professionals and graduate students reviewed and critiqued the survey. Second, a pilot test was conducted using five Master of Library and Information Studies students. The participants in the pilot study were invited to comment on the survey. After the pilot study, the survey was distributed.

3.3.2 Survey structure

The survey was titled “The Student Research Process: Technologies, Activities, Information and People.” It contained 18 pages including an introductory page (see Figure 3), an informed consent page (see Appendix A), and a final acknowledgement page (see Figure 4), which thanked respondents for their participation and invited them to provide their email addresses to participate in a draw for one of eleven gift certificates from the campus bookstore. Each page was optimized for scanning and readability by limiting the amount of scrolling. See Appendix B for the survey in its entirety.

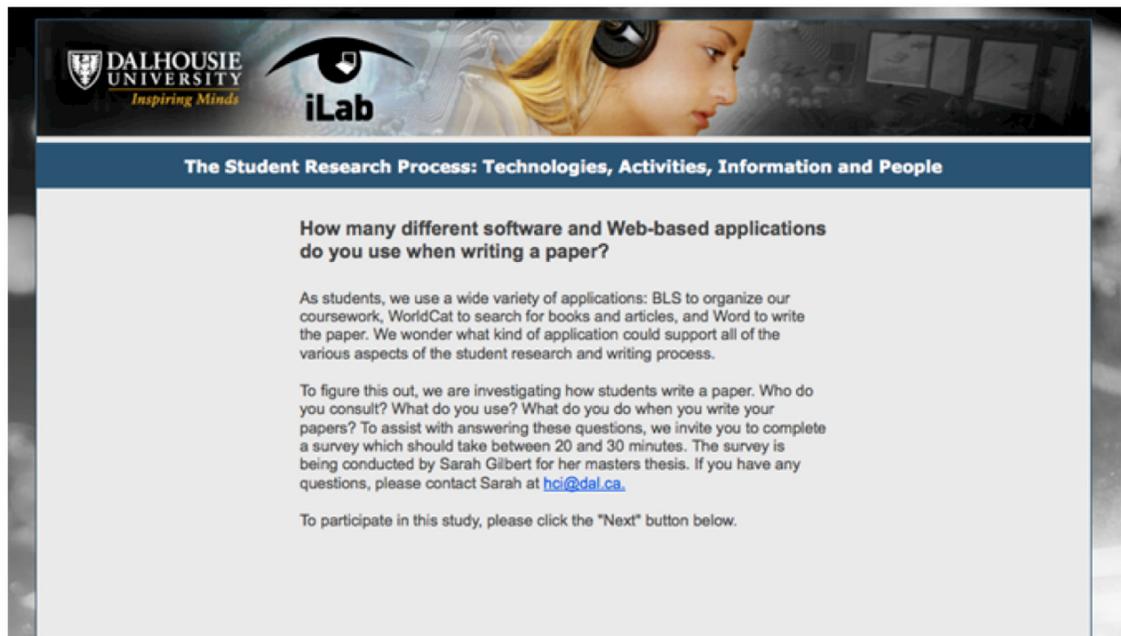


Figure 3: Survey introduction page

Thank you for completing this survey!

If you would like to be entered in a draw for a chance to win one prize of one \$50 gift certificate, or one of 10 prizes of \$20 gift certificates from the Dalhousie Bookstore, please provide your email address.

Note: email addresses are kept separately from the data, and will only be used to enter you into the draw.

We appreciate your time!

Sarah Gilbert, Principal Investigator, MLIS Candidate
Elaine Toms, Supervisor, Canada Research Chair in Management Informatics

If you have any further questions, please contact Sarah at:

(902) 494-8392
hci@dal.ca

I would like to participate in the draw. Here is my email address:

Figure 4: Acknowledgement page

Due to the length of the survey, the questions were presented in an order that was deemed the least cognitively exhaustive: the sections requiring the most consideration from students (Current Practices and Activities) were posed immediately following Demographics.

At the beginning of each page (with the exception of pages that were a continuation of a larger section) respondents were provided with explanations and instructions. It was made explicit why each section was included in the survey.

The first question, “Have you written at least one paper that required you to consult sources outside of the course textbook?” was a screening question and thus, mandatory. Continuing the survey required an affirmative response, as respondents would need paper-writing experience to complete the survey. No other questions in the survey were mandatory.

The Activities section included an entire page devoted to describing and explaining the research-paper writing phases, as the questions that followed would appear redundant if not considered within the context of each phase (See Figure 5).

The research and writing process may be divided into four core phases. Please review the description of each of the phases. Please note that the steps described below may overlap, and may also appear more than once during the process of researching and writing a paper.

The remainder of the survey will ask you a series of questions about the activities you conduct, the sources you use, the people you consult, and the technologies you use.

	<p>SELECT: deciding on a topic for research <i>Example: Your assignment is to write a paper on Halifax. You have many topic options; during the Select phase, you decide that you will write a paper on the history of the city.</i></p>
	<p>EXPLORE: investigating information so that you can decide on a focus within the topic <i>Example: Founded in 1749, Halifax has a long history, and you can't include it all! During the Explore phase, you search for information about a specific historic period or incident. During your search, you find a lot of information about the Halifax Explosion, and so you decide to write about it.</i></p>
	<p>COLLECT: gathering information that defines, extends, and supports the focus <i>Example: You need to gather information about the Halifax Explosion by consulting books, articles, or other forms of information.</i></p>
	<p>WRITE: using information gathered to write the paper <i>Example: You feel like you have enough information to start writing! You now start composing your paper, using information to review previous research and support your thesis statement.</i></p>

Figure 5: Survey screen shot of introduction to activities page

After respondents completed each page of the survey, they were not permitted to return to previous questions, as we wanted to ensure that the steps provided in the Current Practices section were not influenced by the extensive activity list provided in the sections that followed it. See Table 12 for an overview of the structure. To review the entire survey, see Appendix B.

Table 12: Survey structure outline

Sections	Description	Page # (in Appendix B)
1. Introduction	Welcome to the survey and study description	93
2. Informed consent	Study design, motivation and data retention policies	93-94
3. Paper writing experience	Assurance that the respondent has written at least one research paper	94
4. Demographic profile	Educational experience, age, gender, language, etc...	94-97
5. Current practices in writing a paper	Questions about a specific paper written by respondent	97-99
6. Activities	→ Includes introduction page and four phase pages →Intro page: Description of phases with examples. →Phase pages: Select from a list of activities that are sometimes, often or never conducted during the Select phase, Explore Phase, Collect Phase, and Write phase.	99-107
7. Sources	What information sources are used, and what information objects the sources are used to find	108-111
8. People	Who is consulted during the process	111-112
9. Technologies	List of technologies and opportunity to explain how each is used during the process	112-113
10. Acknowledgements	Draw entry and thank you	114

3.4 QUESTIONNAIRE

The questionnaire (sections 3-9 in Table 12) was divided into six types of questions: Demographics, Current practices, Activities, Sources, People, and Technologies.

- 1. Demographic profile:** This section asked respondents about their educational experience, work experience, language, age, and gender. These questions were asked to develop a profile of the respondents. (See Table 12, Number 4)
- 2. Current practices:** Based on a critical incident technique, this section asked respondents to think of a paper they had recently written and outline the steps they

took researching and writing that paper. Space for a maximum of 20 steps was provided. (See Table 12, Number 5) This section was not analyzed for this research.

3. **Activities:** The complete list of 31 activities (See Table 5 for activities) was presented to respondents four times, once for each phase of the paper writing process (See Table 4 for phases). Each phase was defined before the activities were listed and respondents were asked to select which of the following activities they conduct during that specific phase. For each activity, respondents were asked to identify if they conducted the activity during “most” papers they write, “some” papers they write, or “never.” Initially, the activities were listed in alphabetic order. However, during the editing process the descriptions of some activities were changed for clarity and thus, alphabetic order was not retained. Respondents were asked to indicate if and what problems they experience during each phase. (See Table 12, Number 6)
4. **Sources:** This section was divided into four subsections:
 - a. The first subsection asked respondents what information sources were used to obtain a variety of information objects. These sources included: WorldCat, NovaNet, search engines, databases, Google Scholar, personal collections and recommendations. Respondents were asked to indicate if they use each source during “some” papers they write, “most” papers they write, or “never.”
 - b. If a respondent used a particular source during some papers or during most papers they write, than they were presented with a conditional list of information objects. See Table 9 for information objects included in the survey.

Example: if a respondent indicated that they never use Google Scholar, than they would not be asked what types of information objects they use Google Scholar to find; the question would not be visible. If they indicated that they use Google Scholar during some papers or most papers they write, they were presented with a list of information objects. The list only included information objects that are accessible through a particular access point or source. In the case of Google

distributed in English, respondents had to have a basic level of English language skills in order to participate.

The survey invitation with the survey URL was sent out to various listservs within the Dalhousie University community (see Appendix C for recruitment email). Because Dalhousie has a diverse set of Faculties within the university, the respondents were expected to have diverse academic backgrounds and levels of experience. Recruitment emails were sent to all departments within the University. Currently, 16,693 are students enrolled at Dalhousie University (n.d.); it is expected that most would have received the recruitment email from their affiliated departments. Sending the survey via listservs prevented direct contact with respondents. To increase participant motivation, respondents who completed the survey and wished to provide their email address would be entered into a draw for either one prize of one \$50 gift certificate to the university bookstore, or one of 10 prizes of \$20 gift certificates to the university bookstore. The email addresses were stored separately from the data to maintain anonymity, and were not retained by the researcher after the draw took place.

Further recruitment was conducted by visiting three undergraduate classes (with a total of 240 students) to introduce and promote the study and to increase survey response rates. The researcher described her study, the survey, and the stipend to the students in the classes, and distributed bookmarks with the survey URL (See Appendix D for the script of the presentation to students, and see Appendix E for the bookmark).

3.5.2 Demographics

A total of 162 respondents completed the survey. The respondents were 24% male, 75% female, and 0.62% preferred not to say. 84% of respondents were under 30 years old. See Table 13 for a cross tabulation of respondents' age by gender.

Table 13: Respondent age by gender

Age	Male	Female	Prefer not to say	Total
18-20	8	30	0	23% (N=38)
21-23	13	37	0	31% (N=50)
24-26	8	18	0	16% (N=26)
27-29	4	18	0	14% (N=22)
30-32	3	7	0	6% (N=10)
33-35	1	4	1	4% (N=6)
36-38	1	1	0	1% (N=2)
39-41	1	0	0	1% (N=1)
42-44	0	3	0	2% (N=3)
48-50	0	2	0	1% (N=2)
51-more	0	2	0	1% (N=2)
Total	39	122	1	23% (N=38)

69% of respondents reported having a received a previous degree. See Table 14 for breakdown of degrees in progress, and degrees previously awarded.

Table 14: Degrees in process and degrees awarded

Degree Type	Degree in progress	Degree Awarded
College Diploma	2% (N=4)	12% (N=19)
Undergraduate Degree	50% (N=81)	47% (N=76)
Graduate Degree	35% (N=57)	9% (N=14)
PhD	8% (N=13)	0% (N=0)
Professional	4% (N=7)	1% (N=2)
Total	99% (N=162)	69% (N=111)

While 69% of respondents reported having previous degrees, the majority of respondents had just begun their degree in process; approximately 55% were in their first or second years of study for either graduate or undergraduate programs. See Table 15 for the breakdown of respondents' year of study.

Table 15: Respondents' year of study

Year of Study	Frequency
First year	25.9% (N=42)
Second year	30.3% (N=49)
Third year	21% (N=34)
Fourth year	11.8% (N=19)
Over four years	9.3% (N=15)
Other	1.9% (N=3)
Total	100 (N=162)

Respondents came from a wide variety of disciplines. Most of respondents were completing degrees in health professions and sciences (40.7%) followed by Arts and Social Sciences (25.9%). Frequencies total over 100% because respondents were permitted to select multiple disciplines if applicable. See Table 16 for a detailed list of respondents' disciplines.

Table 16: Disciplines in progress

Discipline in Process	Frequency
Science	21% (N=34)
Health Professions	19.8% (N=32)
Arts	14.8% (N=24)
Social Science	11.1% (N=18)
Management	9.9% (N=16)
Library and Information Studies	9.3% (N=15)
Architecture	4.9% (N=8)
Other	4.9% (N=8)
Computer Science	4.3% (N=7)
Fine Arts	3.1% (N=5)
Engineering	1.2% (N=2)
Law	1.2% (N=2)
Total	105.6% (171)

3.6 PROCEDURE

The ethics application for the conduct of this study was submitted to the Dalhousie Ethics board for approval on October 15, 2010; approval was received October 27, 2010. (See Appendix G for ethics approval and Appendix H for the ethics application). The survey was made live on January 19, 2011 and closed on February 10, 2011. Recruitment

emails were sent in increments to 47 listservs between January 19, 2011 and January 31, 2011. Respondents clicked on the link in an email message or entered the survey URL into their browsers. First they were asked whether they had written a paper as described in Section 3.3.3; if they responded “yes”, then they continued with the survey as described in Section 3.3.3. If not, they were directed to the final, “Thank you” page of the survey and did not have the option of entering the draw.

3.7 DATA ANALYSIS

Data was exported from the LimeSurvey software to SPSS. A copy of the data and the survey were securely retained for future reference. In SPSS, frequencies, counts, and cross tabulation, were used to analyze data from the Demographics, Activities, Information, and People sections of the survey, as data collected from these sections were primarily nominal. Repeated measures analyses of variance (ANOVA) were used to examine differences in activity levels by subtask within each phase.

Data from the Technologies section came from open-ended questions (see Appendix F). The responses were exported into Microsoft Excel for coding. Coding was both emergent and *a priori*. *A priori* codes for the technologies section came from the list of 31 activities (See Table 5), the grouped subtasks (See Table 6) and the list of seven people (See Section 3.3.2). Emergent codes were created from the responses. During analysis, three subtasks emerged in addition to the grouped subtasks (See Table 6): Communicate, Administration, and Other, and these are further discussed in section 4.3.2.

An inter-rater reliability test was conducted using a sample of 15% of the total responses. To select which 15% would be included in the sample, every sixth response (starting one row down after each column, to prevent responses from a limited selection of respondents) was used. A significant difference in agreement was found. Both coders (the researcher and the inter-rater) re-examined the selection to identify the differences and discussed possible modifications. Fourteen of the researcher’s items in the inter-rated sample were changed to agree with the inter-rater’s codes. To ensure coding integrity, a second round of coding took place. A total 71 items were recoded to accommodate the changes made during inter-rater reliability testing.

CHAPTER 4 RESULTS

4.1 INTRODUCTION

Chapter 4 presents the results of this study in three sections:

- a) which activities were performed during each of the phases by individual activity and by subtask of the research-paper writing process;
- b) which technologies were used;
- c) which information sources were used.

4.2 ACTIVITIES

Results in the activities section are presented in two sections. First, the results from the detailed list of 31 activities (see Table 5) are reported according to the four phases of the research-paper writing process used in the survey (Select, Explore, Collect, and Write). The second section reports results from the analysis of the five subtasks of the paper writing process, Search, Read/Learn, Analyze, Organize, and Compose (See Table 6).

4.2.1 Activities by phase in the paper writing process

Respondents indicated which of the 31 activities they conduct and were asked to select from three options for each activity:

1. “I do this for most papers I write”;
2. “I do this for some papers I write”; or
3. “Never”.

Each list was presented four times in the survey, once for each phase. The section below presents the results by phase.

Select (Deciding on a topic for research)

During this phase, 22 of the 31 activities were conducted by over 50% of respondents for “most” papers they write. Activities conducted least frequently by respondents included assigning tags to web pages (77.2% indicated that they never conduct this activity), searching for information with tags (53.7% indicated that they never conduct this activity), and creating tables as content (48% indicated that they never

conduct this activity). The top three activities conducted most frequently by respondents during the Select phase were learning information (91.4% for most papers), searching for information (88.3% for most papers), and determining relevancy (86.4% for most papers). See Table 17 for the complete activity results from the Select phase.

Explore (Investigating information to decide on a focus within the topic)

During this phase, 19 of the 31 activities were conducted by over 50% of respondents for “most” papers they write. Activities conducted least frequently by respondents included assigning tags to web pages (73.5% indicated that they never conduct this activity), creating diagrams or models to insert as content (53.7% indicated that they never conduct this activity), and searching for information with tags (51.9% indicated that they never conduct this activity). The top three activities conducted most frequently by respondents during the Explore phase were learning information (84.6% for most papers), reading documents (83.3% for most papers), and searching for information (80.3% for most papers).

Activities conducted the least and most frequently by respondents were similar in both the Select and Explore phases. Of the three activities conducted least frequently, two were the same (assigning tags to web pages and searching using tags). Of the top three activities, two were the same (learning information and searching for information). See Table 18 for the complete activity results from the Explore phase.

Collect (Gathering information that defines, extends, and supports the focus)

During this phase, 20 of the 31 activities were conducted by over 50% of the respondents for “most” papers they write. Activities conducted least frequently by respondents included assigning tags to web pages (67.9% indicated that they never conduct this activity), searching for information using tags (48.8% indicated that they never conduct this activity), and creating models or diagrams to insert as content (43.2% indicated that they never conduct this activity). The top three activities conducted most frequently by respondents during the Collect phase were reading documents (80.2% for most papers), keeping track of documents (77.8% for most papers), and scanning/browsing the content of documents (76.5% for most papers).

Of the three activities conducted least frequently, all three were same for both the Explore and Collect phases (assigning tags to web pages, creating models or diagrams as

content, and searching using tags), and two of the activities conducted least frequently were the same for both the Collect and Select phases (assigning tags to web pages and searching using tags). The top three activities conducted during the Collect phase were largely different from the top three activities conducted during the Select and Explore phases. Only one activity, reading, was included in the top three most frequently conducted activities during both the Explore and Collect phases. None of the top three activities were the same between Select and Collect. See Table 19 for the complete activity results from the Collect phase.

Write (Using information gathered to write the paper)

During this phase, 15 of the 31 activities were conducted by over 50% of respondents for “most” papers that they write. Activities conducted least frequently by respondents included assigning tags to web pages (75.3% indicated that they never conduct this activity), searching for information with tags (64.8% indicated that they never conduct this activity), and annotating (43% indicated that they never conduct this activity). The top three activities conducted most frequently by respondents were writing sections of the paper (83.3% for most papers), re-reading the content of their paper (80.9% for most papers), and editing their paper by conducting an analysis of its organization (79% for most papers).

Two of the activities that occurred least frequently were the same in the Write phase as in the Select, Explore, and Collect phases (assigning tags to web pages and searching for information using tags). None of the activities conducted most frequently were the same in the Write as in any of the other three phases. See Table 20 for the complete activity results from the Write phase.

Select

Table 17: Select phase activity frequencies

Activity	Never		Some		Most	
Annotate documents	47	29.0%	54	33.3%	57	35.2%
Assign tags to web pages	125	77.2%	19	11.7%	12	7.4%
Citation chain	15	9.3%	51	31.5%	92	56.8%
Compare/contrast content of multiple documents	11	6.8%	43	26.5%	103	63.6%
Create diagrams/models as content	78	48.1%	59	36.4%	19	11.7%
Create reference list	20	12.3%	17	10.5%	124	76.5%
Create tables as content	79	48.8%	60	37.0%	17	10.5%
Create tables to organize thoughts	63	38.9%	60	37.0%	35	21.6%
Determine relevancy	7	4.3%	14	8.6%	140	86.4%
Edit by analysis of content	33	20.4%	36	22.2%	90	55.6%
Edit by analysis of organization	32	19.8%	32	19.8%	95	58.6%
Edit by analysis of paper's evidence	33	20.4%	33	20.4%	94	58.0%
Group docs by subtopic	45	27.8%	54	33.3%	59	36.4%
Keep track of documents	5	3.1%	26	16.0%	130	80.2%
Learn information	0	0.0%	13	8.0%	148	91.4%
Look up definitions	4	2.5%	43	26.5%	112	69.1%
Make connections between different pieces of information	11	6.8%	53	32.7%	93	57.4%
Re-read content of your paper	25	15.4%	18	11.1%	116	71.6%
Read documents	2	1.2%	21	13.0%	138	85.2%
Re-find information	10	6.2%	39	24.1%	111	68.5%
Scan/browse the content of documents	3	1.9%	18	11.1%	139	85.8%
Search for information	3	1.9%	13	8.0%	143	88.3%
Search for information with tags	87	53.7%	45	27.8%	26	16.0%
Search for specific documents	4	2.5%	59	36.4%	94	58.0%
Summarize the main point of your paper	21	13.0%	39	24.1%	96	59.3%
Summarize/organize thoughts with diagrams	60	37.0%	57	35.2%	42	25.9%
Write drafts of paper	44	27.2%	31	19.1%	82	50.6%
Write notes to organize ideas	16	9.9%	42	25.9%	100	61.7%
Write notes to extract information	25	15.4%	44	27.2%	89	54.9%
Write outlines	25	15.4%	43	26.5%	88	54.3%
Write sections of paper	40	24.7%	18	11.1%	100	61.7%

Explore

Table 18: Explore phase activity frequencies

Activities	Never		Some		Most	
Annotate documents	45	27.8%	48	29.6%	64	39.5%
Assign tags to web pages	119	73.5%	21	13.0%	13	8.0%
Citation chain	16	9.9%	53	32.7%	88	54.3%
Compare/contrast content of multiple documents	10	6.2%	38	23.5%	109	67.3%
Create diagrams/models as content	87	53.7%	42	25.9%	25	15.4%
Create reference list	20	12.3%	37	22.8%	99	61.1%
Create tables as content	78	48.1%	52	32.1%	22	13.6%
Create tables to organize thoughts	62	38.3%	56	34.6%	36	22.2%
Determine relevancy	6	3.7%	25	15.4%	123	75.9%
Edit by analysis of content	37	22.8%	41	25.3%	76	46.9%
Edit by analysis of organization	38	23.5%	38	23.5%	78	48.1%
Edit by analysis of paper's evidence	36	22.2%	39	24.1%	77	47.5%
Group docs by subtopic	29	17.9%	55	34.0%	72	44.4%
Keep track of documents	3	1.9%	24	14.8%	129	79.6%
Learn information	1	0.6%	18	11.1%	137	84.6%
Look up definitions	6	3.7%	42	25.9%	107	66.0%
Make connections between different pieces of information	8	4.9%	44	27.2%	104	64.2%
Re-read content of your paper	27	16.7%	28	17.3%	99	61.1%
Read documents	3	1.9%	16	9.9%	135	83.3%
Re-find information	10	6.2%	41	25.3%	104	64.2%
Scan/browse the content of documents	2	1.2%	29	17.9%	124	76.5%
Search for information	3	1.9%	22	13.6%	130	80.2%
Search for information with tags	84	51.9%	40	24.7%	30	18.5%
Search for specific documents	8	4.9%	44	27.2%	103	63.6%
Summarize the main point of your paper	18	11.1%	45	27.8%	90	55.6%
Summarize/organize thoughts with diagrams	57	35.2%	44	27.2%	55	34.0%
Write drafts of paper	44	27.2%	34	21.0%	76	46.9%
Write notes to organize ideas	13	8.0%	41	25.3%	102	63.0%
Write notes to extract information	19	11.7%	43	26.5%	93	57.4%
Write outlines	22	13.6%	43	26.5%	87	53.7%
Write sections of paper	37	22.8%	37	22.8%	81	50.0%

Collect

Table 19: Collect phase activity frequencies

Activities	Never		Some		Most	
Annotate documents	33	20.4%	43	26.5%	76	46.9%
Assign tags to web pages	110	67.9%	21	13.0%	20	12.3%
Citation chain	12	7.4%	53	32.7%	88	54.3%
Compare/contrast content of multiple documents	9	5.6%	38	23.5%	106	65.4%
Summarize/organize thoughts with diagrams	56	34.6%	50	30.9%	48	29.6%
Create diagrams/models as content	70	43.2%	57	35.2%	24	14.8%
Create reference list	16	9.9%	34	21.0%	104	64.2%
Create tables as content	67	41.4%	64	39.5%	20	12.3%
Create tables to organize thoughts	47	29.0%	63	38.9%	42	25.9%
Determine relevancy	11	6.8%	34	21.0%	108	66.7%
Edit by analysis of content	36	22.2%	42	25.9%	72	44.4%
Edit by analysis of organization	39	24.1%	35	21.6%	77	47.5%
Edit by analysis of paper's evidence	37	22.8%	37	22.8%	77	47.5%
Group docs by subtopic	24	14.8%	50	30.9%	79	48.8%
Keep track of documents	5	3.1%	22	13.6%	126	77.8%
Learn information	8	4.9%	27	16.7%	116	71.6%
Look up definitions	11	6.8%	42	25.9%	96	59.3%
Make connections between different pieces of information	5	3.1%	38	23.5%	107	66.0%
Re-read content of your paper	26	16.0%	29	17.9%	97	59.9%
Read documents	2	1.2%	20	12.3%	130	80.2%
Re-find information	7	4.3%	41	25.3%	104	64.2%
Scan/browse the content of documents	3	1.9%	26	16.0%	124	76.5%
Search for information	6	3.7%	27	16.7%	118	72.8%
Search for information with tags	79	48.8%	43	26.5%	27	16.7%
Search for specific documents	8	4.9%	39	24.1%	104	64.2%
Summarize the main point of your paper	19	11.7%	40	24.7%	93	57.4%
Write drafts of paper	29	17.9%	37	22.8%	85	52.5%
Write notes to organize ideas	12	7.4%	37	22.8%	101	62.3%
Write notes to extract information	13	8.0%	46	28.4%	92	56.8%
Write outlines	19	11.7%	34	21.0%	98	60.5%
Write sections of paper	22	13.6%	32	19.8%	98	60.5%

Write

Table 20: Write phase activity frequencies

Activities	Never		Some		Most	
Annotate documents	70	43.2%	39	24.1%	40	24.7%
Assign tags to web pages	122	75.3%	15	9.3%	10	6.2%
Citation chain	63	38.9%	39	24.1%	45	27.8%
Compare/contrast content of multiple documents	25	15.4%	45	27.8%	81	50.0%
Summarize/organize thoughts with diagrams	64	39.5%	41	25.3%	46	28.4%
Create diagrams/models as content	66	40.7%	51	31.5%	32	19.8%
Create reference list	14	8.6%	21	13.0%	117	72.2%
Create tables as content	63	38.9%	50	30.9%	36	22.2%
Create tables to organize thoughts	66	40.7%	48	29.6%	37	22.8%
Determine relevancy	34	21.0%	45	27.8%	72	44.4%
Edit by analysis of content	8	4.9%	25	15.4%	123	75.9%
Edit by analysis of organization	4	2.5%	24	14.8%	128	79.0%
Edit by analysis of paper's evidence	5	3.1%	24	14.8%	127	78.4%
Group docs by subtopic	46	28.4%	38	23.5%	66	40.7%
Keep track of documents	9	5.6%	34	21.0%	107	66.0%
Learn information	33	20.4%	48	29.6%	67	41.4%
Look up definitions	28	17.3%	50	30.9%	71	43.8%
Make connections between different pieces of information	6	3.7%	33	20.4%	113	69.8%
Re-read content of your paper	4	2.5%	19	11.7%	131	80.9%
Read documents	20	12.3%	49	30.2%	79	48.8%
Re-find information	26	16.0%	40	24.7%	85	52.5%
Scan/browse the content of documents	19	11.7%	43	26.5%	89	54.9%
Search for information	39	24.1%	54	33.3%	56	34.6%
Search for information with tags	105	64.8%	25	15.4%	19	11.7%
Search for specific documents	33	20.4%	46	28.4%	70	43.2%
Summarize the main point of your paper	7	4.3%	26	16.0%	121	74.7%
Write drafts of paper	9	5.6%	22	13.6%	123	75.9%
Write notes to organize ideas	16	9.9%	50	30.9%	83	51.2%
Write notes to extract information	27	16.7%	53	32.7%	68	42.0%
Write outlines	28	17.3%	30	18.5%	93	57.4%
Write sections of paper	6	3.7%	13	8.0%	135	83.3%

4.2.2 Subtasks of the research paper writing process

While the previous analysis examined each of the potential activities by stage in the process, this analysis examined the activities by subtask in the research paper writing process. The activities were grouped into five subtasks (See Table 6).

To do this analysis, each response value was assigned a score: “never” was assigned 0, “I do this for some papers I write” was assigned 1, and “I do this for most papers” was assigned 2. The scores were arbitrary, other than that “most” deserves a higher score than “some,” and “never” should have no score. Each respondent’s score was calculated to show the frequency with which they conduct each subtask based on the set of activities that made up that subtask. See Table 6 for the subtask coding schema. The subtasks each had a maximum score related to how many activities comprised each subtask. For example, the maximum score for the Search subtask would be twelve, meaning that if a respondent conducted all six Search activities for “most” papers they write, then the score for “Search” would be twelve. Likewise, three activities comprised the Read/Learn subtask. If a respondent conducted each Read/Learn activity during “most” papers, then their score would be 6, the maximum score. These scores were relative measures, and provided a means of comparing the amount of activity per subtask that occurs within a phase, although it did not account for the quantity of any of the activities within that phase. By doing so, we are able assess whether some subtasks are more likely to occur in one phase versus the others.

The scores were assessed using a repeated measures analysis of variance (ANOVA) with the GLM test in SPSS. Table 21 illustrates the results from this analysis. Because of the number of levels within each variable, *post-hoc* tests using pairwise comparisons were used to isolate the differences in the four phases in which significant differences were found in amount of activities. Only the Analyze subtask shows differences in levels of activities from among the four phases.

Table 21: Subtask differences by phase

Subtask	Phase	Mean	Std. Dev.	Repeated measures (ANOVA)
Search (N=128) Max score=12	Select	8.7	2.1	F(3,128)=27.987, p<.001
	Explore	8.7	2.3	
	Collect	8.7	2.3	
	Write	6.5	3.5	
Read/Learn (N=141) Max score=6	Select	5.6	0.9	F(3,138)=28.673, p<.001
	Explore	5.5	1	
	Collect	5.3	1.2	
	Write	4.1	1.9	
Analyze (N=136) Max score= 8	Select	6.3	1.7	F(3,136)=0.705, p=0.551
	Explore	6.4	1.7	
	Collect	6.4	1.8	
	Write	6.2	1.7	
Organize (N=129) Max score=18	Select	9.9	3.6	F(3,126)=11.179, p<.001
	Explore	10.4	3.6	
	Collect	11.2	3.9	
	Write	9.5	4.5	
Compose (N=130) Max score=18	Select	11	5.2	F(3,127)=15.565, p<.001
	Explore	10.5	5.5	
	Collect	11	5.1	
	Write	13.9	3.3	

These results of this analysis are described below:

- **Search:** most search activities were conducted with similar frequencies during Select, Collect, and Explore (72.5% for all three phases). Significantly fewer search activities were conducted during the Write phase (54.2%).
- **Read/Learn:** most read/learn activities were conducted during Select (93.3%) and Explore (91.7%) with marginally fewer conducted during Collect (88.3%) Significantly fewer read/learn activities were conducted during Write (68.3%). Most read/learn activities were conducted during Select.
- **Analyze:** There were no statistically significant differences between the frequencies of analyze activities conducted during each phase.
- **Organize:** There were no significant differences between organize activities conducted during Select (55%) and Write (52.8%). However, there were significant differences between Select & Write, and Explore (57.8%), and Select

& Write, and Collect (62.2%), as well as between Explore and Collect. The fewest organize activities were conducted during the Select and Write phases, and the most during the Collect phase.

- **Compose:** There were no significant differences between compose activities conducted during Select (61.1%), and Collect (61.1%), and only marginally significant differences between Select, Explore (58.3%), and Collect. A statistical difference was found between compose activities conducted during the first three phases, and Write (77.2%). Most compose activities were conducted during the Write phase.

Thus, all of these subtasks are conducted during each of the phases, but with differing levels of activity.

4.3 TECHNOLOGIES

Respondents were presented with a list of 25 technologies (see Tables 10 & 11), and asked:

During the research-paper writing process, what do you use each of the following technologies for? Please be as detailed as possible! You may indicate ‘never’ if you don’t use the technology during the research-paper writing process.

Results are reported in two parts: frequency of use of each technology, and technology use analysis.

4.3.1 Technology frequencies

With what frequencies do students use each technology? To calculate frequency of use, all responses that indicated a use of the technology were summed. Four respondents bypassed the technology section and so percentages are based on 158 respondents. The technology used with the highest frequencies was word processors (97%), followed by pen and paper (93%), and email (84%). Over half of the respondents indicated that they use Blackboard Learning System (58%), day planners (57%), note paper (63%), and presentation software (54%). One per cent of respondents indicated using Twitter. As these were open-ended questions, it is unknown whether respondents who left fields blank actually do not use the technology during the research-paper writing process. So while results indicate that 97% of respondents use word processors, it cannot be said that

3% of respondents do not use word processors. See Table 22 for the complete set of results.

Table 22: Technology frequencies

Technology	Frequency	%
Word Processor	153	97%
Pen and Paper	147	93%
PDF Readers	132	84%
Email	132	84%
Post-it or Other Note Paper	100	63%
BLS	92	58%
Day Planner	90	57%
Presentation Software	85	54%
Bibliography Software	68	43%
Statistical Analysis Tools	66	42%
Facebook	45	28%
Instant Messenger	42	27%
Texting	35	22%
Google Docs	34	22%
Cell Phone	34	22%
White/Chalk Boards	25	16%
LiveHelp	25	16%
Phone	23	15%
Smart Phone	22	14%
Forums	21	13%
RSS Reader	10	6%
Video Calling Software	9	6%
eReader or Tablet Computer	9	6%
Twitter	1	1%

4.3.2 Technology Use

The narrative provided for the use of each technology was coded against the five subtasks defined in Table 10, as well as the emergent types. The final coding schema is contained in Appendix F. The final categories included the five subtasks of the research-paper writing process (Search, Read/Learn, Analyze, Organize, and Compose) and the three emergent groups (Communicate, Administration, and Other). Respondents were free to identify multiple uses for each technology. Results indicate that each technology is often used for a variety of purposes. If a respondent indicated that he or she used the

technology, but did not indicate how or for what, that information was not included in the use-analysis. Thus, frequencies based on how the technologies were used by respondents are somewhat lower than the frequencies of use. The remainder of this section will describe which technologies were used for which subtask. See Tables 23 and 24; numbers are bolded to emphasize high-frequency technology uses.

Search

Very few of the technologies included in the survey were used for Search activities. Because a section was included on information sources earlier in the survey, search-related technologies were not included in the technologies list; that analysis is in Section 4.4. Of the people who indicated using the listed technologies to conduct Search activities, 44.4% used BLS (Blackboard Learning System) and 13.6% used LiveHelp; as R387 indicated: “Sometimes BLS is useful to find links for secondary sources.” See Table 23.

Read/Learn

Respondents did not specify a wide variety of technologies as a means to support Read/Learn activities. Of those who indicated using technologies to conduct Read/Learn activities, 41.1% used PDF readers. Other means by which respondents reported conducting Read/Learn activities include: email (16.8%), texting (7%), and Facebook (5.6%). Technologies, such as email and texting, were used by respondents to ask questions or to ask for clarification. For example, R424 used texting to ask friends questions about articles or found information. See Table 23.

Analyze

Respondents indicated using few technologies to conduct Analyze activities. Of the respondents who indicated using technologies to conduct analyze activities, statistical analysis tools (for example SPSS or Excel) were used with the highest frequency (39.3%) followed by pen and paper (19.1%) and notepaper (12.4%). Statistical analysis tools were used for analyzing data collected by respondents. For example, R142 only uses data analysis software if data was self-generated. Pen and paper and notepaper were used for brain storming and idea generation. For example, when responding to using pen and paper during the research-paper writing process, R229 stated: “this is how [I] start, write all ideas/brainstorm.” See Table 23.

Organize

Respondents indicated using several technologies to help them conduct Organize activities during the research and writing process. Of those, 36.8% use pen and paper, 20.6% use notepaper, 17.4% use day planners, and use 4% use bibliography software. Some respondents used notepaper and pen and paper to keep track of information; for example, post-it notes were reported to be used as bookmarks or place keepers (for example, R151), and pen and paper was sometimes used as a means to keep track of references (for example, R008). Bibliography software was used to store references (for example, R143). Day planners were used for organizing time. For example, R176 uses a day planner for “Creating a paper writing time line with deadlines such as: finish outline by this date, or first draft due by this date.” See Table 23.

Compose

Of the respondents who reported using technologies to compose their paper, most indicated that they use word processors (51.1%). However, 12.1% reported that they use pen and paper as part of the composition process. For example, R145 writes his or her paper first with a pen and paper, and then transcribes it using a computer. Many respondents did not use Google Docs during composition; R191 reporting using Google Docs only when working on collaborative group projects and never for individual work. 17.7% of respondents reported using presentation software, primarily for preparing presentations of their papers. Of those who reported using email to compose (4.6%), some used it to edit by exchanging drafts to review (e.g., R327). See Table 24.

Communicate

Respondents used many different communication technologies during the research-paper writing process. Of the respondents who reported using technologies to communicate, email was used with the highest frequency (38%), followed by instant messaging (11.4%), and Facebook and texting (9.1% each). As an example, R141 used Facebook “to share information and get information about the paper from others.” See Table 24.

Administration

Of the respondents who reported using technologies for administrative purposes, most indicated that they used BLS (44.3%), often to submit the paper and access articles or links that may have been posted on the course site (for example, R143). Others reported using PDF readers (22.6%), and email (13.9%). Email was used for administrative purposes as a means to submit the paper (for example, R345). See Table 24.

Other

Other uses included procrastination and complaining, translation, and charts or diagrams. The charts or diagrams code was included in this category when respondents did not indicate for what the charts or diagrams were used, e.g., for analysis and/or for inclusion in the document. Of the respondents who reported using technologies for other purposes, statistical analysis tools were used to create charts or diagrams (30.5%), and Facebook (22%) was used to complain or procrastinate. One respondent used white boards to translate and one respondent used online forums to translate. See Table 24.

Table 23: Technology use – Research-paper writing tasks subtasks

Technology	Subtask							
	Search		Read/Learn		Analyze		Organize	
BLS	36	44.4%	6	2.8%	1	1.1%	0	0.0%
Cell Phone	1	1.2%	5	2.3%	0	0.0%	5	1.1%
Day Planner	0	0.0%	0	0.0%	1	1.1%	83	17.4%
E-reader/tablet	5	6.2%	1	0.5%	0	0.0%	2	0.4%
Email	2	2.5%	36	16.8%	5	5.6%	19	4.0%
Filesharing	2	2.5%	4	1.9%	0	0.0%	0	0.0%
Google Docs	0	0.0%	9	4.2%	0	0.0%	2	0.4%
Instant Messaging	1	1.2%	12	5.6%	3	3.4%	0	0.0%
LiveHelp	11	13.6%	13	6.1%	0	0.0%	0	0.0%
Forums	7	8.6%	5	2.3%	1	1.1%	0	0.0%
Post-its	2	2.5%	1	0.5%	11	12.4%	98	20.6%
Pen and Paper	0	0.0%	0	0.0%	17	19.1%	175	36.8%
Stat analysis tools	0	0.0%	1	0.5%	35	39.3%	2	0.4%
Phone	1	1.2%	3	1.4%	0	0.0%	2	0.4%
PDF readers	0	0.0%	88	41.1%	0	0.0%	7	1.5%
Presentation software	3	3.7%	0	0.0%	0	0.0%	3	0.6%
Bibliography software	1	1.2%	0	0.0%	1	1.1%	19	4.0%
Smart phone	6	7.4%	1	0.5%	0	0.0%	6	1.3%
Twitter	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Facebook	0	0.0%	12	5.6%	2	2.2%	3	0.6%
Texting	0	0.0%	15	7.0%	1	1.1%	4	0.8%
Video calling	0	0.0%	0	0.0%	1	1.1%	0	0.0%
White boards	0	0.0%	1	0.5%	6	6.7%	10	2.1%
Word processor	0	0.0%	1	0.5%	4	4.5%	33	6.9%
Total	78	100.0%	214	100.0%	89	100.0%	473	100.0%

Table 24: Technology use – Other tasks

Technology	Sub-phase							
	Compose		Communicate		Administration		Other	
BLS	0	0.0%	25	7.1%	51	44.3%	0	0.0%
Cell Phone	0	0.0%	21	6.0%	0	0.0%	2	3.4%
Day Planner	0	0.0%	0	0.0%	0	0.0%	0	0.0%
E-reader/tablet	3	1.1%	0	0.0%	0	0.0%	0	0.0%
Email	13	4.6%	133	38.0%	16	13.9%	0	0.0%
Filesharing	1	0.4%	2	0.6%	1	0.9%	0	0.0%
Google Docs	6	2.1%	16	4.6%	3	2.6%	0	0.0%
Instant Messaging	1	0.4%	40	11.4%	1	0.9%	8	13.6%
LiveHelp	0	0.0%	4	1.1%	0	0.0%	0	0.0%
Forums	0	0.0%	4	1.1%	0	0.0%	2	3.4%
Post-its	4	1.4%	0	0.0%	0	0.0%	0	0.0%
Pen and Paper	34	12.1%	0	0.0%	1	0.9%	0	0.0%
Stat analysis tools	1	0.4%	0	0.0%	0	0.0%	18	30.5%
Phone	0	0.0%	21	6.0%	0	0.0%	1	1.7%
PDF readers	0	0.0%	0	0.0%	26	22.6%	0	0.0%
Presentation software	50	17.7%	1	0.3%	10	8.7%	6	10.2%
Bibliography software	24	8.5%	0	0.0%	1	0.9%	0	0.0%
Smart phone	0	0.0%	4	1.1%	1	0.9%	1	1.7%
Twitter	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Facebook	0	0.0%	32	9.1%	0	0.0%	13	22.0%
Texting	0	0.0%	32	9.1%	0	0.0%	5	8.5%
Video calling	0	0.0%	7	2.0%	0	0.0%	1	1.7%
White boards	1	0.4%	8	2.3%	0	0.0%	1	1.7%
Word processor	144	51.1%	0	0.0%	4	3.5%	1	1.7%
Total	282	100%	350	100%	115	100%	59	100%

Respondents were asked to identify other technologies not included in the list. Thirty-three respondents identified additional technologies. Of the 33, 15 respondents identified information sources previously identified in the Sources section. Five respondents (R055, R112, R113, R163 and R301) identified the Internet as an additional technology. Four respondents listed technologies included in the technology list. Two respondents identified specific software programs. However, three additional technologies used during the research paper writing process were identified. Three

respondents added digital recording devices to the list, three added highlighters to the list, and five added music or mp3 players (such as an iPod or iTunes).

4.4 INFORMATION SOURCES

In four parts, the following section describes the information sources used in the research-paper writing process. As defined in the previous chapter, information sources included general sources of information, access tools used to find information, information objects, and people consulted for information during the research-paper writing process.

4.4.1 General information sources

General information sources were defined as repositories through which a variety of information objects can be accessed. Respondents were presented with the following list of information sources:

- WorldCat
- NovaNet
- Search engines
- Databases
- Google Scholar
- Recommendations
- Personal Collections

For each item in the list, respondents were asked to select from three options:

1. “I do this for most papers I write”;
2. “I do this for some papers I write”; or
3. “Never”.

In general, frequency of use for most general information sources was moderate (i.e., between 40-60% for most papers). Information sources used least frequently by respondents were WorldCat (60.1% indicated that they never use WorldCat) and personal collections (25.8% indicated that they never use personal collections). Databases were reported as having the highest frequency of use (74% of respondents reported that they use databases for most papers they write) followed by search engines (66.25% of respondents reported that they use search engines for most papers they write). Table 25 presents the frequency of use for general information sources.

Table 25: General access tools and sources frequency use

Source	Never		Some Papers		Most Papers	
WorldCat	92	60.1%	25	16.6%	36	23.5%
NovaNet	31	19.5%	49	30.8%	79	49.7%
Search engines	12	7.5%	42	26.25%	106	66.25%
Databases	20	12.7%	21	26.25%	117	74%
Google Scholar	35	22%	63	39.6%	61	38.4%
Personal Collections	40	25.8%	70	45.2%	45	29%
Recommendations	9	5.6%	83	51.9%	68	42.5%

Respondents were asked if there were any information sources they used that were not included in the list above. Several respondents provided specific examples of repositories already listed. For example, two respondents (R151 and R128) indicated that they use Jstor. Three respondents (R315, R326, and R294) indicated that they use course-based materials, such as lectures and textbooks, and two respondents (R265 and R159) indicated that they use self-collected data, such as interviews (R265).

4.4.2 Information objects

When respondents selected “I do this for most papers I write” or “I do this for some papers I write” in the general information source section, a conditional sub-question was posed. In the sub-questions, respondents were given the option of selecting from a list of information objects that they may use each particular repository to find. Summarizations of the information objects found using each general information source are presented below. Percentages are based on the sum of respondents who use each information source (i.e., the sum of respondents who selected that they use each source for “some” or “most” papers).

- **World Cat (N=61):** used most frequently to access journal articles (92%) and books or eBooks (82%); used least frequently to access maps (2%).
- **NovaNet (N=128):** used most frequently access journal articles (84%) and books and eBooks (83%); used least frequently to access maps (5%).
- **Search Engines (N=148):** used most frequently to access journal articles (79%), web pages (75%), statistics (61%), and newspaper articles (56%), used least frequently to access data sets (26%).

- **Databases (N=138):** used most frequently to access journal articles (97%) and books or eBooks (44%); used least frequently to access photos or videos (3%).
- **Google Scholar (N=124):** used most frequently to access journal articles (95%), and books or eBooks (57%); used least frequently to access patents (2%).
- **Personal Collections (N=115):** used most frequently to access books or eBooks (68%) and journal articles (58%); used least frequently to access patents (3%).
- **Recommendations (N=155):** used most frequently to access journal articles (89%), books or eBooks (73%), and web pages (52%); used least frequently to access patents (3%)

For each information source, respondents were asked if they use it for any information types not listed. Response rates were low for these questions, with a mean of 4 responses per information source. As an example, two respondents (R135 and R126) indicated that they use many of the tools (including NovaNet, search engines, databases, personal collections, and recommendations) to access musical scores. See Tables 26 and 27 for a summary of the information repositories used to access various types of information.

Table 26: WorldCat, NovaNet, search engines, and databases by information object

Information objects	Information sources							
	WorldCat (N=61)		NovaNet (N=128)		Search Engines (N=148)		Databases (N=158)	
Books	50	82%	106	83%	79	53%	61	44%
Journal articles	56	92%	107	84%	117	79%	134	97%
Webpages	7	11%	10	8%	111	75%	11	8%
Newspaper articles	17	28%	34	27%	83	56%	36	26%
Maps	1	2%	6	5%	42	28%	N/A	N/A
Government or corporate reports	18	30%	32	25%	76	51%	24	17%
Original documents	6	10%	10	8%	N/A	N/A	N/A	N/A
Data sets	2	3%	7	5%	38	26%	26	19%
Photos or videos	N/A	N/A	N/A	N/A	64	43%	4	3%
Statistics	N/A	N/A	N/A	N/A	91	61%	34	25%
Patents	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 27: Google Scholar, personal collections, and recommendations by information object

Information objects	Information sources					
	Google Scholar (N=124)		Personal Collections (N=115)		Recommendations (N=155)	
Books	71	57%	78	68%	110	73%
Journal articles	118	95%	67	58%	134	89%
Webpages	37	30%	25	22%	79	52%
Newspaper articles	N/A	N/A	24	21%	52	34%
Maps	N/A	N/A	14	12%	17	11%
Government or corporate reports	N/A	N/A	15	13%	42	28%
Original documents	N/A	N/A	26	23%	48	32%
Data sets	N/A	N/A	25	22%	28	19%
Photos or videos	N/A	N/A	33	29%	31	21%
Statistics	N/A	N/A	27	23%	49	32%
Patents	3	2%	3	3%	5	3%

4.4.3 Specific information sources

Specific information sources were defined as repositories through which a particular type of information object can be accessed. Respondents were presented with the following list of information sources:

- Social bookmarking sites
- RSS feeds
- Library or Public Archives
- Government Websites
- YouTube
- Geographic Websites
- Geospatial Information

For each item in the list, respondents were asked to select from three options:

1. “I do this for most papers I write”;
2. “I do this for some papers I write”; or
3. “Never”.

Most of the specific information sources were not used by respondents with very high frequencies (i.e.; greater than 50% for most papers). Social bookmarking sites were used with low frequencies (2.5% for most papers) as were RSS feeds (1.3% for most papers). Library or public archive use was reported with the highest frequency (57.9% for most papers). Government websites were used with moderately high frequencies (30.4% for most papers). See Table 28 for a summary of the specific access tools used during the research paper writing process.

Table 28: Specific information source frequencies

Source	Never		Some Papers		Most Papers	
Social bookmarking sites	146	92.4%	8	5.1%	4	2.5%
RSS Feeds	142	90.4%	13	8.2%	2	1.3%
Library or public archives	18	11.3%	49	30.8%	92	57.9%
Government websites	21	13.3%	89	56.32%	48	30.4%
YouTube	117	74.1%	38	24.01%	3	1.9%
Geographic websites	90	56.6%	57	35.8%	12	7.5%
Geospatial data	129	81.6%	21	13.3%	8	5.1%

4.4.4 People

Respondents were presented with a list of people who they may consult during the research paper writing process, and were asked to select from three options for each source:

1. “I do this for most papers I write”
2. “I do this for some papers I write”
3. “Never”.

Respondents reported consulting with librarians with the lowest frequency (7.3% for most papers), followed by subject experts (13.9% for most papers). Respondents reported consulting professors with the highest frequency (44.4% for most papers). Classmates were also consulted with moderately high frequencies (42.8% for most papers).

Respondents were also asked if there was anyone else they consult during the research-paper writing process. Response rates were low for this question with only 10 responses. Respondents often identified specific family members, such as siblings, or spouses/partners. Two respondents (R176 and R016) identified either web forums or “people on the web” (R016). Two respondents (R265, R395) identified colleagues as additional people they consult. See Table 29 for a summary of the people consulted by respondents during the research paper writing process.

Table 29: Frequency of Consulting People

People	Never		Some Papers		Most Papers	
Librarians	81	54.4%	57	38.8%	11	7.3%
Professors	10	6.3%	79	49.4%	71	44.4%
Classmates	14	8.8%	77	48.4%	68	42.8%
Subject Experts	62	41.4%	68	45%	21	13.9%
Friends	22	14.2%	92	59.4%	41	26.4%
Family members	53	34%	66	42.3%	37	23.7%

Respondents were asked if they communicate with people in-person. 93% of respondents reported that they did. Respondents used in-person communication when conducting Read/Learn activities (27%) as well as Analyze activities (24%). During Read/Learn activities, participants would talk to people in person to ask questions, to ask for clarification, or for recommendations. For example, R441 reported conversing face to face to “clarify what I need to do, get advice on what would be the best approach to

something.” In person communication was also a means by which people conducted Analyze activities, primarily through brain storming and seeking help formulating a focus. For example, R459 stated that he/she uses in person communication “for topic ideas, to clear up thoughts in my own head it is always helpful to talk about them out loud, bounce ideas back and forth.” In person communication was used least frequently for searching (1%) and organizing (1%). See Table 30 for the frequency data of the activities conducted using in person communication.

Table 30: In-person communication

Sub-Phase	Frequency	%
Read/Learn	73	27%
Analyze	64	24%
Compose	20	7%
Organize	3	1%
Search	3	1%
Other	0	0%
Total	267	100%

4.5 SUMMARY

The following summary outlines the elements of the research-paper writing process conducted most and least frequently by respondents.

Activities

In all four phases, assigning tags to web pages and searching for information using tags were two of the activities conducted least frequently. The activities conducted with the highest frequencies were similar for the first three phases. Learning information, searching for information, and reading information were three of the activities conducted with the highest frequencies during Select, Explore, and Collect. Activities conducted with the highest frequencies during the Write phase were different than the other phases and were writing sections of the paper and editing (either by editing for organization, or re-reading and reviewing their paper).

The activities were grouped into five subtasks: Search, Read/Learn, Analyze, Organize, and Compose. Search activities were conducted with the highest frequencies during Select, Collect and Explore, and at significantly lower frequencies during Write.

Most Read/Learn activities were conducted during Select and Explore, with marginally fewer conducted in Collect, and significantly fewer conducted in Write. There were no statistically significant differences between Analyze activities conducted during each phase. Most Organize activities were conducted during the middle two phases (Explore and Collect), and fewer were conducted during Write and Select. Most Compose activities were conducted during the Write phase.

Technologies

Each technology was used by at least one respondent. Twitter was the least frequently used technology, used during the research paper writing process by a single participant. Word processors were the most frequently used technology.

Eight technologies were used predominately during selected subtasks:

- BLS for Search
- PDF readers for Read/Learn
- Statistical analysis software for Analyze
- Pen and paper for Organize
- Word processors for Compose
- Email for Communicate
- BLS for Administration

Information sources

Of the information sources, databases were used with the highest frequencies by respondents followed by search engines. Aside from personal collections, respondents reported using each information source most frequently to find journal articles. Specific information sources were used less frequently than were general information sources. Only library or public archives were used by over half of the respondents for most papers.

People

Professors were the people most frequently consulted by respondents followed by classmates. In person communication was used by 93% of respondents and was used most frequently for reading/learning and analyzing.

CHAPTER 5 ANALYSIS & DISCUSSION

5.1 OVERVIEW

Using a web-based survey, this study explored the activities students conduct, the people they consult, and the technologies and information sources they use during the research-paper writing process. In doing so, it also expanded the current frameworks of the process (Kuhlthau, 1993; Vakkari, 2001). While prior research focused on information search, this study extended the process to include the composition element. At the same time, it identified the core activities that are part of the process and inductively identified the core subtasks that may be used during the phases. Results show subtasks are conducted during all phases but with differences within each phase. For example, the Search subtask is performed less during the Write phase, but with about the same frequency within Select, Explore, and Collect. Similarly, existing technologies are used to facilitate certain activities and subtasks, but are not used only for the same activities and subtasks. The use of subtasks, activities and technologies are repeated throughout the research-paper writing process. In essence, the process is not a simple procedure, but is an iterative one. As the iteration occurs at the level of the subtasks conducted within the process, all technologies need to be readily available to use in a student-centric information appliance.

The following section will elaborate on the connections between the phases, subtasks, technologies, information sources, and people, and will present a map of the connections between the subtasks and technologies to discuss design implications for a student-centric information appliance.

5.2 RESEARCH QUESTIONS

In Chapter 2, the following quotation was used to highlight the importance of understanding the elements of a task if that task is to be supported by an interactive system:

If we wish to develop systems to support information needs and searching generated by work tasks, we should model people's tasks and characteristics so that they are connected to those features of systems that can be manipulated to improve the search process and results (Vakkari, 2005, p.424).

The student research-paper writing process has been defined as a work task, and as such, it has a set of diverse core components (or characteristics) that require support. This study has identified those components, and has connected them to various technologies (or features) that can be used to suggest how to support the research-paper writing process through the design of an interactive system. The first research question identifies the core components of the research-paper writing process. The second research question shows how these components can be used to suggest the informed design of a student-centric information appliance.

5.2.1 Research Question 1

Given the research-paper writing process as described by Kuhlthau (1993) and Vakkari (2001), which activities are performed, and which sources are used and which people are consulted? How are these activities, sources, and people related to the various phases of the research-paper writing process?

Results show that each phase of the research-paper writing process uses a series of subtasks, each of which is accomplished with a set of related activities, which in turn are facilitated by a set of technologies. The following section describes how each subtask supports each phase, and how the activities support each subtask within each phase to provide a detailed description of the activity differences between each phase.

The Search subtask is conducted more often during Select, Explore, and Collect, than in Write, and each of the activities conducted within Search are similar. Some of the most frequently performed Search activities conducted are search for information, look up definitions, and re-find information. However results from studies conducted by Kuhlthau (1993), and Vakkari (2001) suggest that the types of information sought during each phase are different. For example, a search for background information may be conducted during Select and Explore, and a search for specific information may be conducted during Collect. This study did not examine this aspect.

The Read/Learn subtask is conducted most frequently during Search and Explore, and tends to occur less during Collect. And, like the Search subtask, studies conducted by Kuhlthau (1993) and Vakkari (2001) provide suggestions about the differing learning needs of students as they progress through the process. During Select and Explore, students are likely conducting Read/Learn activities as a means to discover more about their topics, while during Collect, they may be conducting Read/Learn activities to discover how they might support the focus of their topic.

In general, the Analyze subtask was performed during all phases of the process. However, there is a difference between the individual Analyze activities conducted during the phases. During Search, Explore, and Collect the most frequently conducted Analyze activities are assessing relevancy and comparing and contrasting the content of multiple documents, while during the Write phase, the most frequently conducted Analyze activities are summarizing the main point of the paper, and making connections between different pieces of information. So while the Analyze subtask is conducted throughout the process, the type of Analyze activities varies by phase. The difference between the types of Analyze activities conducted during the first three phases and during the last phase suggests that composing a paper requires a different type of analysis than does choosing, exploring, or supporting a topic.

Organize activities are conducted most frequently during the Collect phase, followed by the Explore and Select phases. Organize activities are conducted least frequently during the Write phase. During all phases, keeping track of documents was the Organize activity conducted with the highest frequency. However, during the first three phases, note taking was conducted with high frequencies while during the Write phase, the frequency of note taking dropped.

Compose activities are conducted with similar frequencies during Collect and Select, and are conducted with lower frequencies during Explore, and conducted with the highest frequencies during Write. The Compose activities conducted with the highest frequencies during Select, Collect, and Explore are creating a reference list, while the most frequently conducted compose activities conducted during Write are writing sections and reviewing the paper.

These findings show that the activities conducted with high frequencies during the first three phases, by subtask, are all similar. While the same subtask may be conducted during the Write phase, the activities conducted within that subtask are often different from those conducted during the first three tasks. By examining the differences between each phase, or by using prior research to supplement findings, the nuances of between the subtasks by phase are illuminated to present a more holistic perspective of the research-paper writing process.

However, while the core subtasks and activities may differ by phase, it must be emphasized that the non-core subtasks are still conducted during each phase. For example, while the Search subtask is conducted with significantly lower frequencies during the Write phase, Search activities are still conducted by 52.4% of respondents. This is not an isolated example. While Compose activities are conducted with significantly lower frequencies during Select, Explore, and Collect, they are still conducted by between 53.3% and 61.1% of respondents during these phases. This finding demonstrates that the subtasks are used throughout the phases of the process, and are highly iterative. The phases and subtasks can be used to describe the changing and varied foci of students as they progress through the process; however, these foci do not imply that the process consists of a set of procedural steps.

As the information sources and people consulted during the research-paper writing process were not presented within the various phases in the survey, each person or source cannot be connected to a subtask in the same way as the activities. However, as Searching activities are conducted to find information, it is reasonable to associate information sources with the Search subtask. Thus, as Search activities are conducted with the highest frequencies during the first three phases of the process, we can assume that sources are used most frequently during the first three phases. Results show that general information sources are used more frequently than are specific information sources. The general information sources used most frequently by respondents are databases, NovaNet (the consortium catalogue of Nova Scotia University libraries), and search engines. Recommendations are also used with high frequencies. General information sources were used most frequently to access journal articles, followed by books and eBooks, and webpages.

As will be discussed in more detail in the following section, technologies used to communicate with people are used with high frequencies to support a variety of subtasks. As such, it is reasonable to assume that students consult people throughout the research-paper writing process. Results indicate that the people consulted with the highest frequencies are professors, classmates, and friends.

The subtasks, activities, information sources, and people used most frequently during the research-paper writing process have been illuminated to provide further insight into that process. But how might this illumination be used to suggest design applications for a student-centric learning application? Results described in Research Question 2 show how using the connections between the subtasks and technologies can inform design.

5.2.2 Research Question 2

How may various technologies be used to support the research-paper writing process, and how may they be incorporated into the design of a software application, or information appliance, to support that process?

As results from Research Question 1 show, the student research-paper writing process consists of highly iterative subtasks. The design implication is that certain features and technologies may support particular foci and thus may need to be *emphasized* during certain points of the process. However, results show that all subtasks occur during all phases. This means that while certain features may be not need to be emphasized during certain phases of the process, these features must always be *available*. Figure 11 maps the technologies to the subtasks and phases of the research-paper writing process.

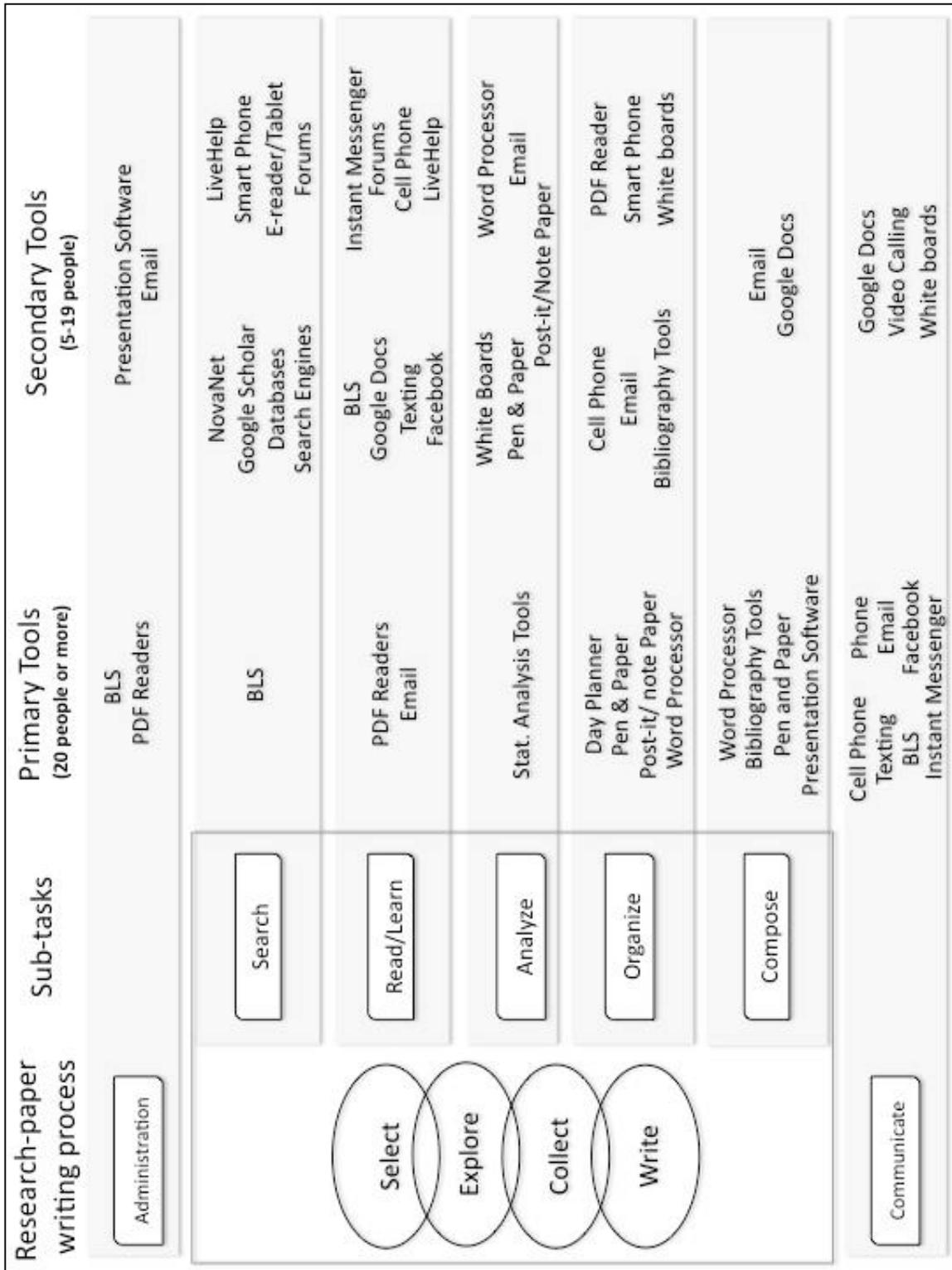
The map is divided into four columns. The first column, “The research-paper writing process,” identifies the four sub phases of the process, identifying the iterative nature of the process by representing the phases as overlapping circles, and notes other work-related generic tasks that are conducted in tandem, namely Administration and Communicate.

As results found that the subtasks are performed throughout the process, they are not linked to particular phases so as not to imply subtask exclusively in some phases.

However, to show that they occur as part of the overall research-paper writing process, the phases and subtasks are grouped in a large square box.

The connections shown in the map are between the subtasks and the technologies. The technologies that support each subtask are horizontally aligned with the applicable subtask. Results described in Section 4.3.2 were used to inform the connections between the technologies and subtasks. Because response rates for technology use were low, so too are the requirements for being considered as either a “primary technology,” or a “secondary technology.” The numbers for inclusion were chosen to differentiate between the technologies used most frequently to support a particular subtask, and the technologies used less frequently to support a particular task. The numbers are based on the frequency of use data (Section 4.3.2) where participants were asked to describe for what they use each technology, not if they used it for “some papers,” “most papers,” or “never.” See Figure 6.

Figure 6: Subtasks and tools



Administration

Few of the listed technologies were used to support Administrative activities. Primary administrative technologies included BLS to access information about the assignment itself and submit the final paper, and PDF readers as a general access tool. Other technologies included Presentation software, often to view class slides, and email, used to submit the final paper.

Design suggestion: A student-centric information appliance should include features that allow students to access information about their assignments, and submit their assignments.

Search

Of the tools listed in the technology section of the survey, BLS was used most frequently to search for information as a source of web links or articles posted by classmates or professors. Search-specific tools were listed in the sources section. On the map (Figure 6) these tools are included in the Secondary Tools column, not because fewer participants rely on them, but because they were not analyzed in the same way as the other technologies. Therefore, while it is reasonable to assume that these access points support Search, the connection is not direct and they are not considered “primary tools.” The search specific tools used most frequently by respondents were primarily general access points such as Databases, NovaNet, Google Scholar, and Search Engines.

Design suggestion: As access points are an integral means by which students find information, direct links to frequently used access points should be included as a feature in a student-centric information appliance. If these links could be viewed within the system, (such as web pages are viewed within a browser) students would not have to navigate between systems while completing a single task. As students are also using BLS to access suggested or recommended sources, a student-centric information appliance should include a forum through which citations and web-links to information objects can be shared. While results indicate that social tagging is not used with high frequencies during the research-paper writing process, including these features may provide an effective way to organize and share information.

Read/Learn

Email and PDF readers are the technologies used by most respondents to conduct Read/Learn activities. However, a variety of secondary technologies were used to support reading and learning. Of these technologies, most are used to communicate with others during the process, namely to ask questions, to seek clarification, and for help formulating a focus.

Design suggestion: PDF readers should be included as a feature in a student-centric information appliance to support reading and learning. Technologies used to communicate with others are addressed in the “Communicate” section below.

Analyze

Statistical analysis tools were used with the highest frequencies to conduct Analyze activities. These tools include software programs such as Excel, or SPSS, and were most often used as a means to analyze self-collected data. Tools such as pen and paper, notepaper and whiteboards were used during brainstorming and idea generation. While both are considered analytical activities, each requires a different type support.

Design suggestion: To accommodate for different types of Analyze activities, technologies that support both data analysis (i.e., statistical analysis software) and idea generation (perhaps idea mapping software) should be included in a student-centric information appliance.

Organize

A variety of technologies are used to support Organize activities. Day planners are used to organize time, and pen and paper, notepaper, and word processors are used primarily to write notes and outlines. The secondary tool, bibliography software is used to gather and collect citations.

Design suggestion: Like the Analyze subtask, the tools that support Organize can be used differently, depending on the specific Organize activity. This means that a student-centric information appliance should include a variety of tools, such as calendars, word processors, and bibliography software, to support the variety of Organize activities conducted during the research-paper writing process.

Compose

The primary technologies used to support Compose activities were word processors, bibliography software, pen and paper, and presentation software.

Respondents used Word processors, and pen and paper primarily to write and review their papers, bibliography software was primarily used to create reference lists, and presentation software was used primarily to create presentations. However, while many respondents used bibliography tools, many others found that they had difficulties with the technology, for example R171 stated: “I really thought this program would be awesome, but when I got everything working and all my references were appended, the format that was programmed did not match what the format was SUPPOSED to be. Waste of time.”

Design suggestion: Of course, word processors should be included in a student-centric information appliance. Although some respondents reported difficulties working with bibliography software programs, this does not mean that they should not be included in design. Rather, when users are faced with a variety of similar options, for example, citation styles, comments such as the one made by R171 highlight the importance of clear, transparent instructions.

Communicate

Although Xie (2009) described the information search process of students as an individual activity, it is clear from the high frequencies of technologies used for Communication that students do not undertake writing a research paper in isolation. Technologies such as telephones, and mobile phones (including smart phones) to connect through voice and text; and social media, instant messaging systems, and email to connect through text, are all used during the research-paper writing process. While video calling applications were reported with lower frequencies than other communication technologies, this does not imply that the technology does not proficiently support the process. Rather, students simply may not have access to those who they would wish to discuss their papers with through video calling.

Design Suggestion: Because different types of communication technologies are used with high frequencies throughout the research-paper writing process, a variety of communication options should be included in a student-centric information appliance, including email and instant messaging to allow for both synchronous and asynchronous text-based communication. As in person communication was conducted with high frequencies, including video calling features in a student-centric information appliance

may provide students with the opportunity to remotely connect with people “face-to-face” during the research-paper writing process.

Using mobile technologies to support the research-paper writing process

It is interesting to note the high frequencies of use for both pen and paper, and post-it and other notepaper, in part due to its portability and convenience. Despite the influx of mobile technologies (most notably, tablet computers and smart phones), students still use pen and paper and notepaper to conduct a wide range of subtasks. Some respondents reported a preference for pen and paper over a computer because they believed it helped them to work more efficiently and effectively. For example, R402 stated: “for everything... personally my mind works quicker with a pen and paper than a computer.” R145 reported using pen and paper for most of the composition process: “I write all my papers by hand and then transfer them into my computer, usually there adding evidence.” However, others, such as R354, use pen and paper only if they do not have access to a computer. Responses, such as those from R354, suggest that, as mobile technology becomes more affordable and more ubiquitous, than the activities supported by pen and paper need to be technologically supported. While currently only 6% of respondents reported using smart phones during the research-paper writing process, and only 4% reported using tablet computers, these frequencies will likely increase, but only if the applications are functional and usable; they will need to be “fit for purpose.”

Design Suggestion: Designing mobile applications that are be integrated across various platforms (such as laptops/desktops, and mobile technologies) may provide students with ways to continue using an integrative interactive system, even when they do not have immediate access to their primary mode of computing.

Providing for iteration in the research-paper writing process

The map shows that many of the technologies are used for different subtasks within the research-paper writing process. This implies that a single technology does not have a single use. One tool may be used to support a variety of needs. This further confirms the need to not limit the features students can access in a student-centric information appliance. Not limiting accessibility will also allow students to have control over the system’s features, complying with Toms’, et al. (2009) assertion that highly automated

systems may detract from usability. However, as Diriyee, et al. (2010) found, including features that do not support the immediate task may become distracting and may also detract from usability.

Design suggestion: An apt example of how tools can be available yet not visible when not in use is the Picture Tools tab in Microsoft Word (MS Office 2007 to present). When an image is inserted using the picture button located in the Insert tab in the ribbon, a new tab, named “Picture Tools” appears in the ribbon and is highlighted with a different colour. This tab has a variety of options specific to editing and formatting images and shapes. When a user has completed inserting and editing an image, the Picture Tools tab disappears until the image is clicked on, or another image is added. This model could be applied in the design of a student-centric information appliance. For example, when a user is searching, access to information sources could become available. When a particular information object is selected from an information source, tools that support reading and learning could appear. Including a tabbing feature such as this would ensure that tools are always available while maintaining flexibility and decreasing clutter.

The map connecting the technologies used during the research-paper writing process to the subtasks conducted within that process, can be used not only as a means to illuminate how each technology is used during the process, but can also be used to inform a number of design suggestions for a student-centric learning appliance (See Figure 6). As a number of technologies are used during the process for a variety of reasons, it is important to consider the iteration involved in the process. Thus, the features of a student-centric information appliance must always be accessible and available to truly support the research-paper writing process.

5.3 RESEARCH DESIGN ISSUES

There are several limitations with the research design of this study, primarily resulting from issues with the survey. Responses are self-reported, and there is no guarantee that respondents responded truthfully. The respondents were provided with lists to select from, which may have prompted them. The survey was lengthy and thus dropout rates were high. As the Technology section was the final set of questions in the survey, fatigued respondents may not have responded with as much detail as they would

have, given a shorter survey. However, while there were some limitations with the survey, the survey format itself allowed for input from a greater number of students, as well as students with a variety of experience levels and students from a variety of disciplines. Although observation or interviews would have provided a greater depth to responses, this study focused on developing a detailed framework of the research paper writing process and thus was less focused on the detailed processes of a small number of participants.

5.4 CONTRIBUTIONS

The contributions to this study are both theoretical and professional.

5.4.1 Theoretical

The frameworks of the research-paper writing process developed by Kuhlthau (1993) and Vakkari (2001) were developed to study the information seeking processes of students as they progress from phase to phase. This study started with those phases as a platform, and augmented them to describe the research-paper writing process to create a more holistic framework. This research also extended their work by adding the notion of subtasks, activities, information sources, and technologies as elements of the process.

5.4.2 Professional

As there is no integrated interactive information appliance which supports the research-paper writing process of students, this study has set out to find what the various elements of this information appliance might be, and how they might fit together to support all the varied phases of the process. By using the disparate phases of the research-paper writing process described by Kuhlthau (1993) and Vakkari (2001) and building upon them, this study has not only identified the basic elements of the process, but also has described the strong connections between these elements. These connections are illustrated in the map connecting the subtasks of the process to the technologies that support them (See Figure 6). This map can be used as a starting point for the development of a student-centric information appliance that will provide support based on the actual process-based requirements of students.

Figure 10 illustrates how each of the subtasks of the research-paper writing process may be linked to the various technologies that support them. As such, it presents

a preliminary outline for the design of a student-centric information appliance. For example, the Search subtask is supported by both technologies and information sources. When Search is linked to the phases of the research and writing process, the design implication is that Search activities require the most support during the initial stages of the research-paper writing process. However, as Search activities are conducted throughout the process, the tools and information sources supporting Search must always be available. Similarly, Compose activities are conducted primarily during the Write phase. The map indicates that many of the primary tools used to support composition may also be used to support other subtasks, either as primary or secondary tools. For example, word processors are a primary tool used to support Organize activities, and a secondary tool used to support Analyze activities. Bibliography software, a primary tool used to support composition, is also a secondary tool used to support Organize activities. These findings indicate that while word processors and bibliography software are two technologies that support the Compose activities conducted primarily during the Write phase, they support other subtasks conducted throughout the process. Therefore, not only does the map provide details about how tools may be used to support specific subtasks, it shows how these tools may be used across the entire process.

Conversely, the results of the study show the activities students are not conducting and the information sources and technologies they are not using. We do not know why they are not being used. For example, results show that many students do not tag articles or search for articles using tags during the research-paper writing process. Tagging and searching through tags may provide students with valuable links to sources, and may help them organize their own sources (Mor, Ferran, Garreta-Domingo, & Mangas, 2011). Similarly, results indicate that librarians are consulted less frequently during the research and writing than other people, and that general information sources are used less frequently than specific information sources. These results may indicate that the people and sources do not meet students' needs. Alternately, they may point out a fundamental lack in student education and training. Educators may find these results insightful in understanding which technologies and sources to use, and what activities to conduct.

The main limitation of the map is that it connects only technologies currently used by respondents with subtasks. However, these activities and subtasks provide insights

into students' actual practices, although additional activities may be performed. As found by this study, the subtasks and activities, and the tools and technologies that support them may then be used to suggest the incorporation of new task-specific technologies that could bridge gaps in students' current practices and provide even more effective support for the student research-paper writing process.

5.5 FUTURE RESEARCH

Future research could include conducting a similar study to assess the effect of experience levels of students or of students within different domains on the elements of the research-paper writing process. Do graduate students conduct different activities during different phases than do undergraduate students? Do students of arts, sciences, or health professions require the same technological support? If differences are found, these analyses could be used as a means to suggest the design of a specialized information appliance according to demographic factors such as experience or domain. Conversely, no differences may imply that a universal information appliance may be sufficient to support all students. These studies would also provide further insight into the research-paper writing process and demonstrate if there are demographic factors that affect the process.

While the map of the technologies and subtasks provides a basis for the design of an information appliance, it would be beneficial to implement the design suggestions based on the results found in this study. User testing could determine what features are used by participants and when, and what features are not used and when, and thus, could either confirm or deny the results found during this study.

CHAPTER 6 CONCLUSION

Students engaged in the complex task of researching and writing a paper would benefit from the support provided by an integrated and cohesive student-centric information appliance. Despite the fact that a myriad of technologies and information sources are used throughout the process, there is no single system that provides support to students from the onset of the research-paper writing process through to its conclusion. To identify the requirements of a student-centric learning appliance, an online survey was distributed to students of a variety of experience levels and domains. Respondents provided information about the activities they conduct during the research-paper writing process, when during the process they conduct them, and also about the information sources and the technologies that they use.

This study used the activities that students' conduct during the research-paper writing process as a means to analyze the phases of the process. The activities were grouped to describe subtasks of the phases and tests were conducted to identify the statistical differences between the subtasks by phase. Results of this analysis showed that there were statistical differences between each of the subtasks, save for Analyze, which was conducted with similar frequencies throughout all of the phases. However, while there were statistical differences between the subtasks conducted during each phase, all of the subtasks and activities were still conducted, albeit with lower frequencies. This finding demonstrates that the research-paper writing process consists of highly iterative subtasks.

The activities conducted during the research paper writing process are supported by technologies and information sources; this study was able to suggest connections between technologies, sources, and subtasks of the process as a means to show what type of support would be required, and how this support might be most effectively displayed. However, as findings from the subtask analysis demonstrate the iterative nature of the research-paper writing process, the various features of a student-centric information appliance may not always need to be viewable but they must always be available.

This study has examined the various elements of the research paper writing process, i.e., the activities, sources, and technologies, and connected these elements to phases in the process. These connections not only provide further insight into the research paper

writing process, but the map of the subtasks to tools illustrates the complexity of the process and is a starting point for the design of a student-centric learning appliance.

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APPENDIX A Informed Consent



How Do You Write a Paper?

We are investigating how students write papers. What information do they consult, what sources do they check, and what software do they use? The research will assist in designing a system to support students when doing their academic work.

The survey will take approximately 20 minutes. Your participation in this survey is voluntary and anonymous. You will not be asked to provide any identifying information and we will not be tracking any activities that you do on the Web. You may withdraw from the study at any time and you may refuse to answer any questions. There are no known risks to participating. We will aggregate all responses, and may use your comments as anonymized direct quotes in our papers. We will retain the data for five years and may use it to compare with similar data collected in later studies.

Respondents will have a chance to win one prize of one \$50 or one of 10 prizes of \$20 gift certificates from the Dalhousie Bookstore.

If you have any questions or would like to learn more about this research, please contact Sarah Gilbert, MLIS student or Dr. Elaine Toms, Canada Research Chair in Management Informatics at the iLab at hci@dal.ca

In the event that you have difficulties with, or wish to voice concern about, any aspect of your participation in this study, you may contact Patricia Lindley, Director of Dalhousie University's Office of Human Research Ethics Administration: (902) 494-1462.

Have you written one paper that required you to consult readings outside your textbook? If so, and if you agree with the preceding statements, please click the "I Agree" button. If not, please select "I do not wish to participate" button.

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APPENDIX B Survey

The Student Research Process: Technologies, Activities, Information and People

How many different software and Web-based applications do you use when writing a paper?

As students, we use a wide variety of applications: BLS to organize our coursework, WorldCat to search for books and articles, and Word to write the paper. We wonder what kind of application could support all of the various aspects of the student research and writing process.

To figure this out, we are investigating how students write a paper. Who do you consult? What do you use? What do you do when you write your papers? To assist with answering these questions, we invite you to complete a survey which should take between 20 and 30 minutes. The survey is being conducted by Sarah Gilbert for her masters thesis. If you have any questions, please contact Sarah at hci@dal.ca.

To participate in this study, please click the "Next" button below.

Informed Consent

1

Informed Consent

We are investigating how students write papers. What information do they consult, what sources do they check, and what software do they use? The research will assist in designing a system to support students when doing their academic work.

If you are a current student, have written at least one paper that required you to use sources outside of the course textbook, and would like to participate in this study, please complete the following six part survey; it will take between 20 and 30 minutes.

Respondents who complete the survey will have the chance to win one prize of one \$50 gift certificate or one of 10 prizes of \$20 gift certificates from the Dalhousie Bookstore. Your participation in this survey is voluntary and anonymous. You will not be asked to provide any identifying information and we will not be tracking any activities that you do on the Web. *You may withdraw at any time and you may refuse to answer any questions. There are no known risks to participating. We will aggregate all responses, and may use your comments as anonymized direct quotes in our papers. We will retain data and may*

If you have any questions or would like to learn more about this research, please contact Sarah Gilbert, MLIS student or Elaine Toms, Canada Research Chair in Management Informatics at the iLab at hci@dal.ca.

In the event that you have difficulties with, or wish to voice concern about, any aspect of your participation in this study, you may contact Patricia Lindley, Director of Dalhousie University's Office of Human Research Ethics Administration: (902) 494-1462.

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*

Please choose only one of the following:

- I AGREE TO THE ABOVE CONDITIONS AND WISH TO PARTICIPATE
- I DO NOT WISH TO PARTICIPATE

Paper Writing Experience

2 1. Have you written at least one paper that required you to consult sources outside of the course textbook? *

Please choose only one of the following:

- Yes
- No

Part I- Demographic Profile

3

This survey contains six sections: Demographic Profile; Current Practices in Writing a Paper; Activities; Sources; People; and Technologies . The answers in this section, Demographic Profile, will be used to describe the general characteristics of the group of people who respond to the survey.

Please note: You will not be able to return to previous pages in the survey.

4 2. Which of the following degrees/diplomas you have been awarded and which are you in the process of completing?

Check any that apply:

	Degrees(s) Awarded	Degree in Progress
College Diploma	<input type="checkbox"/>	<input type="checkbox"/>
Undergraduate Degree	<input type="checkbox"/>	<input type="checkbox"/>
Graduate Degree: Masters or equivalent	<input type="checkbox"/>	<input type="checkbox"/>
Graduate Degree: PhD, Doctoral or equivalent	<input type="checkbox"/>	<input type="checkbox"/>
Professional Degree: Medicine, Law, etc...	<input type="checkbox"/>	<input type="checkbox"/>

5 3. In which of the following areas, was/is your major? If you have not yet declared a major, please indicate in which area you are considering majoring.

Check any that apply:

	Degree(s) Awarded	Degree in Progress
Architecture and Planning	<input type="checkbox"/>	<input type="checkbox"/>
Arts (e.g., English, French or History)	<input type="checkbox"/>	<input type="checkbox"/>
Computer Science	<input type="checkbox"/>	<input type="checkbox"/>
Dentistry	<input type="checkbox"/>	<input type="checkbox"/>
Education	<input type="checkbox"/>	<input type="checkbox"/>
Engineering	<input type="checkbox"/>	<input type="checkbox"/>
Fine Arts (e.g., Music, Theater, Costume Studies or Design)	<input type="checkbox"/>	<input type="checkbox"/>
Health Professions (eg.; Nursing, Pharmacy or Social Work)	<input type="checkbox"/>	<input type="checkbox"/>
Law	<input type="checkbox"/>	<input type="checkbox"/>
Management (e.g., Commerce, Public Administration, Public Relations or Tourism and Hospitality)	<input type="checkbox"/>	<input type="checkbox"/>
Science (e.g., Economics, Math or Chemistry)	<input type="checkbox"/>	<input type="checkbox"/>
Social Sciences (e.g., Anthropology or Sociology)	<input type="checkbox"/>	<input type="checkbox"/>
Theology	<input type="checkbox"/>	<input type="checkbox"/>
Other	<input type="checkbox"/>	<input type="checkbox"/>

6 4. What is your current year of study?

Please choose only one of the following:

- First year
- Second year
- Third year
- Fourth year
- Fifth year
- Sixth year
- Other

7 5. Are you registered as a full-time or part-time student?

Please choose only one of the following:

- Full-time
- Part-time

Part I- Demographic Profile Continued

8 6. Are you currently employed?

Please choose only one of the following:

- Yes
- No

9 6. a) On average, how many hours do you work in a week?

Please choose only one of the following:

- 0
- 1-5
- 6-10
- 11-15
- 16-20
- 21-25
- 26-29
- 30 or more

10 7. Is English your first language?

Please choose only one of the following:

- Yes
- No

11 7. a) What is your first language?

Please write your answer here:

12 8. What is your gender?

Please choose only one of the following:

- Male
- Female
- Prefer not to say

13 9. What is your age group?

Please choose only one of the following:

- 18-20
- 21-23
- 24-26
- 27-29
- 30-32
- 33-35
- 36-38
- 39-41
- 42-44
- 45-47
- 48-50
- 51-more

Part II: Current Practices in Writing a Paper

14 In this section, Current Practices in Writing a Paper, we would like you to think about one memorable paper you have written...

15 10. What was the subject of the paper? You may provide the title or a brief description.

Please write your answer here:

16 11. How long was the paper? You can provide either number of words OR number of pages.

Please write your answer(s) here:

Words:

Pages:

17 12. Exactly how did you go about writing this paper?

Please briefly list the steps you took while researching and writing this paper from the time it was assigned, to the time you submitted it. For example, did you look at Wikipedia, talk to classmates or professors, search for journal articles, use RefWorks, write an outline, or write a bibliography? Please be as detailed as possible. If you need more space, please select the "More" checkbox.

Please choose all that apply and provide a comment:

- Step 1
- Step 2
- Step 3
- Step 4
- Step 5
- Step 6
- Step 7
- Step 8
- Step 9
- More...

18 12. a) Please continue adding as many steps as you took.

Please choose all that apply and provide a comment:

- Step 11
- Step 12
- Step 13
- Step 14
- Step 15
- Step 16
- Step 17
- Step 18
- Step 19
- Step 20

19 13. Are these the steps that you typically take when writing a paper?

Please choose only one of the following:

- Yes
- No

20 13. a) What do you do differently?

Please write your answer here:

Part III- Activities- Introduction

21 The research and writing process may be divided into four core phases. Please review the description of each of the phases. Please note that the steps described below may overlap, and may also appear more than once during the process of researching and writing a paper.

The remainder of the survey will ask you a series of questions about the activities you conduct, the sources you use, the people you consult, and the technologies you use.

Select

SELECT: deciding on a topic for research*Example: Your assignment is to write a paper on Halifax. You have many topic options; during the Select phase, you decide that you will write a paper on the history of the city.*

Explore

EXPLORE: investigating information so that you can decide on a focus within the topic*Example: Founded in 1749, Halifax has a long history, and you can't include it all! During the Explore phase, you search for information about a specific historic period or incident. During your search, you find a lot of information about the Halifax Explosion, and so you decide to write about it.*

Collect

COLLECT: gathering information that defines, extends, and supports the focus*Example: You need to gather information about the Halifax Explosion by consulting books, articles, or other forms of information.*

Write

WRITE: using information gathered to write the paper*Example: You feel like you have enough information to start writing! You now start composing your paper, using information to review previous research and support your thesis statement.*

Part III- Activities- Select

22 In this section, we will ask you about the activities that you do during the SELECT phase (deciding on a topic for research).

Select

Please note: in this section, we are asking you to think about the activities you conduct while deciding on a topic for research (SELECT). The following three pages will ask you about the activities you conduct during the other phases.

23 14. a) How often do you conduct the following activities during the SELECT phase? (Deciding on a topic for research)

Please choose the appropriate response for each item. Note: not all options may apply in this phase.

Please choose the appropriate response for each item:

	I do this for most papers I write	I do this for some papers I write	Never
Annotate documents, such as adding notes in the margins	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Assign tags to webpages on sites such as Delicious or Cite-U-Like	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Search for information using tags assigned to webpages or articles	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Look at the citation of one document to find other documents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Compare and contrast the content of multiple documents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Summarize/organize your thoughts about your topic by creating flowcharts or diagrams	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Create diagrams/models to insert as content in your paper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Create a reference list of works to be cited in your paper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Create tables that organize your thoughts/ideas about your topic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Create tables to insert as content in your paper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Determine if documents are relevant to your topic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Edit your paper by conducting a critical analysis of its content	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Edit your paper by conducting a critical analysis of its organization	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Edit your paper by conducting a critical analysis of its evidence (e.g. the sources and arguments used to support your thesis)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Group documents by subtopic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Keep track of documents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

24 14. (continued...)

How often do you conduct the following activities during the SELECT phase? (Deciding on a topic for research)

Please choose the appropriate response for each item. Note: not all options may apply in this phase.

Please choose the appropriate response for each item:

	I do this for most papers I write	I do this for some papers I write	Never
Learn information about your topic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Look up definitions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Re-read, review, and clarify the content of your paper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Read documents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Re-find previously encountered information	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Scan/browse the content of documents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Search for information about your topic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Search for specific documents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Write drafts of your paper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Write personal notes to organize your ideas about your topic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Write notes to extract information from a document	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Write outlines	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Write sections of your paper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Summarize the main point of your paper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Make connections between different pieces of information	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

25 15. What problems or challenges have you faced during the SELECT phase (deciding on a topic for research), and how did you respond to those problems/challenges?

Please write your answer here:

Part III- Activities- Explore

26 In this section, we will ask you about the activities that you do during the EXPLORE phase (investigating information so that you can decide on a focus within the topic).

Explore

27 16. a) How often do you conduct the following activities during the EXPLORE phase? (investigating information so that you can decide on a focus within the topic).

Please choose the appropriate response for each item. Note: not all options may apply in this phase.

Please choose the appropriate response for each item:

	I do this for most papers I write	I do this for some papers I write	Never
Annotate documents, such as adding notes in the margins	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Assign tags to webpages on sites such as Delicious or Cite-U-Like	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Search for information using tags assigned to webpages or articles	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Look at the citation of one document to find other documents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Compare and contrast the content of multiple documents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Summarize/organize your thoughts about your topic by creating flowcharts or diagrams	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Create diagrams/models to insert as content in your paper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Create a reference list of works to be cited in your paper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Create tables that organize your thoughts/ideas about your topic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Create tables to insert as content in your paper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Determine if documents are relevant to your topic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Edit your paper by conducting a critical analysis of its content	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Edit your paper by conducting a critical analysis of its organization	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Create tables that organize your thoughts/ideas about your topic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Create tables to insert as content in your paper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Determine if documents are relevant to your topic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Edit your paper by conducting a critical analysis of its content	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Edit your paper by conducting a critical analysis of its organization	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Edit your paper by conducting a critical analysis of its evidence (e.g. the sources and arguments used to support your thesis)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Group documents by subtopic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Keep track of documents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

28 16. (continued...)

How often do you conduct the following activities during the EXPLORE phase (investigating information so that you can decide on a focus within the topic).

Please choose the appropriate response for each item. Note: not all options may apply in this phase.

Please choose the appropriate response for each item:

	I do this for most papers I write	I do this for some papers I write	Never
Learn information about your topic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Look up definitions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Re-read, review, and clarify the content of your paper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Read documents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Re-find previously encountered information	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Scan/browse the content of documents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Search for information about your topic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Search for specific documents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Write drafts of your paper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Write personal notes to organize your ideas about your topic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Write outlines	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Write sections of your paper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Summarize the main point of your paper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Make connections between different pieces of information	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

29 17. What problems or challenges have you faced during the EXPLORE phase (investigating information so that you can decide on a focus within the topic) and how did you respond to those problems/challenges?

Please write your answer here:

Part III- Activities- Collect

30 In this section, we will ask you about the activities that you do during the COLLECT phase (gathering information that defines, extends, and supports the focus).



31 18. a) How often do you conduct the following activities during the COLLECT phase (gathering information that defines, extends, and supports the focus).

Please choose the appropriate response for each item. Note: not all options may apply in this phase.

Please choose the appropriate response for each item:

	I do this for most papers I write	I do this for some papers I write	Never
Annotate documents, such as adding notes in the margins	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Assign tags to webpages on sites such as Delicious or Cite-U-Like	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Search for information using tags assigned to webpages or articles	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Look at the citation of one document to find other documents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Compare and contrast the content of multiple documents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Summarize/organize your thoughts about your topic by creating flowcharts or diagrams	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Create diagrams/models to insert as content in your paper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Create a reference list of works to be cited in your paper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Create tables that organize your thoughts/ideas about your topic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Create tables to insert as content in your paper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Determine if documents are relevant to your topic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Edit your paper by conducting a critical analysis of its content	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Edit your paper by conducting a critical analysis of its organization	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Edit your paper by conducting a critical analysis of its organization	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Edit your paper by conducting a critical analysis of its evidence (e.g. the sources and arguments used to support your thesis)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Group documents by subtopic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Keep track of documents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

32 18. (continued...)

How often do you conduct the following activities during the COLLECT phase (gathering information that defines, extends, and supports the focus).

Please choose the appropriate response for each item. Note: not all options may apply in this phase.

Please choose the appropriate response for each item:

	I do this for most papers I write	I do this for some papers I write	Never
Learn information about your topic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Look up definitions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Re-read, review, and clarify the content of	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Re-find previously encountered information	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Scan/browse the content of documents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Search for information about your topic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Search for specific documents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Write drafts of your paper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Write personal notes to organize your ideas about your topic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Write notes to extract information from a document	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Write outlines	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Write sections of your paper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Summarize the main point of your paper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Make connections between different pieces of information	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

33 19. What problems or challenges have you faced during the COLLECT phase (gathering information that defines, extends and supports the focus) and how did you respond to those problems/challenges?

Please write your answer here:

Part III- Activities- Write

34 In this section, we will ask you about the activities that you do during the WRITE phase (using information gathered to write the paper).



35 20. a) How often do you conduct the following activities during the WRITE phase (using information gathered to write the paper).

Please choose the appropriate response for each item. Note: not all options may apply in this phase.

Please choose the appropriate response for each item:

	I do this for most papers I write	I do this for some papers I write	Never
Annotate documents, such as adding notes in the margins	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Assign tags to webpages on sites such as Delicious or Cite-U-Like	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Search for information using tags assigned to webpages or articles	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Look at the citation of one document to find other documents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Compare and contrast the content of multiple documents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Summarize/organize your thoughts about your topic by creating flowcharts or diagrams	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Create diagrams/models to insert as content in your paper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Create a reference list of works to be cited in your paper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Create tables that organize your thoughts/ideas about your topic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Create tables to insert as content in your paper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Determine if documents are relevant to your topic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Edit your paper by conducting a critical analysis of its content	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Edit your paper by conducting a critical analysis of its organization	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Edit your paper by conducting a critical analysis of its evidence (e.g. the sources and arguments used to support your thesis)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Group documents by subtopic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Keep track of documents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

36 20. (continued...)

How often do you conduct the following activities during the WRITE phase (using information gathered to write the paper).

Please choose the appropriate response for each item. Note: not all options may apply in this phase.

Please choose the appropriate response for each item:

	I do this for most papers I write	I do this for some papers I write	Never
Learn information about your topic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Look up definitions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Re-read, review, and clarify the content of your paper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Read documents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Re-find previously encountered information	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Scan/browse the content of documents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Search for information about your topic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Search for specific documents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Write drafts of your paper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Write personal notes to organize your ideas about your topic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Write notes to extract information from a document	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Write outlines	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Write sections of your paper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Summarize the main point of your paper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Make connections between different pieces of information	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

37 21. What problems or challenges have you faced during the WRITE phase (using information gathered to write the paper) and how did you respond to those problems/challenges?

Please write your answer here:

Part IV- Sources

38 This section asks about what you use to look for information sources when researching and writing a paper.

39 22. I use the following to look for information:

Please choose the appropriate response for each item:

	I do this for most papers I write	I do this for some papers I write	Never
WorldCat	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
NovaNet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Search Engines (such as Google, Bing or Yahoo)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Databases (such as EbscoHost or ProQuest)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Google Scholar	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Personal Collections (such as your own printed or digital documents)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Recommendations (such as from a friend or professor)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

40 22. a) I use WorldCat to get (you may select multiple options):

Please choose all that apply:

- Books or eBooks
- Journal articles
- Webpages
- Newspaper articles
- Maps
- Government or corporate reports
- Original documents (such as diaries or correspondence)
- Data sets
- Other:

41 22. b) I use NovaNet to get (you may select multiple options):

Please choose all that apply:

- Books or eBooks
- Journal articles
- Webpages
- Newspaper articles
- Maps
- Government or corporate reports
- Original documents (such as diaries or correspondence)
- Data sets
- Other:

42 22. c) I use search engines to get (you may select multiple options):

Please choose all that apply:

- Books or eBooks
- Journal articles
- Webpages
- Newspaper articles
- Maps
- Government or corporate reports
- Statistics
- Data sets
- Photos or videos
- Other:

43 22. d) I use databases (such as ProQuest or EbscoHost) to get (you may select multiple options):

Please choose all that apply:

- Books or eBooks
- Journal articles
- Webpages
- Newspaper articles
- Government or corporate reports
- Statistics
- Data sets
- Photos or videos
- Other:

44 22. e) I use Google Scholar to get (you may select multiple options):

Please choose all that apply:

- Books or eBooks
- Journal articles
- Webpages
- Patents
- Other:

45 22. f) I use personal collections to get (you may select multiple options):

Please choose all that apply:

- Books or eBooks
- Journal articles
- Webpages
- Newspaper articles
- Original documents (such as diaries or correspondences)
- Photos or videos
- Statistics
- Maps
- Government or corporate reports
- Data sets
- Patents
- Other:

46 22. g) I use recommendations to get (you may select multiple options):

Please choose all that apply:

- Books or eBooks
- Journal articles
- Webpages
- Newspaper articles
- Original documents (such as diaries or correspondence)
- Photos or videos
- Statistics
- Maps
- Government or corporate reports
- Data sets
- Patents
- Other:

47 23. I use the following to look for information:

Please choose the appropriate response for each item:

	I do this for most papers I write	I do this for some papers I write	Never
Social bookmarking sites (such as Delicious)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
RSS feeds	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Library or Public Archives	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Government websites	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
YouTube	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Geographic websites (such as Google Maps or MapQuest)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Geospatial data	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

48 24. Do you use anything else to look for information?

Please choose only one of the following:

- Yes
- No

49 24. a) What else do you use?

Please write your answer here:

Part V- People

50 This section asks you about the people you consult when researching and writing a paper.

51 25. During the research and writing process, I discuss my paper with:

Please choose the appropriate response for each item:

	I do this for most papers I write	I do this for some papers I write	Never
Librarians	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Professors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Classmates	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Subject Experts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Family Members	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

52 26. Are there any other people with whom you discuss your paper?

Please choose only one of the following:

- Yes
- No

53 26. a) Who?

Please write your answer here:

Part VI- Technologies

54 This section asks you about the technologies you use when researching and writing a paper.

27. During the research and writing process, for what do you use each of the following technologies? Please be as detailed as possible! You may indicate "never" if you don't use the technology during the research and writing process.

Pen and paper	<input type="text"/>
Online forums	<input type="text"/>
RSS Reader (eg: Google Reader)	<input type="text"/>
File sharing software (e.g., FileZilla)	<input type="text"/>
Email	<input type="text"/>
In person conversations (e.g., with profs, TAs, friends)	<input type="text"/>
Google Docs	<input type="text"/>
Instant messaging (e.g., MSN, Facebook chat)	<input type="text"/>
LiveHelp	<input type="text"/>
Day planner	<input type="text"/>
E-reader/tablet computer (e.g., iPad, Kindle)	<input type="text"/>
Post-it or other note paper	<input type="text"/>
Cell phone (not including smart phones)	<input type="text"/>
BLS	<input type="text"/>

28. During the research and writing process, what do you use each of the following technologies for? Please be as detailed as possible! You may indicate "never" if you don't use the technology during the research and writing process.

Smart phone	<input type="text"/>
Word Processor (e.g., Word or Open Office)	<input type="text"/>
Scanner/photocopier/printer	<input type="text"/>
White/chalk boards or flip charts	<input type="text"/>
PDF readers (e.g., Mac Preview, Adobe Acrobat)	<input type="text"/>
Texting	<input type="text"/>
Statistical analysis tools	<input type="text"/>
Facebook	<input type="text"/>
Bibliography Software (e.g., RefWorks, EndNote)	<input type="text"/>
Presentation software (e.g., Powerpoint, Prezi)	<input type="text"/>
Phone (not including cell phones or smart phones)	<input type="text"/>

Part VI- Technologies- Continued

57 29. You have already commented on the technologies listed below. What other technologies do you use to research and write a paper, and how do you use them?

BLS	Facebook	Post-it, or other note paper	Data analysis software
Cell phone	Instant messaging	Presentation software	Video calling applications
Day planner	LiveHelp	Bibliographic software	White/chalk boards or flip charts
Email	Online forums	Scanner/photocopier/printer	Word processors
Twitter	PDF readers	Smart phone	File sharing software
Google Docs	Pen and paper	In person conversations	
RSS Reader	Phones		

Please write your answer here:

Draw Entry

58 Thank you for completing this survey!

If you would like to be entered in a draw for a chance to win one prize of one \$50 gift certificate, or one of 10 prizes of \$20 gift certificates from the Dalhousie Bookstore, please provide your email address.

Note: email addresses are kept separately from the data, and will only be used to enter you into the draw.

We appreciate your time!

Sarah Gilbert, Principle Investigator, MLIS Candidate
Elaine Toms, Supervisor, Canada Research Chair in Management Informatics

If you have any further questions, please contact Sarah at:

(902) 494-8392
hci@dal.ca

Please choose all that apply and provide a comment:

I would like to participate in the draw. Here is my email address:

Thank you for your time!

APPENDIX C Recruitment Email

Subject: Need students to respond to Dal survey!

Dear X

Could you please distribute this message to your graduate and undergraduate students?

How do you write a paper? Who do you consult? What do you use? What do you do when you write a paper?

We are researching how students research and write papers. All we need is about 20 minutes of your time to answer a web survey.

This research is supporting a masters thesis and has received ethics approval. Thus you may close your browser at any time if you do not wish to answer any question. However if you respond to the survey you will be enter into a draw for one \$50 or one of 10 \$20 gift certificates to the Dalhousie Bookstore.

To participate in this study, please click the link below.

<http://ilab.management.dal.ca/survey>

The survey will be available until Feb 15.

Thank-you in advance.

Sarah Gilbert
MLIS candidate, School of Information Management
iLab

Elaine Toms
Professor & CRC in Management Informatics
Director, iLab
Faculty of Management

APPENDIX D Recruitment Script

Hi!

My name is Sarah Gilbert and I'm a Masters of Library and Information Studies student here at Dal. _____, has graciously allowed me to take a few minutes of your time to promote a study that I'm conducting for my Masters thesis.

I'm conducting a survey called "The Student Research Process: Activities, Technologies, Information, and People", and I'm trying to get as many students as possible to complete the survey and tell me about your paper writing process. Why do I need to know about your paper writing process? The intent of my research is to design an application that will make the process easier. So right now when you write a paper, you use a whole bunch of different applications and programs, like the Internet, databases, the library, Word, PDF readers, and so on. After finding out what you use, what you do, when you do it, and who you talk to, I'm going to use that information so that I can design an application that will help you do what you need to do when you need to do it. Except, of course research and write your paper for you! You'll still have to do that!

I'm going to pass around some bookmarks with the survey URL. I've been finding that on average, the survey takes approximately 20-30 minutes to complete. When you complete the survey, you can provide your email address to be entered in a draw for one \$50 gift certificate or one of 10 \$20 gift certificates to the Dal book store. The survey is anonymous. I don't know who says what, and I store the email addresses in a separate file from the rest of the survey responses.

If you have any questions, feel free to contact me at hci@dal.ca. The email address is also on the bookmarks.

Thank you all for your time!

APPENDIX E Recruitment Bookmark

How do YOU write a paper? Participate in a study!
<http://ilab.management.dal.ca/survey>



Questions?
Contact hci@dal.ca

APPENDIX F Technology Coding Manual

Description	Code	Function	Groups	Notes
Missing	66	administrative	N/A	
Misunderstand the technology/don't know the technology	47	administrative	N/A	(eg: think Google Docs= Scholar)
Never	1	administrative	N/A	
Use the technology	8	administrative	N/A	(no use given) Includes sometimes, often, and never, or if the respondent just indicates a brand or implement
I don't know what the respondent means/ vague	48	administrative	N/A	
Access information about the assignment itself	46	new activities	Administ -rate	
Ask Questions for info, clarification, verification, or recommendations	45	new activities	Read/ Learn	
Brainstorming/idea generation	49	new activities	Analyze	
Charts and diagrams (general)	58	new activities	Other	Must be asking a PERSON (or in a forum)
Complain/Entertainment/Procrastination	42	new activities	Other	eg: description, rubric
Data Analysis/stats	57	new activities	Analyze	
Editing (general)	50	new activities	Compose	
Focus formulation/topic selection	54	new activities	Analyze	
Note taking (general)	55	new activities	Organize	
Open docs/access information	59	new activities	Administ -rate	
Organization (general)	67	new activities	Organize	
Presentation	60	new activities	Other	
Sharing information	51	new activities	Read/ Learn	
Storing information	53	new activities	Organize	Includes annotated bibs
Submit Paper	44	new activities	Administ -ration	
Summarizing documents	56	new activities	Analyze	
Timeline/schedule/Planning	43	new activities	Organize	
Translation	52	new activities	Other	
Annotate documents, such as adding notes in the margins	41	original activities	Organize	
Assign tags to web pages on sites such as Delicious or Cite-U-Like	2	original activities	Organize	
Compare and contrast the content of multiple documents]	5	original activities	Analyze	
Create a reference list of works to be cited in your paper	40	original activities	Compose	

Description	Code	Function	Groups	Notes
Create diagrams/models to insert as content in your paper	7	original activities	Compose	
Create tables that organize your thoughts/ideas about your topic	9	original activities	Organize	
Create tables to insert as content in your paper	10	original activities	Compose	
Determine if documents are relevant to your topic	11	original activities	Analyze	
Edit your paper by conducting a critical analysis of its content	12	original activities	Compose	
Edit your paper by conducting a critical analysis of its evidence (e.g. the sources and arguments used to support your thesis)	14	original activities	Compose	
Edit your paper by conducting a critical analysis of its organization	13	original activities	Compose	
Group documents by subtopic	15	original activities	Organize	
Keep track of documents	16	original activities	Organize	..and information in general; also includes personal information or information found (such as bookmarks to keep track of info found in a book
Learn information about your topic	17	original activities	Read/ Learn	
Look at the citation of one document to find other document	4	original activities	Search	
Look up definitions	18	original activities	Search	
Make connections between different pieces of information	31	original activities	Analyze	
Re-find previously encountered information	21	original activities	Search	
Re-read, review, and clarify the content of your paper	19	original activities	Compose	
Read documents	20	original activities	Read/ Learn	
Scan/browse the content of documents	22	original activities	Read/ Learn	docs/info in general
Search for information about your topic	23	original activities	Search	
Search for information using tags assigned to web pages or articles	3	original activities	Search	
Search for specific documents	24	original activities	Search	

Description	Code	Function	Groups	Notes
Summarize the main point of your paper	30	original activities	Analyze	
Summarize/organize your thoughts about your topic by creating flowcharts or diagrams	6	original activities	Organize	
Write drafts of your paper	25	original activities	Compose	
Write notes to extract information from a document	27	original activities	Write Notes	
Write outlines	28	original activities	Organize	
Write personal notes to organize your ideas about your topic	26	original activities	Organize	
Write sections of your paper	29	original activities	Compose	
Classmates	34	people	Communi- cate	Includes groups
Colleagues	39	people	Communi- cate	Includes co-workers/co- authors
Communication- general	38	people	Communi- cate	Used if no one is specified
Family	37	people	Communi- cate	
Friends	36	people	Communi- cate	
Librarians	32	people	Communi- cate	
Professors	33	people	Communi- cate	
Subject Experts	35	people	Communi- cate	

APPENDIX G Ethics Approval



Social Sciences and Humanities Research Ethics Board Letter of Approval

Date: October 27, 2010.

To: Sarah Gilbert, School of Information Management
Elaine Toms, School of Business Administration

The Social Sciences Research Ethics Board has examined the following application for research involving human subjects:

Project # 2010-2335

Title: Understanding the Information, Resources and Tools That Students Use to Write a Term Paper: A Task Analysis Approach

and found the proposed research involving human subjects to be in accordance with Dalhousie Guidelines and the Tricouncil Policy Statement on *Ethical Conduct in Research Using Human Subjects*. This approval will be in effect for 12 months from the date indicated below and is subject to the following conditions:

1. Prior to the expiry date of this approval an annual report must be submitted and approved.
2. Any significant changes to either the research methodology, or the consent form used, must be submitted for ethics review and approval *prior to their implementation*.
3. You must also notify Research Ethics when the project is completed or terminated, at which time a final report should be completed.
4. Any adverse events involving study participants are reported immediately to the REB

Effective Date: October 27, 2010.

signed: _____

Expiry Date: October 27, 2011.

IMPORTANT FUNDING INFORMATION - Do not ignore

To ensure that funding for this project is available for use, you **must** provide the following information and **FAX** this page to **RESEARCH SERVICES at 494-1595**

Name of grant /contract holder _____ Dept. _____

Signature of grant / contract holder _____

Funding agency _____

Award Number _____ Dal Account # (if known) _____

APPENDIX H Ethics Application

APPLICATION FOR SUBMISSION TO THE DALHOUSIE UNIVERSITY SOCIAL SCIENCES AND HUMANITIES RESEARCH ETHICS BOARD

SECTION 1. ADMINISTRATIVE INFORMATION

Project Title Understanding the Information, Resources and Tools that Students use to Write a Term Paper: A Task Analysis Approach
--

1.1 Local Principal Investigator [Lead researcher affiliated with Dalhousie University]			
Name	Sarah Gilbert		
Department	School of Information Management		
		Phone	494-8392
Email	sagilber@dal.ca	Fax	494-1503
For student submissions	Supervisor's Name/Department	Elaine Toms/ School of Business Administration	
	Degree Program	Masters of Library and Information Studies	

Co-investigator(s) Names and affiliations	N/A

1.2 Signature of Local PI attesting that:	
a. All co-investigators have reviewed the ethics submission and are in agreement with it. b. All investigators have read the TriCouncil Policy Statement <i>Ethical conduct for Research Involving Humans</i> and agree to abide by these guidelines	
Signature	Date
---	-----

Other ethics reviews (if any)	Where	N/A
-------------------------------	-------	-----

	Status	N/A		
Funding (if any)	Agency	NCE GRAND/ NSERC		
	Award Number	N/A		
Peer review (if any)	N/A			
Planned start date	November 2010	Planned end date	August 2011	
Contact person for this submission (if not PI)	Name	N/A		
	Email	N/A	Phone	N/A

SECTION 2. PROJECT DESCRIPTION

[Complete all parts, referring to the Guidance Document corresponding to this form]

2.1 INTRODUCTORY SUMMARY	[250 words max]
2.1.1 briefly describe the rationale, purpose, study population and methods	
<p>2.1.1 At present, many software systems support student work. Systems such as Blackboard administer a course. A student has tools such as a word processor to facilitate composition and a battery of products from search engines to library catalogues to support information seeking and retrieval. All of these systems work independently which means that students do not have a cohesive integrated environment in which to do the fundamental tasks associated with academic work such as writing a term paper which is an information intensive task.</p> <p>This project will examine one student task, writing a paper, to understand how information, tools that manipulate information, and actions, analyses and functions performed on that information are integrated within the student's workflow. Insights achieved from this research will help define the requirements needed by software to support academic work. The ultimate goal is not to do the work for a student; rather, the intent is to provide students with the appropriate environment – an information appliance – so that the student can focus on comprehension, analysis and composition, not on how they will obtain and sometimes re-find the information they need, or spend hours scrutinizing what may be two versions of exactly the same paper, or re-finding a good quotation that was seen days ago. We need better systems to remove some of the drudgery of writing a paper.</p> <p>Students at both undergraduate and graduate level will be surveyed to identify the steps, processes, tools and strategies they utilize when writing a paper. The results will be analyzed to identify students' needs at various phases of the task, and to discover which needs are presently being met, and which are not. These needs will then be mapped to identify features that should be present in an information appliance</p>	

to support academic work.

2.2 BACKGROUND AND PURPOSE - In this section discuss [3 pages max, not including references]

- 2.2.1 why there is a need to undertake the study (including a brief literature review)
- 2.2.2 what new knowledge is anticipated as an outcome of the study
- 2.2.3. if this is intended to be a pilot study, or a fully developed project

2.2.1 Search is a task conducted by millions of people everyday; however, the motivations behind conducting various searches are nearly as numerous as the people conducting them. Search engine giants such as Bing, Yahoo and Google are beginning to offer enhanced search options such as visualizations, image and video searches, and filters, yet still focus on the “one-size-fits all” search interface. While this type of interface may be useful in certain circumstances such as finding a hotel or a movie review, more complex tasks require a slew of subtasks and activities that are rarely limited to simply searching. Search may be embedded in the activity, but the activity may require sensemaking, evaluation, decision making, etc. Information needs to be gathered, organized, extracted, manipulated, and paraphrased to name a few of the activities that a student undertakes in the course of writing a paper. We believe what we need is an “information appliance” to support academic work.

Coined by Raskin in 1978, and popularized by Norman in 1998, an information appliance is defined as “an appliance specializing in information... designed to support a specific activity” (Norman, 1998, p. 53). To effectively design an information appliance it is imperative that the complex nature and each of the elements that comprise the task be fully understood. The user, their needs, their processes, their actions and the task requirements, all must be accounted for in design. This study seeks to analyze each aspect of one complex task – that of a student writing a research paper, and map the process to needs, functions and tools. Understanding the task will inform the requirements of a information appliance to support academic work, that will guide students through the paper-writing, workflow process, and allow them to focus on critical analysis and creative composition.

The stages that students take in writing a research paper were documented by Kuhlthau (1993). Through her studies of high school students, she observed the six steps involved in the paper-writing process: task initiation, during which the student prepares for the decision of selecting a topic; topic selection, during which the student decides on a topic; prefocus exploration, during which the student investigates information on their topic with the intent of finding a focus; focus formulation, the phase during which the student decides on a focus; information collection, the process of finding information that supports the focus; and presentation, the act of writing the paper itself.

Vakkari (2001) augmented Kuhlthau’s interpretation, noting that each phase in the process requires varied information such as general background information, faceted background information and specific information, and as importantly, better support for

the process. In general, the sort of needs identified by both can be connected to the types of information searches conducted during each phase.

The stages of the process are iterative, and the primary types of searches can be associated with Marchionini's (2006) lookup, learn and investigative type searches. However to support these types of searches, a person may need to use a variety of additional functions such as making connections, receiving suggestions, discriminating among papers, organizing information chunks, and being stimulated to think outside the box (Prefontaine, Bartlett and Toms, 2001).

While Kuhlthau model offers interesting insights into the basic process of the paper-writing task, it was done prior to the growth in the Web and the universal (or nearly) availability of digital information. There have been no studies that have combined the required elements: task process, information needs, search type, information function, and tools and placed them within the context of the task workflow process.

Kuhlthau, C.C. 1993. *Seeking Meaning: A Process Approach to Library and Information Science*. Norwood, NJ: Ablex Publishing.

Norman, D.A. 1998. *The Invisible Computer*. MIT Press, Cambridge, MA.

Prefontaine, G., Bartlett, J.C. & Toms, E.G. 2001. A taxonomy of browsing facilitators for digital libraries. Paper presented at the CAIS/ACSI 2001 (Quebec, CA, May 27-29, 2001).

Marchionini, G. 2006. Exploratory search: From finding to understanding. *Commun. ACM*, 49(4), 41-46.

Vakkari, P. 2001. A theory of the task-based information retrieval process: A summary and generalisation of a longitudinal study. *JDoc*, 57(1), 44-60.

2.2.2 This work will reexamine the workflow process used to write a paper, and identify the various information and technology needs at each point in the process. The outcome will be a richer understanding of the task itself that may be used to facilitate a better environment to support academic work.

2.2.3 This is intended to be a fully developed project

2.3 STUDY DESIGN – In this section

2.3.1 state the hypotheses or the research questions or research objectives

2.3.2 describe the general study design and how it will address the hypotheses / questions /

objectives

2.3.3 describe how many participants are needed and how this was determined

2.3.4 describe the plan for data analysis in relation to the hypotheses/questions/objectives

2.3.5 if a phased review is being requested, describe why this is needed for this study and

which phases are contained in this application

2.3.1 Research Questions:

1. How closely does the workflow model created by Kuhlthau and amended by Vakkari match the existing patterns used by current students when writing a research paper?

2. What are the task requirements? That is, what sources (human or information objects) are consulted? What information, tools (or software), functions, activities or actions do students take when writing a paper?

3. What, thus, do students need to have accessible and available in a software application (and conversely what do they need hidden) when working on a term paper?

2.3.2 This is an exploratory study of the process used to write term papers. The data will be collected by a Web-based survey (see Appendix C). The survey is comprised of three main parts, Demographics, Current Practices in Writing a Paper, and Paper Writing Model. Data collected from Current Practices in Writing a paper will be used to address RQ #1. The third section, Paper Writing Model will be used to address RQ #2. The first part will be used to provide a profile of our sample to be used as variables in analysis. RQ #3 will be addressed during final analysis of the aggregated and coded data supported additionally by past research.

2.3.3 Survey will be distributed on the Web. We are anticipating 100 respondents, but based on experience at the iLab, that number could be as high as 400.

2.3.4 The data from the survey will be aggregated and data derived from open-ended questions will be coded using content analysis. The descriptions provided by students regarding their personal paper-writing processes will be coded and compared to the process described by Kuhlthau and Vakkari. The questions related to each stage in the model (final section of the survey) will be used compiled to look for patterns of behaviour in source, information, and tool use. The functions/actions will be isolated for further analysis using to ascertain if different types of activities that may require different types of support are used at different stages.

2.3.5 N/A

2.4 RECRUITMENT – In this section, for each type of participant to be recruited, describe

- 2.4.1 the study population
- 2.4.2 any social / cultural / safety considerations
- 2.4.3 and justify all specific inclusion / exclusion criteria of participants
- 2.4.4 any recruitment instruments (attach copies)
- 2.4.5 who will be doing the recruitment and what actions they will take
- 2.4.6 any screening measures, and how they will be used (attach copies)
- 2.4.7 any permissions that are needed and attach letters

2.4.1 The study population will be students who have written at least one paper that has required them to consult sources outside of a textbook.

2.4.2 N/A

2.4.3 N/A

2.4.4 See Appendix A for copy of the recruitment letter.

2.4.5 The primary investigator will be responsible for recruiting respondents and will send the recruitment letter to various Dalhousie email lists. Depending on response numbers, a secondary reminder email may be sent out.

2.4.6 N/A

2.4.7 N/A

2.5 INFORMED CONSENT PROCESS – In this section

- 2.5.1 describe the informed consent process (attach a copy of all consent forms)
- 2.5.2 if oral consent is desired, describe why it is necessary and how it will be done (attach a copy of the script)
- 2.5.3 if a waiver of informed consent is sought, explain why and describe how the four criteria needed for this are met
- 2.5.4 for third party consent (with or without assent), describe how this will be done
- 2.5.5 describe plans (if any) for on-going consent
- 2.5.6 if community consent is needed, describe how it will be obtained

2.5.1 Students who click on the link in the recruitment letter will be presented with the consent form (see Appendix B). The Consent Form outlines the conditions and invites them to email for more information, or continue with the survey by clicking the “I Consent” button, or not participate by clicking the “I do not wish to participate” button.

2.5.2 N/A

2.5.3 N/A

2.5.4 N/A

2.5.5 N/A

2.5.6 N/A

2.6 DETAILED METHODOLOGY - In this section describe

2.6.1 where the research will be conducted

2.6.2 what participants will be asked to do and the time each task will take (plus total time)

2.6.3 what data will be recorded and what research instruments will be used (attach copies)

2.6.4 the roles and qualifications of the study investigators / research staff

2.6.5 how long the participants will be involved in each part of the study

2.6.1 The research will be conducted at Dalhousie University. The survey is mounted on a Dalhousie server, and all data collected will be stored on that server. However, because the data collection process is via an online survey, respondents will be able to complete the survey wherever there is an Internet connection and a computer.

2.6.2 The respondents will be asked to complete an online survey, which will take no longer than 20 minutes (but the exact time will be confirmed in pilot testing in house before the survey is advertised externally).

The survey (see Appendix C) will be divided into five parts.

Section 1. Introduction and Consent Form

This will take approximately two minutes to read and review. Willing respondents will select the "I agree" button and will be directed to the survey.

Section 2. Demographics

This asks respondents about age, gender and education. This data is used to provide a profile of the respondent group when reporting results. Completion of this section should take approximately two minutes.

Section 3. Current Practices in Writing a Paper

The third section will take about 5 minutes to complete. Respondents will be asked to provide an example of a research paper they have written recently, and to supply details such as title and length. They will then be asked to outline the steps they took to complete the paper, if it was a typical assignment, and whether or not they

encountered any problems while writing the paper.

Section 4. Paper Writing Model

The fourth section should take about 10 minutes to complete. The respondents will be asked to view a model of the task writing process and compare it to their own. They will then be provided with a series of lists, and asked to indicate which of the following options they make use of during a particular phase of the task writing process.

Section 5. Thank you.

This section will thank respondents for their participation and will provide the URL where the final report will be presented. It will also invite them to participate in a draw (see Appendix D).

2.6.3 Data will be gathered through the online survey. The survey is included in Appendix C.

2.6.4 The PI is a student in her second year of the MLIS program who is conducting research for her master's thesis. She has worked as a research assistant for her supervisor for eight months, four of which were full-time. She has created an online survey for a previous course and has written a paper that was presented as a poster in the HCIR Workshop 2010 outlining the preliminary aspects of this study. The supervisor is a research chair who is an expert in human computer interaction and information science, with expertise in the research domain and the methodology.

2.6.5 Respondents will only be involved in completing the survey.

2.7 DECEPTION / INCOMPLETE DISCLOSURE (if applicable) - In this section describe

2.7.1 what misdirection will be used (if any) and discuss its justification

2.7.2 what information will not be disclosed to participants and discuss its justification

2.7.3 how participants will be debriefed and given the opportunity to withdraw

2.7.1 There will be no misdirection used in this study

2.7.2 N/A

2.7.3 Respondents will be briefed on the introductory page and in the Consent Form. They withdraw by closing their browser window or by selecting the "I do not wish to participate" button.

2.8 RISK ANALYSIS – In this section describe

- 2.8.1 what risks or discomforts are anticipated for participants
- 2.8.2 the estimated probability of these risks (e.g., low, medium, high or more precisely if possible)
- 2.8.3 what steps will be taken to mitigate the risks
- 2.8.4 what risks might exist for communities that are involved in the study

2.8.1 There are no risks.

2.8.2 N/A

2.8.3 N/A

2.8.4 N/A

2.9 BENEFITS - In this section describe

- 2.9.1 the direct benefits (if any) of participation to participants (not compensation)
- 2.9.2 the indirect benefits of the study (i.e., contribution to new knowledge)

2.9.1 There are no direct benefits to respondents except the outcome of the research.

2.9.2 Benefits will be in the outcome of the research.

2.10 CONFIDENTIALITY and ANONYMITY - In this section describe

- 2.10.1 whether the data to be collected is of a personal or sensitive nature
- 2.10.2 how the data will be collected, stored and handled in a confidential manner
- 2.10.3 how long the data will be retained, and what the plans are for its destruction
- 2.10.4 if it is possible for participants to remain anonymous, and how it will be achieved
- 2.10.5 how a 'duty to disclose' abuse or neglect of a child, or adult in need of protection, will be handled
- 2.10.6 if a waiver of confidentiality is to be sought from participants, and why

2.10.1 No sensitive data will be collected.

2.10.2 Data will be collected by distributing an online survey. The survey will be

distributed using an open source survey package that is installed on a server at Dalhousie University. The survey responses will be stored on the same server.

2.10.3 Data will be retained for five years, and the files destroyed after that period.

2.10.4 No identifying information will be collected. Reported data will be aggregated.

2.10.5. N/A

2.10.6 N/A

2.11 USE OF QUOTATIONS – In this section describe

2.11.1 whether participants will be quoted in the final report, and if so

2.11.2 describe how permission will be obtained for this

2.11.3 describe whether the quotes be attributed, how permission for this will be obtained and

how participants will be given the chance to see how the quotes are used

2.11.1 Respondents may be quoted in the final report.

2.11.2 Permission will be obtained in the Consent Form (Appendix B).

2.11.3 Any quotations will be anonymized through the use of pseudonyms. Respondents will be informed of this in the Consent Form (Appendix B). Since there is no way to connect a participant to a quote, no request for permission can be obtained.

2.12 COMPENSATION - In this section describe

2.12 1 what compensation will be offered to participants (if any), how it will be done and how

it will be handled for participants who do not complete the study

2.12.2 whether participants are likely to incur any additional expenses

2.12.1 Participants will be invited to leave their email address on the final page to be considered for a draw as described in the Recruitment letter.

2.12.2 Respondents will incur no expenses, except for the use of their time.

2.13 PROVISION OF RESULTS TO PARTICIPANTS - In this section, describe

- 2.13.1 plans to provide results of the study to participants
- 2.13.2 whether individual results will be provided to study participants, and how
- 2.13.3 how participants will be informed of results that may indicate they may be at risk

2.13.1 Results of this study will be posted on the iLab website. The URL will be included on the final page of the survey.

2.13.2 Individual results will not be provided to study respondents.

2.13.3 N/A

2.14 COMPLIANCE WITH PRIVACY LEGISLATION – In this section,

- 2.14.1 state what software (if any) you will use to collect (e.g. survey software), store (e.g., database software) or analyze your data.
- 2.14.2 state whether a survey company will be used to assist in data collection, management storage or analysis
- 2.14.3 describe what provisions (if any) of the University policy on the *Protection of Personal Information from Access Outside Canada* apply and how they have been met.

2.14.1 LimeSurvey is an open-source software, installed on a Dalhousie University computer and will be used as the survey software to collect data. The data will be stored on a secure server located at Dalhousie University.

2.14.2 N/A

2.14.3 N/A

2.15 CONFLICT OF INTEREST – In this section

- 2.15.1 whether any conflict of interest exists for any member of the research team in relation to the sponsor of the study
- 2.15.2 whether any conflict of interest exists for any member of the research team with respect

to their relationship to the potential research respondents (e.g., teacher / student)
2.15.1 N/A
2.15.2 N/A

SECTION 3. INFORMED CONSENT

Consult Section 3 of **GUIDANCE FOR SUBMITTING AN APPLICATION FOR RESEARCH ETHICS REVIEW**

3.1 **CONSENT FORM CHECKLIST**

Please complete this checklist and submit with the application.

YES	N/A	Have you included the following in your consent form / process?
X		Identification of document as CONSENT FORM
X		Title of study
X		Identity and affiliation of researchers
X		Contact information of individual conducting the study
X		Invitation to participate in research
X		Assurance of voluntariness and right to withdraw without repercussions
X		Short description of the purpose of the study
X		Short description of the study design and how many participants are involved
X		Inclusion and exclusion criteria
X		Description of what the participant is being asked to do
X		Estimate of the participant's time commitment
X		Description of where the research will take place
	X	Description of special clothing or other preparations required of the participant
X		Description of how anonymity will be handled
X		Description of how confidentiality of the data will be assured
X		Description of any necessary limitations of confidentiality protections
X		Description of the nature and probability of risks for participants
X		Description of the benefits for participants
	X	Declaration of any researcher conflict of interest
	X	Description of any possible commercial outcomes of the research
	X	Description of how participants will review transcripts of interviews
X		Description of how study results will be provided to participants
	X	Permissions requested for audio/video taping
X		Permissions requested for use of quotations
X		Permission for future use of data in specified studies
	X	Permission to recontact participant for participation in future studies
	X	Permissions related to transportation/use of data outside of Nova

		Scotia
	X	How assent of participant will be sought when 3 rd parties give consent
		Signature statement indicating that information has been provided
		Signatures of participant and person obtaining consent

YES	N/A	Have you addressed the following in your Consent Form / Process ?
X		Appropriate Reading comprehension level (Grade 8)
X		Avoidance of technical language
X		Formatting: font size (min 12 pt), headings, page numbering
	X	Clear distinction between clinical care / research procedures
	X	No waiver of rights is sought

3.2 GENERAL NOTES ON CREATING A CONSENT FORM

This section of the Guidance document provides general information to guide the development of a Consent Form

3.3 CONSENT FORM TEMPLATE

Researchers should use the headings and suggested text provided in this section of the Guidance document unless it can be demonstrated in the protocol that these are not appropriate for the particular context of the consent process for this study.

Ethics Appendix A

Recruitment instrument: Survey recruitment letter

To: XXXX
From: Sarah Gilbert, Principal Investigator

Re: Participate in a survey!

Are you a student who has written at least one paper that has required you to consult information outside of your textbook?

We are looking for undergraduate and graduate students to respond to a 20 minute survey about how students write papers and the information and software they use when writing a paper.

The survey will be available from November 1 to December 1 and will consist of a series of short questions about the paper writing process.

Your participation in this survey is voluntary and all information you provide will be kept confidential.

To participate, simply follow the link [URL will be inserted here].

This survey is part of Sarah Gilbert's MLIS thesis research at Dalhousie University. If you have any questions, please contact us at the iLab at Dalhousie University: hci@dal.ca.

Thank you,

Sarah Gilbert, Principal Investigator
MLIS Candidate
School of Information Management

Dr. Elaine Toms, Supervisor
Canada Research Chair in Management Informatics
Director, iLab, Faculty of Management

Ethics Appendix B

Informed consent process: Consent form



How Do You Write a Paper?

We are investigating how students write papers. What information do they consult, what sources do they check, and what software do they use? The research will assist in designing a system to support students when doing their academic work.

The survey will take approximately 20 minutes. Your participation in this survey is voluntary and anonymous. You will not be asked to provide any identifying information and we will not be tracking any activities that you do on the Web. You may withdraw from the study at any time and you may refuse to answer any questions. There are no known risks to participating. *We will aggregate all responses, and may use your comments as anonymized direct quotes in our papers. We will retain the data for five years and may use it to compare with similar data collected in later studies.*

Respondents will have a chance to win one prize of one \$50 or one of 10 prizes of \$20 gift certificates from the Dalhousie Bookstore.

If you have any questions or would like to learn more about this research, please contact Sarah Gilbert, MLIS student or Dr. Elaine Toms, Canada Research Chair in Management Informatics at the iLab at hci@dal.ca

In the event that you have difficulties with, or wish to voice concern about, any aspect of your participation in this study, you may contact Patricia Lindley, Director of Dalhousie University's Office of Human Research Ethics Administration: (902) 494-1462.

Have you written one paper that required you to consult readings outside your textbook? If so, and if you agree with the preceding statements, please click the "I Agree" button. If not, please select "I do not wish to participate" button.

Principle Investigator/Contact Person: Supervisor:

Sarah Gilbert
MLIS Candidate
iLab and School of Information
Management
Dalhousie University

Dr. Elaine Toms
Canada Research Chair in Management
Informatics
iLab, Faculty of Management
Dalhousie University

NOTE: this consent form was approved by protocol 2006-1406, Measuring User Engagement. This study is using the same methodology although the objectives are different, and has the same level of risk. The italicized sentences are new.

Ethics Appendix C
Research Instrument: Survey

Survey Draft

Section 1. Profile of Group

Please respond to the following questions. Note that we are asking these questions so as to describe the group of people who respond to the survey

1. Please indicate which of the following degrees/ diplomas you have been awarded, and which ones you are in the process of completing. For each, specify your major or the area of interest.

	Degree(s) Awarded	Degree In progress	Major/ Area of Interest
College Diploma	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Undergraduate Degree	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Graduate Degree: Masters or equivalent	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Graduate Degree: PhD, Doctoral or equivalent	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Professional Degree (medicine, law, etc...)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
N/A	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	

2. What year of study are you currently completing In your current degree program?

- First
- Second
- Third
- Fourth
- Fifth
- Sixth
- Other _____

3. Are you registered as a full-time or part-time student?

- Full time
- Part Time

4.a. Are you currently employed?

- Yes
- No

b. If yes, how many hours do you work in a week?

- 0

- 1-5
- 6-10
- 11-15
- 16-20
- 21 or more

5. Is English your first language?

- Yes
- No (if no, what is your first language? _____)

6. What is your gender?

- Male
- Female
- Prefer not to say

7. What is your age group?

- | | | |
|--------------------------------|--------------------------------|-----------------------------------|
| <input type="checkbox"/> 18-20 | <input type="checkbox"/> 30-32 | <input type="checkbox"/> 42-44 |
| <input type="checkbox"/> 21-23 | <input type="checkbox"/> 33-35 | <input type="checkbox"/> 45-47 |
| <input type="checkbox"/> 24-26 | <input type="checkbox"/> 36-38 | <input type="checkbox"/> 48-50 |
| <input type="checkbox"/> 27-29 | <input type="checkbox"/> 39-41 | <input type="checkbox"/> 51- more |

*****Break*****

Part 2. Current Practices in writing a paper

Think about one memorable paper that you have written for one of your courses.

8. What was the title of a paper you have written recently?

9. How long was the paper supposed to be?

About ____ words OR ____ pages

10. Was this paper typical of other papers you have written?

___ Yes

___ No

11. Exactly how do you go about writing a paper? Please briefly list the steps you took while researching and writing this paper from the time it was assigned, to the time you submitted it. For example, did you look at Wikipedia, talk to classmates or professors, search for journal articles, use RefWorks, write an outline, or write a bibliography? Please be as detailed as possible.

Step 1: _____

Step 2: _____

Step 3: _____

Step 4: _____

Step 5: _____

Step 6: _____

12.a. Are these the steps that you typically take when writing any paper?

___ Yes

___ No

b. If no, what do you tend to do differently?

13.a. Did you encounter problems while writing this paper?

Yes No

b. If yes, please briefly describe the problem(s).

c. Is this a problem you normally encounter while writing a paper?

Yes No

14. In your last term at university, how many papers were you assigned that required you to consult sources of information outside of textbook readings?

0

1

2

3

4

5

6

7 or more

not applicable – I was not a university student last term

15. Please indicate the degree to which you agree with the following statements:

a. I often complete my papers in an efficient (ie: time effective) manner.

Strongly Disagree Moderately Disagree Slightly Disagree Neutral Slightly Agree
 Moderately Agree Strongly Agree N/A

b. I often complete my papers in an effective (ie: you are often awarded with anticipated grades from your professor) manner.

Strongly Disagree Moderately Disagree Slightly Disagree Neutral Slightly Agree
 Moderately Agree Strongly Agree N/A

*****Break*****

Section 3. Paper Writing Model

This is one possible process that people follow when writing papers. Please review the description of the following paper-writing steps . We will next ask you a series of questions about what you do at each of these phases.



Select: Deciding on a topic for research.

Example: Your assignment is to write a paper on Halifax. You have many topic options, but during the select phase, you decide that you will write a paper on the history of the city.



Explore: Investigating information so that you can decide on a focus within the chosen or assigned topic.

Example: Founded in 1749, Halifax has a long history, and you can't include it all! During the Explore phase, you will search for information about a specific historic period or incident. During your search you read a lot of information about the Halifax Explosion, and so you decide to write about it.



Collect: Gathering information that defines, extends and supports the focus.

Example: You now need to gather information about the Halifax Explosion



Write: The process using the information gathered to write the paper.

Example: You feel like you have enough information to start writing! You're now going to start composing your paper, using the sources to review previous research and support your thesis statement.

16. During the Select phase you decide on a topic for your paper

Example: Your assignment is to write a paper on Halifax. You have many topic options, but during the select phase, you decide that you will write a paper on the history of the city.

Please indicate what you do during this phase.

a. Who do you discuss the problem with? What mechanism do you use to talk to the person?

Person	By				
Librarians	Email	LiveHelp		In Person	Other (indicate)
Yes ☺	<input type="checkbox"/> Often	<input type="checkbox"/> Often		<input type="checkbox"/> Often	_____
No ☹	<input type="checkbox"/> Sometime	<input type="checkbox"/> Sometime		<input type="checkbox"/> Sometimes	<input type="checkbox"/> Often

	<input type="checkbox"/> Never	<input type="checkbox"/> Never		<input type="checkbox"/> Never	<input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Professors or TAs Yes ☉ No ☉	Email <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	BLS <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Social Networking (Facebook, MSN, Skype, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	In person <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Other (please indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Classmates Yes ☉ No ☉	Email <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	BLS <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Social Networking (Facebook, MSN, Skype, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	In person <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Online Forums Yes ☉ No ☉					
Experts Yes ☉ No ☉	Email <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never		Social Networking (Facebook, MSN, Skype, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	In Person <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Friends Yes ☉ No ☉	Email <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never		Social Networking (Facebook, MSN, Skype, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	In Person <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never

Friends Yes ☉ No ☉	Email <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never		Social Networking (Facebook, MSN, Skype, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	In Person <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Family members Yes ☉ No ☉	Email <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never		Social Networking (Facebook, MSN, Skype, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	In Person <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Other... Yes ☉ No ☉	Email <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never		Social Networking (Facebook, MSN, Skype, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	In Person <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Other...	Email		Social	In Person	Other

b. What sources do you consult? How do you find each?

Source	Do you find them through...					
Books Yes ☉ No ☉	World Cat <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	NovaNet <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Public library <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Search Engines (Google, Bing, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Personal Files <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Journal	World	NovaNet	Databases	Google	Course	Other

articles Yes ☉ No ☉	Cat <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	<input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	such as Proquest <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Scholar <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	readings <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	(indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Web articles that are not e-books or journal articles Yes ☉ No ☉	Social Bookmarking sites such as Delicious <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	RSS Feeds <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Recommendations (from friends, professors, etc.) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Search Engines (Google, Bing, etc.) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never		Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Newspapers Yes ☉ No ☉	Newspaper Websites <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Physical edition <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never				Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Original documents (such as reports, diaries, or correspondences) Yes ☉ No ☉	Library Archives <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Public Archives <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Personal Collections <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Online Digital Archives <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never		Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Photos or video Yes ☉ No ☉	Google images <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Flickr <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Youtube <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never			Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Statistics	Stats Canada					Other (indicate)

Statistics Yes ☉ No ☉	Stats Canada Website <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never					Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Maps Yes ☉ No ☉	Google Maps <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Maps and Geospatial Information Collections at Dalhousie <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never				Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Government or corporate reports Yes ☉ No ☉	Government Websites <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	World Cat <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	NovaNet <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Databases such as Factiva or LexusNexus <input type="checkbox"/> Often <input type="checkbox"/> Sometimes		Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never

c. How often do you use the following types of software when you are choosing a topic?

i. Word processing programs such as MS Word

- Often
- Sometimes
- Never

ii. Spread sheet programs such as MS Excel

- Often
- Sometimes
- Never

iii. Bibliographic programs such as RefWorks

- Often
- Sometimes
- Never

iv. PDF readers such as Mac Preview:

- Often
- Sometimes
- Never

v. File sharing software such as FileZilla:

- Often
- Sometimes
- Never

vii. Web-based collaborative programs such as CiteULike:

- Often
- Sometimes
- Never

viii. Social bookmarking sites such as Delicious:

- Often
- Sometimes
- Never

ix. Other: _____

- Often
- Sometimes
- Never

x. Other: _____

- Often
- Sometimes
- Never

d. How often do you do the following activities when you are choosing a topic?

i. Read relevant information: Yes__ No__

- Often
- Sometimes
- Never

ii. Take notes: Yes__ No__

- Often
- Sometimes
- Never

iii. Write an outline: Yes__ No__

- Often
- Sometimes
- Never

iv. Annotate (for example, highlight important sentences, and make notes within the work itself): Yes__ No__

- Often
- Sometimes
- Never

v. Add sources to a bibliography or works cited list: Yes__ No__

- Often
- Sometimes
- Never

vi. Begin writing the assignment: Yes__ No__

- Often
- Sometimes
- Never

vii. Draw diagrams or models: Yes__ No__

- Often
- Sometimes
- Never

viii. Draw tables or matrices: Yes__ No__

- Often
- Sometimes
- Never

ix. Create annotated bibliographies: Yes__ No__

- Often
- Sometimes
- Never

x. Other: _____

- Often
- Sometimes
- Never

xi. Other: _____

- Often
- Sometimes
- Never

Person	By				
Librarians Yes ☉ No ☉	Email <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never	LiveHelp <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never		In Person <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Some times <input type="checkbox"/> Never
Professors or TAs Yes ☉ No ☉	Email <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never	BLS <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never	Social Networking (Facebook, MSN, Skype, etc..) <input type="checkbox"/> Often	In person <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Other (please indicate) _____ -

			<input type="checkbox"/> Sometimes <input type="checkbox"/> Never		<input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Classmates Yes ☉ No ☉	Email <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never	BLS <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never	Social Networking (Facebook, MSN, Skype, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	In person <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Online Forums Yes ☉ No ☉					
Experts Yes ☉ No ☉	Email <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never		Social Networking (Facebook, MSN, Skype, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	In Person <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Friends Yes ☉ No ☉	Email <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never		Social Networking (Facebook, MSN, Skype, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	In Person <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Family members Yes ☉ No ☉	Email <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never		Social Networking (Facebook, MSN, Skype, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	In Person <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never

Family members Yes ☉ No ☉	Email <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never		Social Networking (Facebook, MSN, Skype, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	In Person <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Other... Yes ☉ No ☉	Email <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never		Social Networking (Facebook, MSN, Skype, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	In Person <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Other...	Email		Social	In Person	Other

17. During the Explore phase you are examining the topic in more detail to decide on a particular focus

Example: Founded in 1749, Halifax has a long history, and you can't include it all! During the Explore phase, you will search for information about a specific historic period or incident. During your search you read a lot of information about the Halifax Explosion, and so you decide to write about it.

Please indicate what you do at this phase.

a. Who do you discuss the problem with? What mechanism do you use to talk to the person?

b. What sources do you consult? How do you find each?

Source	Do you find them through...					
Books Yes ☉ No ☉	World Cat <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	NovaNet <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Public library <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Search Engines (Google, Bing, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Personal Files <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Journal articles Yes ☉	World Cat <input type="checkbox"/> Often	NovaNet <input type="checkbox"/> Often	Databases such as Proquest	Google Scholar <input type="checkbox"/> Often	Course readings <input type="checkbox"/> Often	Other (indicate) _____

No ☉	<input type="checkbox"/> Sometimes <input type="checkbox"/> Never	<input type="checkbox"/> Sometimes <input type="checkbox"/> Never	<input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	<input type="checkbox"/> Sometimes <input type="checkbox"/> Never	<input type="checkbox"/> Sometimes <input type="checkbox"/> Never	<input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Web articles that are not e-books or journal articles Yes ☉ No ☉	Social Bookmarking sites such as Delicious <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	RSS Feeds <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Recommendations (from friends, professors, etc.) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Search Engines (Google, Bing, etc.) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never		Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Newspapers Yes ☉ No ☉	Newspaper Websites <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Physical edition <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never				Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Original documents (such as reports, diaries, or correspondences) Yes ☉ No ☉	Library Archives <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Public Archives <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Personal Collections <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Online Digital Archives <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never		Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Photos or video Yes ☉ No ☉	Google images <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Flickr <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Youtube <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never			Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Statistics Yes ☉ No ☉	Stats Canada Website <input type="checkbox"/> Often					Other (indicate) _____ <input type="checkbox"/> Often

Statistics Yes ☉ No ☉	Stats Canada Website <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never					Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Maps Yes ☉ No ☉	Google Maps <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Maps and Geospatial Information Collections at Dalhousie <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never				Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Government or corporate reports Yes ☉	Government Websites <input type="checkbox"/> Often <input type="checkbox"/> Sometimes	World Cat <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	NovaNet <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Databases such as Factiva or LexusNexus <input type="checkbox"/> Often		Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes

c. How often do you use the following types of software when you are choosing a topic?

i. Word processing programs such as MS Word

- Often
- Sometimes
- Never

ii. Spread sheet programs such as MS Excel

- Often
- Sometimes
- Never

iii. Bibliographic programs such as RefWorks

- Often
- Sometimes
- Never

iv. PDF readers such as Mac Preview:

- Often
- Sometimes

Never

v. File sharing software such as FileZilla:

Often

Sometimes

Never

vii. Web-based collaborative programs such as CiteULike:

Often

Sometimes

Never

viii. Social bookmarking sites such as Delicious:

Often

Sometimes

Never

ix. Other: _____

Often

Sometimes

Never

x. Other: _____

Often

Sometimes

Never

d. How often do you do the following activities when you are choosing a topic?

i. Read relevant information: Yes__ No__

Often

Sometimes

Never

ii. Take notes: Yes__ No__

Often

Sometimes

Never

iii. Write an outline: Yes__ No__

Often

Sometimes

Never

iv. Annotate (for example, highlight important sentences, and make notes within the work itself): Yes__ No__

Often

Sometimes

Never

v. Add sources to a bibliography or works cited list: Yes__ No__

Often

Sometimes

Never

vi. Begin writing the assignment: Yes__ No__

- Often
- Sometimes
- Never

vii. Draw diagrams or models: Yes__ No__

- Often
- Sometimes
- Never

viii. Draw tables or matrices: Yes__ No__

- Often
- Sometimes
- Never

ix. Create annotated bibliographies: Yes__ No__

- Often
- Sometimes
- Never

x. Other: _____

- Often
- Sometimes
- Never

xi. Other: _____

- Often
- Sometimes
- Never

8. During the Collect phase (gathering information that defines, extends and supports the focus), do you...

Please indicate what you do at this phase

Example: You now need to gather information about the Halifax Explosion

a. Who do you discuss the problem with? What mechanism do you use to talk to the person?

Person	By				
Librarians Yes ☉ No ☉	Email <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never	LiveHelp <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never		In Person <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never	Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never

Professors or TAs Yes ☉ No ☉	Email <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	BLS <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Social Networking (Facebook, MSN, Skype, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	In person <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Other (please indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Classmates Yes ☉ No ☉	Email <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	BLS <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Social Networking (Facebook, MSN, Skype, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	In person <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Online Forums Yes ☉ No ☉					
Experts Yes ☉ No ☉	Email <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never		Social Networking (Facebook, MSN, Skype, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	In Person <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never

Friends Yes ☉ No ☉	Email <input type="checkbox"/> Often <input type="checkbox"/> Sometime s <input type="checkbox"/> Never		Social Networking (Facebook, MSN, Skype, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometime s <input type="checkbox"/> Never	In Person <input type="checkbox"/> Often <input type="checkbox"/> Sometime s <input type="checkbox"/> Never	Other (indica te) _____ – <input type="checkbox"/> Often <input type="checkbox"/> Som etimes <input type="checkbox"/> Neve r
Family membe rs Yes ☉ No ☉	Email <input type="checkbox"/> Often <input type="checkbox"/> Sometime s <input type="checkbox"/> Never		Social Networking (Facebook, MSN, Skype, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometime s <input type="checkbox"/> Never	In Person <input type="checkbox"/> Often <input type="checkbox"/> Sometime s <input type="checkbox"/> Never	Other (indica te) _____ – <input type="checkbox"/> Often <input type="checkbox"/> Som etimes <input type="checkbox"/> Neve r
Other... Yes ☉ No ☉	Email <input type="checkbox"/> Often <input type="checkbox"/> Sometime s <input type="checkbox"/> Never		Social Networking (Facebook, MSN, Skype, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometime s <input type="checkbox"/> Never	In Person <input type="checkbox"/> Often <input type="checkbox"/> Sometime s <input type="checkbox"/> Never	Other (indica te) _____ – <input type="checkbox"/> Often <input type="checkbox"/> Som etimes <input type="checkbox"/> Neve r
Other... Yes ☉ No ☉	Email <input type="checkbox"/> Often <input type="checkbox"/> Sometime s <input type="checkbox"/> Never		Social Networking (Facebook, MSN, Skype, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometime s <input type="checkbox"/> Never	In Person <input type="checkbox"/> Often <input type="checkbox"/> Sometime s <input type="checkbox"/> Never	Other (indica te) _____ – <input type="checkbox"/> Often <input type="checkbox"/> Som etimes <input type="checkbox"/> Neve r

b. What sources do you consult? How do you find each?

Source	Do you find them through...					
Books Yes ☉ No ☉	World Cat <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	NovaNet <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Public library <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Search Engines (Google, Bing, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Personal Files <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Journal articles Yes ☉ No ☉	World Cat <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	NovaNet <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Databases such as Proquest <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Google Scholar <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Course readings <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Web articles that are not e-books or journal articles Yes ☉ No ☉	Social Bookmarking sites such as Delicious <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	RSS Feeds <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Recommendations (from friends, professors, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Search Engines (Google, Bing, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never		Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Newspapers Yes ☉ No ☉	Newspaper Websites <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Physical edition <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never				Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Original documents (such as reports, diaries, or correspo	Library Archives <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Public Archives <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Personal Collections <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Online Digital Archives <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never		Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never

Original documents (such as reports, diaries, or correspondences) Yes ☉ No ☉	Library Archives <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Public Archives <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Personal Collections <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Online Digital Archives <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never		Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Photos or video Yes ☉ No ☉	Google images <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Flickr <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Youtube <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never			Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Statistics Yes ☉ No ☉	Stats Canada Website <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never					Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Maps Yes ☉ No ☉	Google Maps <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Maps and Geospatial Information Collections at Dalhousie <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never				Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Government or	Government	World Cat	NovaNet <input type="checkbox"/> Often	Databases such as		Other (indicate)

c. How often do you use the following types of software when you are choosing a topic?

i. Word processing programs such as MS Word

Often

Sometimes

Never

ii. Spread sheet programs such as MS Excel

Often

Sometimes

Never

iii. Bibliographic programs such as RefWorks

Often

Sometimes

Never

iv. PDF readers such as Mac Preview:

Often

Sometimes

Never

v. File sharing software such as FileZilla:

Often

Sometimes

Never

vii. Web-based collaborative programs such as CiteULike:

Often

Sometimes

Never

viii. Social bookmarking sites such as Delicious:

Often

Sometimes

Never

ix. Other: _____

Often

Sometimes

Never

x. Other: _____

Often

Sometimes

Never

d. How often do you do the following activities when you are choosing a topic?

i. Read relevant information: Yes__ No__

Often

Sometimes

Never

ii. Take notes: Yes__ No__

Often

Sometimes

Never

iii. Write an outline: Yes__ No__

Often

Sometimes

Never

iv. Annotate (for example, highlight important sentences, and make notes within the work itself): Yes__ No__

Often

Sometimes

Never

v. Add sources to a bibliography or works cited list: Yes__ No__

Often

Sometimes

Never

vi. Begin writing the assignment: Yes__ No__

Often

Sometimes

Never

vii. Draw diagrams or models: Yes__ No__

Often

Sometimes

Never

viii. Draw tables or matrices: Yes__ No__

Often

Sometimes

Never

ix. Create annotated bibliographies: Yes__ No__

Often

Sometimes

Never

x. Other: _____

Often

Sometimes

Never

xi. Other: _____

Often

Sometimes

Never

19. During the Write phase (the process using the information gathered to write the paper) do you...

Example: You feel like you have enough information to start writing! You're now going to start composing your paper, using the sources to review previous research and support your thesis statement.

Please indicate what you do during this phase.

Person	By				
Librarians Yes ☉ No ☉	Email <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never	LiveHelp <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never		In Person <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never	Other (indicate) <hr/> <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never
Professors or TAs Yes ☉ No ☉	Email <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never	BLS <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never	Social Networking (Facebook, MSN, Skype, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never	In person <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never	Other (please indicate) <hr/> <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never
Classmates Yes ☉ No ☉	Email <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never	BLS <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never	Social Networking (Facebook, MSN, Skype, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never	In person <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never	Other (indicate) <hr/> <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never
Online Forums Yes ☉ No ☉					
Experts Yes ☉	Email <input type="checkbox"/> Often		Social Networking	In Person <input type="checkbox"/> Often	Other (indicate)

No ☉	<input type="checkbox"/> Sometime <input type="checkbox"/> Never		(Facebook, MSN, Skype, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never	<input type="checkbox"/> Sometime <input type="checkbox"/> Never) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Friends Yes ☉ No ☉	Email <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never		Social Networking (Facebook, MSN, Skype, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never	In Person <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never	Other (indicate) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Family members Yes ☉ No ☉	Email <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never		Social Networking (Facebook, MSN, Skype, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never	In Person <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never	Other (indicate) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Other... Yes ☉ No ☉	Email <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never		Social Networking (Facebook, MSN, Skype, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never	In Person <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never	Other (indicate) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Other... Yes ☉ No ☉	Email <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never		Social Networking (Facebook, MSN, Skype, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never	In Person <input type="checkbox"/> Often <input type="checkbox"/> Sometime <input type="checkbox"/> Never	Other (indicate) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never

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a. Who do you discuss the problem with? What mechanism do you use to talk to the person?

b. What sources do you consult? How do you find each?

Source	Do you find them through...					
Books Yes ☉ No ☉	World Cat <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	NovaNet <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Public library <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Search Engines (Google, Bing, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Personal Files <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Journal articles Yes ☉ No ☉	World Cat <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	NovaNet <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Databases such as Proquest <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Google Scholar <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Course readings <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Web articles that are not e-books or journal articles Yes ☉ No ☉	Social Bookmarking sites such as Delicious <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	RSS Feeds <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Recommendations (from friends, professors, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Search Engines (Google, Bing, etc..) <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never		Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Newspapers Yes ☉ No ☉	Newspaper Websites <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Physical edition <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never				Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Original documents	Library Archives <input type="checkbox"/> Often	Public Archives <input type="checkbox"/> Often	Personal Collections	Online Digital Archives		Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never

(such as reports, diaries, or correspondences) Yes ☉ No ☉	<input type="checkbox"/> Sometimes <input type="checkbox"/> Never	<input type="checkbox"/> Sometimes <input type="checkbox"/> Never	<input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	<input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never		<input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Photos or video Yes ☉ No ☉	Google images <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Flickr <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Youtube <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never			Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Statistics Yes ☉ No ☉	Stats Canada Website <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never					Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Maps Yes ☉ No ☉	Google Maps <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Maps and Geospatial Information Collections at Dalhousie <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never				Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never
Government or corporate reports Yes ☉ No ☉	Government Websites <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	World Cat <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	NovaNet <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never	Databases such as Factiva or LexusNexus <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never		Other (indicate) _____ <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Never

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c. How often do you use the following types of software when you are choosing a topic?

i. Word processing programs such as MS Word

- Often
- Sometimes
- Never

ii. Spread sheet programs such as MS Excel

- Often
- Sometimes
- Never

iii. Bibliographic programs such as RefWorks

- Often
- Sometimes
- Never

iv. PDF readers such as Mac Preview:

- Often
- Sometimes
- Never

v. File sharing software such as FileZilla:

- Often
- Sometimes
- Never

vii. Web-based collaborative programs such as CiteULike:

- Often
- Sometimes
- Never

viii. Social bookmarking sites such as Delicious:

- Often
- Sometimes
- Never

ix. Other: _____

- Often
- Sometimes
- Never

x. Other: _____

- Often
- Sometimes
- Never

d. How often do you do the following activities when you are choosing a topic?

i. Read relevant information: Yes__ No__

Often

Sometimes

Never

ii. Take notes: Yes__ No__

Often

Sometimes

Never

iii. Write an outline: Yes__ No__

Often

Sometimes

Never

iv. Annotate (for example, highlight important sentences, and make notes within the work itself): Yes__ No__

Often

Sometimes

Never

v. Add sources to a bibliography or works cited list: Yes__ No__

Often

Sometimes

Never

vi. Begin writing the assignment: Yes__ No__

Often

Sometimes

Never

vii. Draw diagrams or models: Yes__ No__

Often

Sometimes

Never

viii. Draw tables or matrices: Yes__ No__

Often

Sometimes

Never

ix. Create annotated bibliographies: Yes__ No__

Often

Sometimes

Never

x. Other: _____

Often

Sometimes

Never

xi. Other: _____

Often

Sometimes

Never

20. Do you have any final comments about the paper-writing process? _____

Ethics Appendix D

Debriefing

Thank you very much for completing this survey!

If you would like to be entered in a draw a chance to win one prize of one \$50 or one of 10 prizes of \$20 gift certificates from the Dalhousie Bookstore, please provide your email address.

Note, email addresses are kept separately from the data, and will only be used to enter you into the draw.

We appreciate your time!

Sarah Gilbert, Principle Investigator, MLIS Candidate
Elaine Toms, Supervisor, Canada Research Chair in Management Informatics

If you have any further questions, please contact Sarah at:

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