AN EXPLORATORY STUDY OF THE INFORMATION NEEDS AND BEHAVIOR OF
GRADUATE STUDENTS OF MANAGEMENT SCIENCES AT THE CENTRE FOR
OPERATIONS EXCELLENCE, FACULTY OF COMMERCE,
UNIVERSITY OF BRITISH COLUMBIA

by

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to the required standard

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Abstract

The purpose of the study was to provide insights into the information seeking behaviors and needs of graduate students of Management Sciences at the Centre for Operations Excellence, University of British Columbia. The study describes major aspects of the information seeking patterns taking into account the whole phenomena: from the nature of the original situation where and when the need was recognized, to the characteristics of the information seeker, to the providers which were consulted and degrees of success. Using the case-study method and the sense-making approach, data were gathered through logs, interviews, and a questionnaire. Verbal protocols helped to delve and probe into the qualitative aspects of the search behavior resulting in a model for the search process. Findings revealed that the students went through six stages during their research: [1] Task defining, [2] Focus forming, [3] Monitoring and reviewing, [4] Selecting and sieving, [5] Interpreting, and [6] Presenting. Typically, information seeking occurred in context of task achievement which was affected by various factors such as time, cost, prior knowledge, feedback, motivation and experience and perception of students. A user survey demonstrated that [1] informal channels were used more avidly in information seeking than formal channels, [2] information service providers were not consulted on a regular basis, [3] UBC libraries were very rarely used, [4] factors such as time, location, motivation, cost, perception, feedback played an integral role in information seeking and task completion, [5] satisfaction with services of service provider were based on the relevance, currency, timeliness and accuracy of information provided, and [6] usage of information was weighed against the benefit to analysts. Recommendations for action and further study and a service model were the outcomes of the findings.
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The idea for this research germinated even before I decided to pursue a Master’s. The fact that individuals seek information in different ways has me fascinated. What bothers me though is that the endless search for information in an effective and efficient way is still a dream, especially for the user group researched for the purpose of this project. It is amazing to see how students wander through the maze of information and myriad resources to arrive at a decision and zero in onto certain sources. But is this the right way to look for information? Is it the most effective and efficient way of getting the job done? Is there an easier model that students could follow to minimize time spent on searching and in a cost-effective manner? Will the students follow the same pattern even as they graduate to work in organizations and on projects? Wouldn’t it be better to arrest this behavior at its nascent stage than to let organizations pay dearly?

The above mentioned are just a few questions the current study sets out to respond to.
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Of course, this study would not have been possible without the help and cooperation from various directions. I would first of all like to express my appreciation to my Advisor and Supervisor, Dr. Ken Haycock, who is also the Director, School of Library, Archival, and Information Studies, for his intellectual stimulation, support, suggestions and guidance through each stage of the thesis. I also wish to express appreciation to Dr. Martin Puterman, Dr. Mary Sue Stephenson and Prof. Lynne Lighthall as other members of the committee and Prof. Emerita A. Piternick for chairing the defence.

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And last but not the least, a thanks to all those other people who have supported me in the course of my interaction with them.
Stylistic Conventions Used

Presentation:

The American Psychological Association (APA) style and the University of British Columbia Instructions for the Preparation of Graduate Theses form the basis for the style of this thesis. The APA edition used was the fourth edition of the Publication Manual of the American Psychological Association. Where these styles were in conflict, the UBC Thesis style was used.

(1) Abbreviation: Abbreviations are used only for terms that are recurrent in the thesis. It is not known whether the terms are accepted but they appear on a regular basis in most of the original articles consulted for the literature review.

(2) Capitalization: In general, capitalization is according to APA style. However, for clarity, the names of stages in Information Seeking Process Models determined by authors during information seeking have been capitalized the way they appear in the paper or article. To maintain consistency, in the cases where the stages are not capitalized in the original source are also capitalized in the thesis.

(3) Spelling: As per APA style, the Webster's Third New International Dictionary has been used, even though it is American rather than Canadian spelling.

(4) Terminology: For the purpose of this project, the participants are referred to as "users". The users are the student project analysts, who are graduate students as well as users in other studies examined as a part of the literature review.
Wherever possible, the conventions of the APA have been followed thoroughly except for the following:

(1) Spacing: As per APA, double spacing has been followed throughout the thesis except for: (a) Tables, where single-line spacing is followed for clarity, and (b) References, where double spacing is followed between references but single line spacing is followed within each reference.

(2) Format for Tables: The title format is according to APA but the structure of the tables does not follow APA as it was conflicting with the data input. For the purpose of clarity, Microsoft Word has been used to create tables.
Introduction

Information management in universities is evolving from an undisciplined and an uncoordinated activity to one where it is recognized as having strategic importance. Information resources are increasingly being seen as central to the development of an open learning approach to higher education that will be a major factor in competitiveness within the sector, particularly with the decrease in student funding and associated increase in part time studying. Learning and information resources such as libraries, computing facilities, networks, and media centers play their role in making the field of information management more dynamic than ever.

Internal organizational competition for existing funds makes it mandatory for non-profit organizations, especially academic libraries, to demonstrate the effectiveness of their work. Existing services are further taxed by dramatic technological developments and mushrooming user expectations. Thus, an increasing burden has been placed upon academic librarians and information specialists to put in place evaluative tools to both demonstrate the viability of their present operations and identify possible areas for new or improved service program implementations (Katzer, 1987). Researchers have studied the impact of these factors on the end-user. It was only natural to start with scientists as the user-group as they most wielded influence in the society. Studies in the early sixties and seventies have demonstrated that physicians and scientists communicated through “invisible colleges” and their own interpersonal networks. The idea that scientists operated in remoteness was negated, proving that the group was actually communal. This fact was later substantiated in studies in the healthcare segment. Both formal and informal channels were deemed important for communication and information seeking, although the latter took precedence.
These findings have since been applied to information seeking behaviors in other disciplines and professions as well. By the 1980s and 1990s, library and information services (LIS) researchers had moved into this area more fervently. Inquiries in other professions had expanded beyond scientists and scholars to include lawyers, doctors, nurses, engineers, and accountants. Leckie, Pettigrew & Sylvain (1996, p. 162) attributed this growing interest in the information needs of professionals to several reasons: (a) the natural outgrowth of previous studies, (b) the commercial needs of database vendors to develop services tailored to particular professional demands, and (c) the desire of library and information services scholars to generalize the theoretical analysis of information seeking processes across diverse environments. These studies shared a common theme. The central focus had been the information system and the examination of the user in the context of that system. As Dervin (1999) said, “traditional information seeking and use studies bracket information to that which consensually describes order. As a result we know little about information seeking and use in terrains that require new connections, insightful extrapolations, and hundreds of different strategizing humans do to bridge gaps between formal information (which is always tied to a past) and the necessities of moving into the future in their material worlds” (p. 741). Reviewers advocated for a reverse process, that is, a study of how information systems fit in the life of the user (Dervin & Nilan, 1986; Katzer, 1987).

Whilst information systems and the intermediaries who managed them traditionally had promoted a view of information use from the system’s perspective, a larger and more dramatic area remained untouched. According to Kuhlthau (1991) the former was propelled by the bibliographic paradigm that focused on collecting and classifying texts and devising search strategies for their retrieval, which is an approach characterized by certainty and
order. On the other hand, users’ problems were epitomized by uncertainty and confusion. “A gap between the system’s traditional patterns of information provision and the user’s natural process of information use” (Kuhlthau, 1991, p. 361) was discerned. Several researchers (Belkin, Oddy & Brooks, 1982; Dervin, 1983; Dervin & Nilan, 1986; Ellis, Cox & Hall, 1993; Kuhlthau, 1991, 1993; Vakkari, 1999; Wilson, 1999) have since attempted to bridge this gap by studying information seeking processes, and the behavior during the stages of seeking. The process models provide a foundation for understanding users’ motivation, the pattern of searching and seeking, and the factors affecting this activity.

Even as traditional models focus on information retrieval in the scholarly arena and user behavior specific to humanities and social sciences, very few identify the norms of behavior among business students, especially student project analysts in an academic environment. Student project analysts are Master’s students of Management Sciences, referred in this study as “project analysts” as they are designated that title during their study period at the Centre for Operations Excellence at the University of British Columbia. Their work essentially focuses on consulting work for clients (who are also sponsors and partners in the program) to develop solutions for problems of management of operations and logistics. Typically, students work on projects over a period of time that eventually culminates into a Master’s thesis towards the end of their study program. (The nature of the organization and the nature of the project are discussed further in this chapter).

This group is different from other graduate students since they are treated as professionals within the post-secondary institution. The nature of management sciences being such, the information seeking behavior may vary from other academic researchers. This group primarily produces services hence; their work is more task-oriented. They are
continually required to set objectives and achieve goals to provide consulting services to the 
client in the most efficient and cost-effective manner as possible.

The challenges faced in this context are: (a) to study the information needs and 
seeking behavior of student project analysts, and (b) the integration of an evaluative tool into 
the planning process. Such an activity would be a natural outgrowth of previous research 
done for other professional groups (i.e., scientists, scholars, lawyers, health professionals, 
and engineers). Resulting data would advance theories of human-computer interaction, 
communications (Katzer, 1987), and psychology (Harter, 1992). At a local level the user- 
based evaluation techniques are vital to assessing the usefulness of collections and services, 
user acceptance and service awareness, as well as planning for future services (McClure, 
1994).

 Organizations must choose among various methods to: (a) assess their effectiveness, 
(b) demonstrate their value to the user community or target audience, (c) provide useful and 
usable information, (d) provide facilities (physical, aesthetic and other), and (e) meet the 
demands of the funders and the users. Clearly, information providers must take such factors 
as timeliness, service awareness and accessibility into account when planning and 
implementing program services. These are only some ingredients that go into evaluating 
effective and efficient information services.

Moreover, it is critical that the fundamental question underlying the decision to 
support various activities – namely, *are such efforts appropriately and effectively responsive 
to the needs of their intended audience* – be examined. With a shadowy picture of the 
information needs of the people, we can arrive at only a shadowy determination of the 
success of efforts to meet these needs (Chen & Hernon, 1982).
The Problem

As noted above, while support for the need of user studies was readily accessible in the literature, there was still a conspicuous lack of empirical data available that related directly to the information behavior and needs of student project analysts. The need to develop a model of the search process, information programs and services that supported a broad spectrum of information needs and behaviors (Mick et al., 1980) appeared justifiable. Moreover, the shift from bibliographic studies to user-centered studies and scope necessitates that the users’ search behavior is studied in its entirety. There is a distinct need for business librarians to design information products and services that conform to the attitudes and perceptions of intended information users (Cundari & Stutz, 1995; Ercegovac, 1997; Matarazzo & Prusak, 1990; Mick et al., 1980). In the academic environment, studies have focused on undergraduates. Studies on post-secondary students has been in the non-traditional and clinical programs but the information seeking behavior of graduate students, especially student project analysts in the business environment, has been sparsely explored. Furthermore, the trend in current situations for post-secondary studies is leading to more and more project oriented assignments. This further compounds the need to explore the information seeking activity in the cognitive, the affective, and the social context.

There is a need for more systematic exploration of the users’ interaction with the environment in order to understand better the cognitive processes involved. Accurately describing the nature of this interaction is problematic just as the human mind is complex. Experiences and knowledge that affect behavior are hard to pin down. As the nature of the
interaction is a communicative process, several research approaches (including constructive\textsuperscript{1}, naturalistic\textsuperscript{2}, phenomenological, etc.) have been suggested as alternatives to the traditional paradigm in order to provide richer, context-specific information which is necessary to understand the users' psyche. This study expands exciting research in three areas – it contributes to the body of knowledge with regard to the information seeking behavior of student project analysts, it proposes an information seeking process model, and an information seeking service model.

**Statement of Purpose**

The purpose of this study was to provide an insight into and an analysis of the information seeking behavior of student project analysts at COE and thereby, an understanding of the activity of information seeking. The study has described major aspects of the information seeking patterns taking into account the whole incident: from the nature of the original situation where and when the need was recognized, to the characteristics of the information seeker, to the providers that were consulted and degrees of success. The approach sought to understand the users by studying three realms of activity – physical (actual actions taken), affective (feelings experienced), and cognitive (thoughts concerning both processes and content) – after Kuhlthau (1991).

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\textsuperscript{1} Constructivist approach: A research method based on constructionism, "the view that we actively construct reality on the basis of our understandings, which are largely, though not completely, culturally shared" (Palys, 1997, p. 412)

\textsuperscript{2} Naturalistic inquiry: "Studying real-world situations as they unfold naturally; non-manipulative, unobtrusive, and non-controlling; openness to whatever emerges – lack of predetermined constraints on outcomes" (Patton, 1990, p. 40)
Research Questions

The purpose of the study was to ascertain information needs of student project analysts by delving into the interplay of information seeking activities. The following questions guided the study:

- Why do student analysts seek information?
- How do student analysts identify an information need?
- How do student analysts establish where to seek and find information?
- How do student analysts search for information?
- How do student analysts determine whether the information gathered is satisfactory?
- What, if any, perceived problems or barriers do student analysts face when attempting to access business information?
- What is the level of user satisfaction for present services? Are there identifiable trends/patterns regarding service areas that require further development?

Development of the Research Project

The current research grew and developed from an initial conception to study the impact of information service providers on management consultants, the information seeking patterns and the information needs of management consultants in satellite branches. Since I had worked in the corporate sector for several years, the seed of an idea was sown a long time ago. Management consultants operate in a constantly changing environment where the focus is on providing cost-effective services to their clients. To perform tasks for their projects requires constant input in terms of information. Parallel changes in information needs are thus reflected. In preparation for this research, I set out to gather information on
various studies done in the area. Preliminary preparations included seeking information about management consultants and their information usage through books, journals articles, reports and studies, inter-library loans for material not available in the university libraries, and so forth. Simultaneously, I began negotiations with several Vancouver firms to garner volunteers for the study.

In the process of a search for volunteers, the researcher faced barriers in terms of convincing the firms to perceive a connection between information management and libraries studies or services. In other instances, the process required a lot more time. Even after three months, the researcher was not able to finalize agreements with volunteers from the firms. In order to graduate, I would need to finish my research by the end of April. I had contacted the Centre for Operations Excellence earlier when I approached the Director to be my external supervisor for the thesis. The transition from professionals to graduate students of management sciences was only natural and logical. The shift in focus from professionals also meant a shift in the focus for the literature review.

The perceived benefits of changing the user group to be researched:

- Results of research could contribute value added for their library and their education program,
- Research results could be a part of advocacy for LIS in the corporate sector due to implications of improving information literacy and relevancy of library services to business students,
- teach skills that many management students may not get in the work world, and
- Results could also show them benefit of libraries so that they would want to continue and expect their working environments to house corporate libraries.
Since then, the study has culminated into the current research. The nature of the organization, i.e., the Centre for Operations Excellence and the nature of the project that was tracked for the purpose of the study are further described.

The Organizational Setting: Centre for Operations Excellence at UBC

In an environment of rapid technological change, corporate managers in the areas of telecommunications, healthcare, consulting, resource based industries and financial institutions had to find even grounds to use data effectively to realize gains and reap benefits of massive investments in technology. Concerns regarding education, collaboration and applied research in techniques for effective use of the data for decision-making were paramount. It acted as an impetus to the establishment of a centre committed to addressing these issues. The Centre for Operations Excellence (COE), at University of British Columbia’s Faculty of Commerce, was the result. Established in January 1998 with three inter-linked components: a Master’s (M. Sc.) program, a corporate Partners for Operations Excellence (POE) Program, and an applied research arm (BRAMSS). The Centre’s key goals are training students and developing practical techniques for decision support. Since then, the Masters degree has provided students with a practically oriented program centered on course work, training in consulting skills and applied projects. Students work in teams of faculty, business leaders and COE staff developing and applying innovative approaches to formulating and solving problems facing POE (Partners for Operations Excellence) members. In accordance with overall strategies and goals, the research and development portfolio at COE is organized and accomplished within a project-oriented structure.
Interaction and communication are factors considered to be crucial for success for both the students and the POE members.

In all likelihood, a fixed approach would be followed over the life of the project in such an environment. This structure may also characterize the different stages and decision-points during the project. In addition, the information needs and seeking behavior will depend to some extent on the type of project and the situation. Lippitt & Lippitt (1986) and Ellis & Haugan (1997) have put forth some generic stages of consulting and research that were applicable for the purpose of the study.

1. Engaging in initial contact and entry
2. Formulating a contract and establishing a helping relationship
3. Identification of problems
4. Setting goals and planning for action
5. Evaluation of Alternative solution
6. Development and Testing
7. Implementation
8. Taking action and cycling feedback
9. Completing the project (continuity, support and termination)

The Student Project

The client, one of the POE (Partners for Operations Excellence), identified an area of its work where it was not meeting targets that it had set for itself. The users’ (the student project analysts’) project was to research ways for the client to meet these targets. (The client requested that the users' research remain confidential, so this study will not identify the client
nor provide details of the users' research. Accordingly, the following description is presented in very general terms).

The client was a large organization in the public sector. While the client's mandate involved a broad range of activities, the area of work delimited as the users' research project was a service that the client provided to the public. At the time the users began their research, identification of aspects of the problem included an increasing volume of work, limited resources, and lags between departments which worked on the same projects. Initial areas for research included the workflow, organizational structure, and organizational costs, which included both program costs (cost to the client organization arising from the decisions of actions relating to the work itself) and operational costs (costs to the client for the salaries of its own staff and administrative needs). The objectives were thus to develop a system for effective allocation of resources and design a system for effective workflow.

The project had a specific goal which was measurable, i.e., meeting targets, but the targets reflected work produced by a complex process spread through more than one department. Deciding which part of the client's work processes would be best served by change was an important first step for the users' research.
Organizational Limitations

(1) Confidentiality

- A range of data about the student (i.e., users) work which could not be incorporated into this study due to matters of confidentiality. Details of the user’s research project could not be included in this study.
- The researcher was not granted permission to be directly involved in the users’ courses or research project, due to the nature of the projects being confidential.
- The researcher relied heavily on the users’ perceptions of the available information resources.
- Due to the limitations of confidentiality and restricted access to classes and client information sources, this research could not study the users’ actions directly, but rather their perceptions of their actions.

(2) Time-Line Considerations

- Data collection: The client and COE set the time frame for the users’ project, thus the timelines for this research had to be framed around the clients' project. In order to create a model of information seeking behavior, the research would need to have data spanning the completion or near completion of a project.
- Data Analysis: The final data was collected only a week before the researchers' thesis was due. During that time, the transcription, tabulation and analysis of the newly collected data was done, as well as comparing it to the earlier data, results of other studies, and models from the literature. Writing the final chapters was also done during the same time.

Delimitations

Within the given situation and background, the major delimitations were related to (a) time, (b) the number of students participating in the study, and (c) having to accomplish the objectives in one term. Without a recognized evaluative research tool already in place and
considering the limited resources of the researcher in terms of time, there has been a conscious effort to restrict the subject focus. By identifying the target group of student project analysts at the Centre for Operations Excellence at the University of British Columbia, problems related to generalization between professional user groups (Mick, Lindsey & Callahan, 1980; Leckie et al., 1996) has been avoided and, at the same time, a discrete and manageable user group has been defined. In opposition, as data was gathered from a “convenience sample” from the same organization, it was not plausible to generalize this data to other such centers. As a consequence, the results should be treated as tentative, at best, until the study is replicated in other organizations or even in the same organization with a different group. More studies may demonstrate that these results generalize to management consultants in a professional capacity.

Organization of the Balance of the Study

This paper is divided into five other chapters as follows:

Literature Review

The literature review discusses the background through: the influence of theories and concepts in the study of the information seeking activity; the relationship between information needs, information seeking and information retrieval; the resulting process models; and the role of information professionals in this environment. It should be noted that the literature review focuses on the post-secondary and professional areas. Studies on the K-12 category have been left out as it is beyond the scope of this research.
Methods and Procedures

This chapter is a description of the methodology and the research design employed to glean insights into the information seeking activities of student project analysts at the COE. The sense making approach, the case study method and a combination of qualitative and quantitative data gathering instruments such as logs, interviews and questionnaires were applied to produce results.

Findings

This chapter provides the findings and results of the data. Research data and questionnaire results are reported according to research questions. A summary of the findings is included at the end of the chapter. Wherever possible, descriptive statistics are presented in tables.

Discussion of Findings, Conclusions and Recommendations

This chapter discusses major findings with suggestions and recommendations for further research and actions to be taken.

Summary

This chapter is a compilation of summaries of all the previous chapters.
Review of the Related Literature

The purpose of the project was to provide an insight into the information seeking activity of student project analysts. Accordingly, the literature review discusses the background, the influence of theories and concepts in the examination of the activity; the relationship between information needs, information seeking and information retrieval; the resulting process models; and the role of information professionals in this environment. It should be noted that the research focus is on the post-secondary and professional areas although most information seeking models and studies are based on the K-12 sector.

Background

People find themselves in situations where they must make a decision, answer a question, locate information and perform tasks to attain goals. This results in the need for information. Various sources and media in the form of information providers, information retrieval systems and other channels of information are sought and used. But at the heart of this activity lies the situation that created this need, the gap in information (Dervin & Nilan, 1986), the perception and awareness of the gap, and the resultant search process.

Chen and Hernon (1982) suggested “to ascertain the nature of information-seeking patterns one must ideally investigate: first, the general make-up of consulted information providers; second, the world in which the individual information seeker lives; third, the relationship between the information need and the information provider consulted; and finally, the relation between type of information providers consulted and the success with which the individual’s information need is reduced or resolved” (p. 16).
Researchers also supported the examination of “context” in information seeking. Talja, Keso, & Pietilainen (1999) referred to context as any factors or variables that were seen to affect individuals’ information seeking behavior: socio-economic conditions; work roles; tasks; problem situations; communities and organizations with their structures and cultures.

Researchers maybe divided into distinct camps. One group observed the information seeking (IS) process in an information retrieval environment where the computer system took center stage. Another group examined the individual as a complete package encompassing the cognitive, affective and physical elements, thereby making the user the leading actor. Irrespective of the focus, without an awareness of the conceptual framework, the understanding of the phenomenon remains incomplete. A review of the influence of theories and concepts, the relationship between information needs and user studies, information seeking and information retrieval, and the resulting process models assist to delve into the process of information seeking.

Theories and Concepts

The process of information seeking is intellectual. Factors such as learning, prior experience and knowledge, and feelings set against social structure, combine to play a pivotal role in accessing, locating, and comprehending information for completion of tasks. Information needs are evidenced as evolving from a vague awareness of a void in knowledge when trying to link a “task” to a “solution”.

Kuhlthau (1993) had noticed “serious problems arise when the user’s experience in the process of learning from information does not match the way the system is designed to provide
Users' needs and perspectives should be studied in their totality to design effective and efficient information services and information systems. Library and information studies were in a theory building stage (Kuhlthau, 1993). Consequently, borrowed theory from disciplines such as communications, social sciences (sociology), and psychology (cognitive sciences) formed the backbone for the study of information seeking. According to Kuhlthau (1991, 1993), the constructivist view of learning offered insights into what the users experienced. Researchers carried out pioneering work on this aspect. Dewey (1944), Kelly (1963), and Bruner (1973), cited in Kuhlthau (1993) examined the process of learning angling it from philosophical, historical, psychological and contemporary perspectives. Taylor further built on the concepts to arrive at levels of information needs (1963, cited in Kuhlthau, 1991).

Dewey's contribution lay in his description of "reflective thinking" which interweaved three aspects: thoughts, actions, and feelings. Reflective thinking occurs in five stages: (1) suggestion, (2) intellectualization, (3) guiding idea, (4) reasoning, and (5) testing by action. Extensive thinking and reflection were an integral part of the information seeking process. He explained that facts, data and information aroused ideas that enabled the learner to make inferences.

Kelly's theory purported that constructs were built out of a person's experience that was nothing but an anticipation of future events. Constructs provided guidelines to determine choices within the framework. He described the process of forming new constructs as progressing through a series of psychological stages. Feelings played a central role in the context. He associated stages with feelings in the passage of building and evolving personal constructs. Like Dewey, he suggested five stages: (1) confusion and doubt, (2) mounting
confusion and possible threat, (3) tentative hypothesis, (4) testing and assessing, and (5) reconstructing.

Kelly’s theory was especially crucial in understanding information seeking due to three important contributions: (a) He introduced the concept of feelings which in combination with thoughts and actions depicted a *complete* experience of learning, providing a representation of the person’s experience in any constructive process. (b) He identified a hypothesis stage as a center-point that eventually determined the outcome. According to him, hypothesis established a frame of reference for the prediction of what was to follow. Two types of hypothesis statements existed – one stated in an invitational mood and the other, in an indicative mood. See Table 1 for choices and actions associated with the mood. A hypothesis stated in an invitational mood allowed one to behave as if the facts were known. It assumed the posture of expectancy and enabled one to take risks and to profit from mistakes. Indicative mood, on the other hand, limited predictions, assuming closure of the task. In information seeking, these moods were akin to styles and traits or strategies that arose from the process. (c) Kelly emphasized that the accuracy of the predictions (hypothesis) determined the effectiveness of the actions. Transferred to the information seeking domain, the strategy for search would depend on the interplay of the three variables that would determine the choice (of sources) and thereby, the outcome.

Table 1

<table>
<thead>
<tr>
<th>Mood (Affective)</th>
<th>Choices (Cognitive)</th>
<th>Actions (Physical)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicative</td>
<td>Predicting closure</td>
<td>Confined to prescriptive task</td>
</tr>
<tr>
<td>Invitational</td>
<td>Predicting expansion</td>
<td>Posture of expectancy for formulative task</td>
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</tbody>
</table>
Bruner’s research corroborated and elaborated on Dewey and Kelly’s concepts of constructive sequences. Bruner introduced the concept of an “interpretative task” which was central to the constructive process and was based on constructs built from past experience. This resulted in the creation of something new. Five stages related to the interpretative task were defined as perception, selection, inference, prediction, and action.

See Table 2 for a comparison of the constructive process of Dewey, Kelly, Bruner and Kuhlthau.
The constructivists viewed learning as a dynamic process. New meaning was formed from past experience. Stages of the process were accompanied by fluctuating feelings. In a state of confusion or when something was not known, it led to a feeling of anxiety and uncertainty, but as the learner progressed from one stage to another, s/he gained clarity and uncertainty resulted in certainty. Conversely, a profusion of the known caused both disinterest and boredom.

<table>
<thead>
<tr>
<th>Stages</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Suggestion</td>
<td>Doubt due to incomplete situation</td>
</tr>
<tr>
<td>Intellectualization</td>
<td>Conceptualizing the problem</td>
</tr>
<tr>
<td>Guiding idea (hypothesis)</td>
<td>Tentative interpretation</td>
</tr>
<tr>
<td>Reasoning</td>
<td>Interpretation with more precise facts</td>
</tr>
<tr>
<td>Action</td>
<td>Idea tested by overt or imaginative action</td>
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<tr>
<td><strong>Kelly – Five Stages of Construction</strong></td>
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<tr>
<td>Stages</td>
<td>Definition</td>
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<tr>
<td>Confusion and doubt</td>
<td>New experience</td>
</tr>
<tr>
<td>Mounting confusion and possible threat</td>
<td>Inconsistent/incompatible information</td>
</tr>
<tr>
<td>Tentative hypothesis</td>
<td>A direction to pursue</td>
</tr>
<tr>
<td>Testing and assessing</td>
<td>Assessing outcome of undertaking</td>
</tr>
<tr>
<td>Reconstructing</td>
<td>Assimilating new construct</td>
</tr>
<tr>
<td><strong>Bruner – The Interpretative Task</strong></td>
<td></td>
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<tr>
<td>Stages</td>
<td>Definition</td>
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<tr>
<td>Perception</td>
<td>Encouraging new information</td>
</tr>
<tr>
<td>Selection</td>
<td>Recognizing patterns</td>
</tr>
<tr>
<td>Inference</td>
<td>Joining clusters and categories</td>
</tr>
<tr>
<td>Prediction</td>
<td>Going beyond the information given</td>
</tr>
<tr>
<td>Action</td>
<td>Creating products of the mind</td>
</tr>
<tr>
<td><strong>Kuhlthau – Uncertainty Principle</strong></td>
<td></td>
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<tr>
<td>Stages</td>
<td>Definition</td>
</tr>
<tr>
<td>Process</td>
<td>Constructing meaning and uncertainty</td>
</tr>
<tr>
<td>Formulation</td>
<td>Forming a focused perspective</td>
</tr>
<tr>
<td>Redundancy</td>
<td>Encountering the expected and the unexpected</td>
</tr>
<tr>
<td>Mood</td>
<td>Assuming a posture or attitude</td>
</tr>
<tr>
<td>Prediction</td>
<td>Making choices based on expectations</td>
</tr>
<tr>
<td>Interest</td>
<td>Increasing intellectual engagement</td>
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</table>
Placing the cognitive process in the forefront of considerations of information provision, Taylor (1968, cited in Kuhlthau, 1993) formulated four levels of information need as evident in users' queries as: (1) visceral, an actual but unexpressed need for information; (2) conscious, a within-brain description of the need; (3) formalized, a formal statement of need; and (4) compromised, the question as presented to the information system. Needs were expressed contingent to existing knowledge.

Taking a cognitive stance, DeMey (1977, cited in Kuhlthau, 1993) suggested that prior experience and education determined the information processor's model, commonly referred to as the "cognitive maps" or "knowledge structures". Belkin, Brooks & Oddy (1982) referred to this as an anomalous state of knowledge (ASK) where a gap between a user's knowledge about the topic and what the user needed to know to unravel the problem translated into an information need. On a similar vein, Dervin, Jacobsen, & Nilan (1983) in a breakthrough study found that when information seeking was viewed as a process of sense making, which presented an alternative to studying a single incident. They posited sense making as seeking meaning from observations to construct pictures of reality and used these to guide behavior. In Dervin et al.'s words, "sense making observes rather than assumes connections between situations and information needs, between information exposed to and uses" (p. 7). The process of construction within information seeking further involved molding information such that there was a fusion of prior knowledge with new knowledge that resulted in a new perspective. Krikelas (1983, cited in Kuhlthau, 1993) has described stages during the process as occurring in three stages: (1) information seeking, (2) information gathering, and (3) information giving.
Kuhlthau has used a constructionist approach to empirically test the process and apply it to information seeking and arrive at a grounded theory. A series of five qualitative studies of library users (high school students) in the process of seeking information for completion of extensive projects contributed to the development of a model of the search process within the constructivist framework. Based on her observations the concept of “the uncertainty principle” emerged (See Table 2).

Several other researchers have introduced this concept as well. Uncertainty referred to what the user was aware of not knowing and thus needed to find out, and what Dervin (1983) referred to as an “information need” or “cognitive gap”. Belkin, Oddy & Brooks (1982) referred to the concept as an “anomalous state of knowledge” and in Taylor’s (1968, cited in Kuhlthau, 1993) research the concept translated into a “visceral need”. Bates (1986) recommended that uncertainty should be combined with the variables variety and complexity to arrive at sound designing principles for an information retrieval system. Kuhlthau (1993) has discussed the application of the principle by other researchers in the process of decision-making and as an inherent concept of a cognitive approach. Research into the users’ experience in the process of using information for seeking meaning, gaining a deeper understanding and learning, reveals patterns of uncertainty.

Many researchers have proposed alternate approaches to study information seeking. Belonging to this camp are Limberg, (1998), Talja, Keso, & Pietilainen (1999) and Yoon & Nilan (1999). Limberg proposed phenomenography both as a concept and a methodology to study the effect of information seeking on learning outcomes. Accordingly, phenomenography considers both content and structure that was neglected by other

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3 Phenomenography: "The object of phenomenography is to explore people's different ways of experiencing or understanding or thinking about phenomena in the world" (Limberg, 1998, p.7)
researchers. Talja et al., on the other hand, advocated a study of the process as mediated by social and cultural meanings and values, thereby departing from the traditional behavioral study. This approach has emphasized that information needs, seeking and use were situational and behavior occurred within this framework. The concept of uncertainty, however, cannot stand alone without the concept of certainty. These certainty aspects also affect information seeking (Yoon & Nilan, 1999) in that the user anticipated as s/he was moving towards a path or a goal.

According to early theorists, the process of construction incorporated a cycle of acting and reflecting, feeling and formulating, predicting and choosing, and interpreting and creating. Each stage was dependent on the other. Only the interplay of thoughts, feeling and action would enable a view of the overall picture and eventually predict outcomes.

An appraisal of the theories indicated that there were groups divided on their views on information seeking. They perceived the process through a different lens, but common strands could be seen – IS was based on the seeker's prior knowledge, IS was a learning process, IS was a cognitive process, IS was affected by feelings and IS was trying to make sense out of chaos. IS was also influenced by social and economic factors. To borrow an ancient adage, theories are like "old wine in new bottles", while some have reworded the basic concepts, others have extended these to add new dimensions. The relationship of these theories provided a frame of reference for this study which was informed by theories put forth by Kuhlthau and Dervin who have emphasized information seeking as a process of seeking meaning and making sense in a learning environment.
Information Needs = IS + IR

Information seeking and information retrieval. Many studies have focused on different aspects of the information seeking (IS) process. Some studies centered on information needs of the user groups (Atkinson III & Figueroa, 1997; Atkinson III, 1997; Littlejohn & Benson-Talley, 1990), and some, on information seeking where the user took center stage (Cheuk, 1998, 1999; Jacobson, 1991; Swain, 1996). Some studies focused on professional user groups (Leckie et al., 1996). Other studies have focused on information retrieval (IR) that ranged from the selection of a database to the user's stopping behavior (Anderson, 1998; Fabritius, 1998; Kantor, 1988; Meyer & Ruiz, 1990; Nahl & Tenopir, 1996; Spink, Goodrum & Robins, 1998; Tang & Solomon, 1998; Vakkari, 1999; Yang, 1997). Still others have made major strides in theory building and methodology to approach the information seeking activity (Dervin, 1983, 1999; Dervin & Nilan, 1986; Kuhlthau, 1993, 1996; Talja, Keso, & Pietilainen, 1999; Wildemuth, 1993). While studies on the information seeking process resulted in information search models, studies on IR focused on the retrieval of digital information in various formats such as CD-ROMs, online databases, and Internet resources. This research had direct impact on the proposed area of study since in the digital era, student analysts were likely to rely upon the retrieval of information electronically. At the same time, their search behavior would be directed and guided by the “gaps” (Dervin, 1983; Dervin & Nilan, 1986) existing in their knowledge base or their “anomalous state of knowledge” (Belkin, 1980). The studies were also very valuable for assessing information needs.

The study populations varied widely – from high school students (Kuhlthau, 1993) to undergraduate university students (Atkinson III, 1997; Jacobson, 1991; Yang, 1997) to
professionals (Dervin, 1983; Kuhlthau, 1993; Cheuk, 1998, 1999). A study on the end-user selection of databases in the Business and Law categories of Easy Net’s\textsuperscript{4} multifile Scan option counted the number of scans of the databases selected in the hundreds of thousands (the actual number of scans was confidential but consisted of six digits); however, it was not known how many people collectively performed this number of scans (Meyer & Ruiz, 1990). Jacobson (1991) studied novice users’ search sessions of a full-text multi-file information retrieval system to analyze information seeking behavior in the software environment. Another study focused intensely on the relevance judgment process of a single graduate student during her search for documents relevant to the topic of a specific term paper (Tang & Solomon, 1998). In a similar vein, Garrod (1998) studied novice searchers’ conceptualizations and use of topic knowledge as they used a full-text retrieval system to get information for a series of papers on a single topic. The difference in the studies was that some aimed to gain insight from patterns expressed in the behavior of a number of users but the central focus was the system itself and its usage while the other aimed for a holistic understanding of an individual’s behavior in the context of information retrieval. Other studies focused on different types of populations such as thirty journalists at a single newspaper in Finland (Fabritius, 1998), seven novice online searchers in an academic environment (Nahl & Tenopir, 1996), eight engineers and eight auditors in the business environment (Cheuk, 1999) and even four search intermediaries (Spink, Goodrum & Robins, 1998). The size and type of population studied are important to keep in mind when critically analyzing the research and in determining whether it is generalizable. The study on search intermediary elicitations conducted by Spink et al. took into account the potential for

\textsuperscript{4} EasyNet is a commercial database.
understanding the user and the information retrieval process by examining their interaction with a search intermediary.

**Information needs and user studies.** Services must be evaluated within the context of the users' environment and studies should include the means by which information is transmitted (Griffiths & King, 1993). This study intended to examine the information-seeking behavior of the student project analysts to determine the extent of communication carried out by the students; the amount of time they spent on acquiring, using and producing information; the strategies and patterns employed in their decision-making concerning the sequencing of information; processing, negotiating and weighing information; and overarching these, the cognitive processes underlying the activity, enabling the researcher to acquire a holistic viewpoint of the seeking process.

How people find and use information in the course of their daily work has been a topic of extensive research within the last decade (Leckie, Pettigrew & Sylvain, 1996; Vakkari, 1999). Savolainen (1999) explored the place of the Internet among other sources and channels in information seeking in Finnish households. He reported that the technology was waiting to take-off although users had still to realize the potential of this technology and its impact on daily life. Ross (1999) explored the phenomena of serendipity and that of encountering information in novels that impact readers and their daily lives. The study held implication in the current context since it discussed information use that involved seeking meaning and making sense. Users did not set out to seek information in a formal way but nevertheless, the information gathered impacted their behavior and thinking in the social structure. Moreover, the emerging themes have implications on the search process: the active
engagement of the reader/searcher in constructing meaning from texts; the role of the affective dimension; ‘trustworthiness’ often assessed in terms of personal knowledge and that of their friends; the social context of information seeking; and the meta-knowledge used by experienced readers in making judgments about texts.

Both formal and informal channels for information exchange have been considered. In a study of senior citizens being treated in clinics, Pettigrew (1999) found important information needs were revealed in informal conversations rather than through direct questioning. On an average, professionals spent about fifty-six per cent of their time communicating (Griffiths and King, 1993). This raised several questions. When and for what purpose do analysts seek information? How does the need translate into a search? Are user information needs met? What barriers do they perceive in their search for and use of necessary information (Leckie, Pettigrew & Sylvain, 1996)? To answer these questions requires a clear understanding of how the work of various user groups differs from each other.

There have been a plethora of studies on the healthcare sector (Bawden & Robinson, 1997; King, 1987; Marshall, 1992; Wood & Wright, 1998), engineers (Leckie, Pettigrew & Sylvain, 1996), the corporate sector (Correia & Wilson, 1998; Marshall, 1993; Matarazzo & Prusak, 1990, 1995; Owens, Wilson & Abell, 1995), and studies on undergraduate students, but very few studies focus on business (Atkinson III, 1997; Atkinson III & Figueroa, 1997; Littlejohn & Benson-Talley, 1990). The target group is under-represented in these studies as well.

1. User studies - Business students: User behavior has changed considerably in the light of rapid technological changes, digitized formats and electronic access. Few studies
identify the norms of behavior among business students in an academic environment. In a study of undergraduate and graduate business students, Atkinson III & Figueroa (1997) report findings that have an impact on the current study: (a) users primarily used the library for class assignments, (b) students applied minimum efforts on search tasks, and (c) users had increased expectations of acquiring information from electronic formats.

Increased dependence on electronic format determines the search behavior as well as the outcomes. Littlejohn & Benson-Talley’s (1990) survey confirmed two things: (a) students’ use of the library was high and the great majority were lacking in the knowledge and skills necessary to make effective use of the library, and (b) not only did the students not know a great deal about the business resources, they still didn’t know that they didn’t know (lack of awareness of their lack of own knowledge). A reason for this continues to be a lack of formal instruction in the use of business resources and lack of faculty participation and support in helping students achieve a higher degree of information skills. The study also revealed that the information seeking behavior of business students is often directed toward rapid retrieval of current, specific facts. Those who do complete the basic library skills course often have difficulty transferring the little they remember after several years from generalized search strategy to specialized industry and company research.

As the speed of data gathering changes dramatically, not only must there be an understanding of the implications relating to the cost and timeliness and the use of electronic sources, but faculty must also shift the focus of assignments from locating information to manipulation and analysis of data. Both the studies focus on how business students use the library. They reveal that very few studies have been conducted in this area, i.e., the information seeking behavior of business students. Whatever studies do exist, are concerned
with needs and skills, hence the focus is eventually the library and the system, but none focus on the users' behavior and the cognitive aspect that affects the search behavior.

2. User studies – Corporate sector: The way information is managed and used is very much a product of the culture and management style of the organization (Owens, Wilson & Abell, 1995). As a result, in some cases, it affects decision-making (Marshall, 1993), while in others it hinders this process due to the very lack of perceived value (Matarazzo & Prusak, 1990, 1995). Management style also determines the flow of information within the organization.

A study on environmental scanning exemplifies this aspect (Correia & Wilson, 1998). Using the case study method and direct observation, data were obtained on the behavior of managers in the Portuguese chemical industry. Findings showed that the manager's perception of environmental change affected the strategic change they implemented. An examination of the information flow from top down in the organizational context and the type of information considered important determined the type of information sought by the individuals. A notable difference was detected between managers of larger companies and managers of smaller companies. In larger groups, managers tended to place emphasis on the dissemination of information because of the complexity of their organizations.

Matarazzo, Prusak and Marshall studied the impact and value of libraries for user groups in the professional arena. Matarazzo and Prusak's user survey of 164 companies (1990) aimed to identify emerging information trends for special libraries. Findings were reinforced by a follow-up study in 1995. These studies provide an indication of the prevailing corporate climate and attitudes of corporate executives responsible for the library. Unfortunately, these studies fail to indicate the impact of the information center on decision-
making. In fact, a disturbing finding was that there was little managerial consensus on how the library added specific value to the firm's performance or how value should be measured. The value of special libraries is apparent in Marshall's findings (1993). She reported that eighty-four per cent of the 299 managers she studied indicated better-informed decision-making. Special libraries are particularly effective in supplying new knowledge, serving to increase the levels of confidence of managers and executives in decisions being made.

These studies, even as they fail to examine the information seeking process, add value to the current study to an extent as they shed light on the information seeking activity of the study population.

3. User studies – Engineers: Many researchers have reported engineers’ information needs, information seeking behavior, and the relationship between information use and their work performance. In their literature review of studies done on engineers, Leckie et al. (1996) highlight the relationship between work roles and tasks to determine the information needs and searching activity. The review makes it clear that a number of factors affect the choice of sources and types of information sought based on the situation. The information seeking activity therefore is a result of a complex interaction of variables such as job functions, work environment, qualifications, career stage, accessibility of information, ease of use and technical quality. Likewise it is expected that student analysts in their professional capacity will have similar factors playing a role in their search behavior.

4. User studies – Healthcare sector: King (1987) examined the contribution to patient care of a group of hospital libraries in Chicago. Using a carefully designed unobtrusive survey of library use, King measured the outcomes of this use in 176 clinical situations. The study essentially focuses on three aspects of information assessment: the quality and
cognitive value of information provided by libraries and its contribution to quality patient care, the impact of information provided by libraries for management, and library performance as assessed by health professionals. Resulting data evaluated such variables as information relevancy, accuracy and currency.

A similar approach was undertaken in the Rochester studies of 1991. This included a systematic sample group of 448 physicians. Marshall (1992) has since revised and expanded King's methodology. Both the Chicago and Rochester studies found that information provided by hospital libraries had a significant impact on clinical decision-making as perceived by physicians (Marshall, 1993). The Rochester study further documents changes in patient care in specific areas such as diagnosis, choice of medical tests, choice of drugs, reduced length of hospital stay and advice given by the physician to the patient (Marshall, 1992). A similar approach may help to shed light on the decision-making patterns of student project analysts especially vis-à-vis the perceived value of information provided by search intermediaries.

While Marshall's study focused on hospital physicians who had ready access to their organizations' special libraries, Wood & Wright (1996) focused on general practitioners in the United Kingdom. A broader approach had been taken in recognition that GPs were likely to make little direct use of libraries in their patient-related decision-making. Results indicated that human sources were considered to be more important than text sources in the context of immediate patient care problems. Physical access to those libraries attached to hospitals had proved problematic in several cases, although this may have improved with technological changes.
Bawden & Robinson (1997) compared the information needs and behavior of nurses in specialist areas, namely midwives and psychiatric nurses. The findings revealed a link between awareness and use of computer systems and the library system. Criteria for choosing sources of information were dependent on availability more than the quality or utility of the source.

Similar studies have been conducted on information needs of dentists and nurses that fall under the healthcare sector. Based on their extensive literature review, Leckie et al. (1996) discussed the commonalities among healthcare professionals. Accordingly, (a) their information needs stemmed from tasks related to work roles such as patient care, current awareness and continuing education, practice management, administration, and research; (b) all sought information from formal and informal sources, available within and outside the organization; and (c) choices were determined by ease of access, past success, time constraints, and quality of information.

Information Retrieval (IR). Information needs are met through information retrieval. Integral to this process are the search strategies. Traditional IR studies concentrated on representations of documents for their retrieval; they were system oriented and studied documents, not tasks and processes. Many studies focused on different aspects of information retrieval from the selection of a database to the user’s decision to stop searching (Kantor, 1987; Meyer & Ruiz, 1990). Studies on IR interaction between texts and searches were typically designed to concentrate on a single search session. But understanding the process of information retrieval and the perceptions and attitudes of users is as crucial as the understanding of documents searched.
While the IR studies encompass many kinds of material, this review focused on the retrieval of digital information in various formats such as CD-ROMs, online databases, and Internet resources and those that discussed the process. This research had direct impact on the proposed area of study; in the digital era, participants are likely to rely upon the retrieval of information electronically. Studies focusing on information retrieval are also valuable when it comes to designing better information retrieval systems.

Meyer & Ruiz (1990) studied end-user selection of databases in EasyNet. The Business and Law categories of the multifile Scan option which counts the scans of the databases selected. However, it was not known how many people collectively performed this number of scans. Another study focused intensely on the relevance judgment process of a single graduate student during her search for documents relevant to the topic of a specific term paper (Tang & Solomon, 1998). The first study aimed to gain insight from patterns expressed in the behavior of a number of users while the latter aimed for a holistic understanding of an individual’s behavior in the context of information retrieval. Other studies focused on different types of populations such as thirty journalists at a single newspaper in Finland (Fabritius, 1998), seven novice online searchers in an academic environment (Nahl & Tenopir, 1996) and even four search intermediaries (Spink, Goodrum, & Robins 1998). The study on search intermediary elicitations conducted by Spink et al. took into account the potential for understanding the user and the information retrieval process by examining their interaction with a search intermediary. These studies were interested in user behavior during the process of information retrieval, but they focused on the system.

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5 EasyNet’s Scan Feature is a multifile search option that lists the postings from a group of 5 to 20 files for each search. Telebase markets the EasyNet service through many distributors such as CompuServe, libraries, and international telecoms. The customer base of these distributors is primarily direct end-users of the information.
Ellis (1989) and Ellis & Haugan (1997) developed a behavioral model for information system design. They delved into the process of information seeking in information retrieval where the online search behavior of different populations (researchers and scientists) was compared to arrive at the model. Yang (1997) examined the information seeking of novice users of a Greek history information database. His study revealed a complex process of interaction that occurred during database searching. The activity was guided by the novices’ goals and task determination. As the users learned to manipulate the database so were they able to refine their tasks. Both the studies examined the users’ cognitive process in information retrieval as a basis for their information seeking models.

The concept of relevance in information studies has been debated. It is an important concept for evaluating the effectiveness of information retrieval. Relevance is defined as “end-users’ perceptions of the potential of certain information to resolve the users’ problems in context of their information seeking and use situations” (Schamber & Bateman, 1996). Searchers who got positive reinforcement in the form of relevant information would continue searching while those who got negative reinforcement in the form of non-relevant information would cease their searching (Kantor, 1987). Relevance has been measured according to how well the topic of information received matches the topic of information requested. Vakkari (1999) attributes the concept of relevance to several factors. If users had well-defined problems, it becomes easier to judge the relevance of the retrieved items. Additional criteria that affect relevance judgments were objective features of the different types of items being reviewed. Shaw (1995) looked at the features of language, journal, and length of articles in her observation of graduate students in language and literature programs as they searched CD-ROM databases. However, Harter (1992) and Anderson (1998) argued
that relevance was a much more complex concept, it was in a constant flux and was being continuously shaped and re-shaped by the searcher.

**IS and IR: the meeting point.** In recent years, the role of networked services has gained increasing attention in information seeking studies. As Savolainen (1999) maintains, it is apparent that with the growing popularity of the Internet, the interests in IR and information seeking (IS) studies will overlap more strongly. A major part of information is sought through use of computers, enhancing the need to understand the ways people select sources and channels that include interactive medium as a part of their IS behavior. Contingent to this is a need for robust interfaces that would provide fast and easy access to resources. Garrod (1998) has lamented the fact that often the interface was not conducive to acquiring relevant information.

Vakkari (1999) perceives IR as a part of a broader process of information seeking. For indeed while information seeking was understood as a process of searching to obtain information in response to a need or for a purpose, IR was understood as the use of an information system for acquiring an answer to that response. Although both IS and IR are a part of a larger schema, i.e., information needs, the integration of research in both the fields is fragmented. As noted in the literature, IR focuses on representation of search strategies to retrieve documents from an electronic / computerized system and the relevance of the documents (Bates, 1989; Schamber & Bateman, 1996; Shaw, 1995). Studies on IS, on the other hand, have focused on the use of documents and the constructive and behavioral process in acquiring those documents (Cheuk, 1998, 1999; Kuhlthau, 1991, 1993).
For a holistic understanding and the designing of better retrieval systems, the study of both IS and IR is advocated. Vakkari has made major contributions in this area. His study within the work environment has proposed systematic relations between categories of information activities, task complexity and problem structure. He developed a model based on the integration of these variables. The model: (a) explained variance of information actions in task performance; (b) connected studies of information types, search strategies and relevance assessments into a single framework thereby facilitating an understanding of the interrelations between the activities; (c) contained concepts that allowed for the connection of studies on information types, search strategies, and relevance assessments to ideas in cognitive psychology, artificial intelligence, organization and communication research.

Information Seeking Models

Many factors affect how users seek information. Several researchers (Bates, 1989; Cheuk, 1998, 1999; Cole, 1997; Ellis & Haugan, 1997; Gutherie, 1988; Gutherie & Dreher, 1990; Kuhlthau, 1989, 1991, 1993; Leckie, Pettigrew & Sylvain, 1996; Marchionini, 1992; Marchionini & Shneiderman, 1988; Yang, 1997) have presented models of information seeking to characterize the process of searching for desired information. Each model described the process that contributed to a better understanding of the user’s perspective and motive.

Bates (1989) proposed a “berrypicking” model of information seeking. She described IR as evolving searches. Every new piece of information the searcher encountered provided new ideas and directions to follow, and consequently, this led to a new conception of the query.
Gutherie (1988) and Guthrie & Dreher (1990) postulated a cognitive processing model to account for the searcher's performance in finding information in and deciphering complicated documents. Gutherie attributed a lack in users' proficiency to an inadequate cognitive model and an understanding on the part of psychologists and educators. The process model derived from the studies had five components: (1) goal formation, where the student defined an objective; (2) category selection, where the student inspected an appropriate category of information; (3) information extraction, where the student mined the relevant information from the selected category; (4) integration, where the information extracted was integrated with goal statement; and (5) recycling referred to the searchers' repeating the first four steps if the goal was not attained or until the searcher was satisfied with the result. Efficient recycling was dependent on a selection of an optimal sequence of categories, with repeated extractions and accurate integrations.

Similarly, Marchionini and Shneiderman (1988) have identified five critical components and their characteristics in an information-seeking framework: the user; the setting; task domain; search system; and outcomes. This framework was largely aimed at designers, emphasizing the nature of variables that may affect the perceived utility and usability of a system. Taking motive and purpose into account, Marchionini & Shneiderman combine the five components and developed a model for human-computer interaction. In their study, they pointed out how users developed mental models from systems through factors such as training, computer experience and reading manuals. The speed and accuracy was contingent on prior experience, frequency of use and the complexity of task domain. Furthermore, Marchionini (1992) pointed out, "information seeking is a form of problem solving; both the information sought (problem) and the search process (solution path) may be
simple or complex” (p. 157). He identified five processes of information seeking: (1) defining the problem, (2) selecting the resources for the search, (3) articulating the problem in terms of search strategy, (4) examining the results of this articulated problem, and (5) extracting the desired information in useful forms. His model emphasizes the nonlinear, evolving, iterative and opportunistic nature of the process. Bates and Marchionini’s frameworks were similar as both models represented an evolving interactive process.

While Bates’ model neglected the ongoing processes of previous searches related to the same problem, Kuhlthau (1993) had put forth a model based on the “uncertainty principle”, explaining the constructive process of information seeking. Kuhlthau’s model was empirically supported by studies on high school students (1989, 1993) and professionals (1996). She has emphasized holistic learning in the information search process (ISP). Accordingly, three realms of experience characterized the stages of ISP: the affective (feelings), the cognitive (thoughts), and the physical (actions). Kuhlthau maintained that the complex search process occurred in a series of stages. The task considered most appropriate to move the process on to subsequent stage were also identified. The six stages and their predominant tasks identified were: (1) initiation, to recognize a need for information; (2) selection, to identify and select the general topic to be investigated; (3) exploration, to investigate information on the general topic in order to extend personal understanding; (4) formulation, to form a focused perspective of the topic from the information related to the focused topic; (5) collection, to gather information that defines, extends and supports the focus; and (6) presentation, to complete the search and prepare to present or use the findings.

She also found that exploration was the most difficult stage for users, particularly when they attempted to move into the collection stage immediately after selection. Collection
strategies, such as making a comprehensive search of sources or taking copious detailed notes, did not work well in the formative stage. Rather, more exploratory strategies; such as listing important facts and interesting ideas or finding a few sources and settling to read and reflect, were more appropriate for the task at hand. Intentionally seeking a focused perspective within the general topic was essential during this period of information seeking. The focus served as a guiding idea for the search throughout the collection stage. Interest, which was not particularly high at the beginning of a search, was found to increase considerably after formulation. Information searchers collected information at all different stages of the process, but she has emphasized that at Stage 5 – collection, an information searchers’ interaction within the information retrieval system may be most effective and efficient.

Kuhlthau’s ISP model has been most prominently used in other empirical studies. In her study of freshmen English students, Swain (1996) validated and verified the model, although her study found that students did not necessarily complete the stages in the order prescribed by Kuhlthau’s studies, some combined stages in an iterative process. Furthermore, interpersonal and social communication seemed to impact Swain’s study population.

Cheuk’s (1998, 1999), and Yang’s (1997) findings further corroborated Kuhlthau’s results and ISP model. Cheuk (1998, 1999) has identified seven critically different situations that participants (auditors, architects and engineers) experienced in their workplace. The seven information seeking and using (ISU) situations were: (1) task initiating situation, this occurred when participants perceived they had a new task to work on; (2) focus forming situation, this occurred when participants perceived they had to gain a better understanding of how they should go about carrying out their tasks or solving problems; (3) ideas assuming
situation, the situation occurred when participants were forming ideas about how to carry out their tasks or to solve problems; (4) ideas confirming situation, when participants were trying to confirm the ideas they had assumed; (5) ideas rejecting situation, when participants encountered conflicting information or they could not get the answers they needed to confirm their assumed ideas; (6) ideas finalizing situation, when participants tried to seek formal consensus to finalize their ideas; and (7) passing on ideas situation, when participants presented ideas to targeted audience.

These situations form a framework for identifying information behavior distinctively associated with each situation. Cheuk’s model departs from Bates’ in the identification of IS as a linear process. Her study population did not follow any specified sequential order, instead they moved between the seven situations in multi-directional paths, coinciding with Kuhlthau’s (1993), Leckie, Pettigrew & Sylvain’s (1996) and Marchionini’s (1992) findings.

Like Cheuk, Yang’s (1997) findings also confirmed Kuhlthau’s results. His study examined six cases of information-seeking behaviors of students working through their class exercises using Perseus, a Greek history information database. According to Yang, the IS processes consisted of five activities: (1) selecting sources of information, (2) executing the search, (3) interpreting the problem, (4) judging for relevance, and (5) retaining or rejecting. Based on these activities, he identified four emerging themes and search strategies during the learner’s information seeking processes: (a) exploratory searching, (b) prescriptive searching, (c) purposive searching, and (d) associative searching. Each stage of searching reflected the subjects’ mental status at the time. They typically engaged in exploratory searching before they came up with a specific direction. At this stage they aimed to establish a framework for their task. Prescriptive searching was used to incorporate their goals and constraints.
Purposeful searching occurred once they could maintain more constant points of reference. At this stage learners searched for specific information that they had identified as directly relevant to their goals. Finally, the learners demonstrated associative searching when they proactively looked for related and interconnected information to support arguments they had in mind. Yang’s study has demonstrated the progressive nature of the IS process. As learners identified their tasks and narrowed their focus, they indulged more and more in associative searching, while exploratory, prescriptive and purposive searching declined.

Cole’s study of history Ph.D. students revealed a five stage process of information seeking: (1) opening of the information process, (2) representational (cognitive) activity, (3) corroborating evidence looked for and found, (4) closing of the information process, and (5) effect of information process. The model built on Kuhlthau’s and Dervin’s studies but differed in the assumption that students’ behavior was driven by unconscious or “semi-conscious” motivations. Kuhlthau and Dervin commented that the students’ behavior was based on an awareness of a ‘gap’ in knowledge.

Ellis & Haugan’s (1997) study of engineers and research scientists in an oil and gas company identified eight generic characteristics to show the relation between R&D process and search patterns to advance a behavioral model: (1) surveying, characterized by initial search for information to obtain an overview of the literature; (2) chaining, characterized by following chains of different forms of referential connection between sources to identify new sources of information; (3) monitoring, characterized by involvement in activities to maintain awareness of developments in the field; (4) browsing, characterized by scanning of primary sources; (5) distinguishing, characterized by ranking information sources based on relevance; (6) filtering, characterized by using certain criteria to make the information as relevant and
precise as possible; (7) extracting, characterized by working through sources to make presentations; and (8) ending, characterized by rechecking of sources in the final stage of accomplishing the task or completion of the project.

Based on their extensive literature review and study of information needs in the healthcare sector, engineers and lawyers, Leckie et al. (1996) have posited an information-seeking model that was applicable to other professionals. The model was based on the interplay of work roles and associated tasks that result in specific information needs. The ensuing information seeking activity and the characteristics of information needs was influenced by a number of interacting variables such as the sources of information available and the awareness of information, which could ultimately affect the outcome. The model is generic and diverges from other models in that an understanding of the process of seeking was most important. The model was derived from an examination of the organizational culture, the work roles, the tasks, and outcomes within this system.

The models discussed (see Table 3 for summary) were useful for the development of this study. Each model highlighted and emphasized the dynamic nature of the information search process, negating traditional beliefs that the process is static in nature and thereby allowing an analysis of the interplay of social, cognitive and behavioral aspects of the process. Furthermore, the models provided a framework to examine the student analysts’ interaction with the information retrieval system and the information service providers.
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<tr>
<th>Researcher</th>
<th>Structure</th>
<th>Emphasis</th>
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<tr>
<td>Bates (1989)</td>
<td>Berry picking model</td>
<td>Contrasts the iterative, evolving nature of problem, the dynamic and modified search pattern with the information retrieval model of one-time conception of the problem, single unitary query and static search.</td>
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<td></td>
<td>1. Iterative, evolving nature of the problem</td>
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<td>2. Dynamic, modified search query</td>
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<td></td>
<td>3. 'Berrypicking' search pattern</td>
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<td>4. Search strategies draw from multiple resources</td>
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<td>Cheuk (1998, 1999)</td>
<td>1. Task initiating situation</td>
<td>Proposes an information-seeking process consisting of seven stages. These can be identified by affective, cognitive, and physical elements exhibited by the searchers. Emphasizes information seeking as a holistic learning process.</td>
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<td>2. Focus forming situation</td>
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<td>7. Passing on ideas situation</td>
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<td>Cole (1997)</td>
<td>1. Opening of the information process</td>
<td>Proposes a five-stage information seeking process with an emphasis on the progress from the unconscious to a conscious activity.</td>
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<td></td>
<td>2. Representational activity</td>
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<td>3. Corroborating evidence looked for and found</td>
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<td>4. Closing of the information process</td>
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<td>5. Effect of information Process</td>
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<tr>
<td>Ellis &amp; Haugan (1997)</td>
<td>1. Surveying</td>
<td>Proposes an 8-stage generic model with an emphasis on behavioral aspects of information searching in context to the system.</td>
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<td>2. Chaining</td>
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<td>4. Browsing</td>
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| Kuhlthau (1991, 1993)            | 1. Initiation  
2. Selection  
3. Exploration  
4. Formulation  
5. Collection  
6. Presentation | Proposes an information-seeking processes consisting of six stages, which can be identified by various affective, cognitive, and physical elements exhibited by the searchers. Emphasizes information seeking as a holistic learning process, filled with uncertainty. |
2. Characteristics of information needs  
3. Factors affecting information seeking  
4. Outcomes | Posits a model based on extensive literature review of professionals and their work activities. The model is generic based on daily work-related practices. |
| Marchionini & Shneiderman (1988) | 1. User  
2. Setting  
3. Task domain  
4. Search system  
5. Outcomes | Describes five components of an information-seeking framework, whose interactions help determine the performance of searching and can aid the design and study of hypertext. |
| Marchionini (1992)               | 1. Define the problem  
2. Select the resource  
3. Articulate the problem  
4. Examine the results  
5. Extract desired information | Identifies five functions of information seeking which emphasize the nonlinear, evolving, iterative and opportunistic nature of the process. |
2. Executing the search  
3. Interpreting the problem  
4. Judging for relevance  
5. Retaining or rejecting | Five stages identified with an emphasis on processes that were evolving, iterative, non-linear and opportunistic in nature. |

Adapted from Yang (1997)
IS and the Role of the Information Professional

This section examines the trends and concepts in information seeking (IS) and information retrieval (IR). Technology has brought about changes in the users’ approach to searching and accessing information and the library’s mode of providing information services. Roles of librarians have been thus redefined to meet the challenges of informational needs in this new, dynamic and interactive environment. How does the role of the information professional as an intermediary within this framework enrich the users experience in information seeking and searching? It is important that library and information science professionals know IS (information seeking) models and IR (information retrieval) systems to be able to add value to the users’ experience, otherwise it would be a case of a “blind man leading a blind”.

The concept of zone of intervention has been introduced by Kuhlthau (1993) based on Vygotsky’s (1978, cited in Kuhlthau, 1996) concept of the zone of proximal development that related to intervening in the learning of others. Accordingly, the zone of intervention is that area in which an information user can do with advice and assistance. While intervention within this zone enables the user to move on with the search process, intervention outside the zone is experienced by the user as intrusive and thereby rendered inefficient and unnecessary. Factors that influence the zone are task complexity, state of confusion, and level of anxiety. An awareness of this concept will enable the intermediary to play an important role.

Both reference and instruction services have been differentiated into five levels of intervention. These describe the intervention of the information professional into the user’s ISP (information seeking process) in order to enhance intellectual access to information. The role of the librarians in reference service is redefined as five levels of mediation: organizer,
locator, identifier, advisor, and counselor. In a similar way, the role of those involved in
instruction was redefined as five levels of education: organizer, lecturer, instructor, tutor and
counselor. At the lowest level (Organizer) and at the highest level (Counselor), the two
services, reference / mediation and instruction / education, merge into one.

Once services have been defined within the levels of intervention, the next step was
to identify ways to diagnose users' problems to determine the level of intervention most
appropriate for effective service. A model of the physician's approach to diagnosing a patient
for treatment was used as a comparison for diagnosing intervention into users' problems in
LIS (library and information services).

Five zones of intervention into users' problems were identified. In zone one (Z1) the
problem was self-diagnosed and a search was conducted by the user independent of any
intervention by the librarian. In zones two (Z2) through five (Z5), the user's problem was
diagnosed through an interview that consisted of a problem statement or request or some
background information about the task, personal interest, time allotted, and information
available. The librarian would make a diagnosis on the basis of theory and experience. The
process approach was proposed as a theory to be incorporated into the information
professional's frame of reference for making diagnostic judgments of what intervention was
required. In zones two (Z2) through four (Z4), the user's problem was diagnosed as requiring
product or source intervention. In zone two (Z2) it was determined that one right source was
required to solve the user's problem; in zone three (Z3), a group of relevant sources; and in
zone four (Z4), a sequence of sources. In zone five (Z5), however, the information
professional diagnosed the user's problem as requiring process intervention, which included
entering into an ongoing dialogue and guidance in exploration, formulation, construction,
learning, and application in the ISP. The five zones of intervention into the users’ problems corresponded with the five levels of mediation and instruction. It was the fifth zone (Z5) that called for process intervention at the counselor level, and was the area that needed further development by library and information professionals. The fifth level of intervention was based on the principle of uncertainty.

Longitudinal studies of high school students and case studies of career professionals supported the concept although Kuhlthau admits, “there is a need to develop ways to diagnose a zone of intervention within complex work-related tasks” (1996, p. 8).

Chapter Summary

The preceding literature review traced the development of the concepts and theories within the constructivist framework, theory from psychology, social sciences and communications and its application to the realm of information sciences. Early researchers in library and information studies examined the system rather than the knowledge constructs. Many researchers set out to examine the user behavior in its entirety. The user’s perspective and way of seeking was of paramount value to these researchers. Kuhlthau, Dervin and Wilson are amongst this group. Wilson (1977, cited in Kuhlthau, 1993) proposed that libraries and information systems be tailored to the way people use information in their daily lives. “Any policy for a library system should be based on an understanding of individual gathering behavior” (p. 1). Connections must be made between the ways people use information and the way libraries and information systems provide information. This more holistic view of information seeking and use was firmly embedded in the notions of cognitive change and behavioral change as central concepts.
Numerous studies have been reviewed, some focused more on information retrieval, while others focused on the process of retrieval and the factors giving rise to this need. The emerging trends are reflected in the information seeking and needs models. Some considered the individual as the starting point, others looked at the organizational context, still others focused on a single work activity. The information user behavior patterns were revealed in all the studies. The relationship of these theories provided a frame of reference for this study which was informed by theories put forth by Kuhlthau and Dervin who have emphasized information seeking as a process of seeking meaning and making sense in a learning environment.
This chapter is a description of the methodology and research design employed to glean insight into the information seeking activity of student project analysts at the Centre for Operations Excellence. The sections describe and discuss the sense making approach, the Research Activity Timeline and the case study method used for this study. Qualitative and quantitative data gathering instruments such as logs, interviews and questionnaires were applied to generate the data.

Research Design

Background

Theoretical background. There have been numerous changes in the way that librarians and information professionals organize information for the end-users for ease of access and searching. With this shift in focus and ever-increasing computing power, end-users have felt empowered to conduct the search themselves. The explosion of the Web has made it simple for users to access information remotely. Against this background, there have been a plethora of user studies focusing on human-computer interaction and information retrieval. The spotlight has been on the information system and the examination of the user in the context of that system. Some researchers have advocated for a reverse perspective, that is, a study of how information systems fit in the life of the user (Dervin & Nilan, 1986). From this perspective the approaches employed for studying information systems should allow the researcher to examine the seeking and searching behavior from the users’ viewpoints. The
understanding, which comes from this research, can be applied in many contexts including enhancement of designs of information retrieval systems which is a critical aspect of ‘expert systems’ in computer sciences.

Methodological background. The current study is a report on an exploratory investigation of the information seeking behavior and needs of graduate students of management sciences at the Centre for Operations Excellence at the University of British Columbia. The research uncovered and described major aspects of the information seeking patterns including the phenomenon of the nature of the original situation when the information need was recognized, the characteristics of the information seeker, and the information providers who were consulted in the process.

The methodology for this study was determined by the goals of the study. When information seeking is examined as a process of construction and also when it takes all the behavioral, cognitive and affective aspects into consideration, quantitative methods may be unable to provide the depth required. Delving into the user’s mind is crucial to get to the crux of the process. Traditionally, research goals orbited around systems as a unit of analysis. In such a situation, the result shed light on the assessment of the system or the library, but not on the user himself / herself. In the bargain, users’ attitudes were side stepped, eliminating a vital link to the progression of the process in the user’s mind. According to Kuhlthau (1993), making inferences about the reasoning behind an act by merely observing the act was inadequate, as internal processes were not readily observed in a study of behavior. It therefore became essential to define qualitative methods that enabled the exploration. Increasingly,

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6 Expert system: "A software application that seeks to capture expertise in limited domains of knowledge and experience and to apply this expertise to solving problems" (Laudon & Laudon, 1998, p. 648).

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qualitative methods are being used to understand the complexity of information seeking and the adoption of information technology by end users (Glazier & Powell, 1992; Mellon, 1990). This study sought qualitative methods which could elicit the users’ perspectives rather than that of the librarian, the service providers, or the search intermediaries or the system.

The methodology for this study evolved from an examination of studies done on information seeking processes as well as research which focused on search behavior and the ensuing information retrieval in the digital environment. This research design also incorporated concerns in the literature related to researcher bias, reliability, and validity. The final design was based on the research questions.

The methodology of studies examined in the literature review were analyzed to determine their strengths and weaknesses and thereby, their application to this study. There are a number of methods that can be employed to further explore processes of information seeking, information search, and retrieval. I have reviewed the sense making approach and the case study method; both were incorporated into the research design. Various data gathering instruments from previous studies (such as logs, interviews and questionnaire) have been discussed in terms of suitability to the approach, the method and this study.

Even while researchers utilized a combination of methodologies, two important contributions to approaches stand out: (a) Dervin, Jacobson & Nilan (1983) presented the sense making approach, and (b) Barry (1997) developed the Research Activity Timeline (RAT) as an extension of the approach. Dervin et al. found that when an individual engaged in information seeking, s/he sought to find meaning that tied in with what s/he already knew in order to produce new knowledge. The approach warrants an examination as it has had a
The "micro-moment time-line interview" was incorporated into the research design in order to get to the heart of the information seeking process of the study population.

1. The Sense making Approach: Theory and Method: Sense making has its historical roots in communications practices. In existence since 1972, it gained publicity in 1983 when Dervin and her colleagues proposed its use in the study of information needs and seeking. Since then, the approach has evolved and undergone a series of changes. In 1983, Dervin referred to it as a constructivist approach, in 1994 she termed it as communication and later, in 1998, she termed it as a verbing approach. In 1999 she referred to it as post-constructivist or post-modern modernist approach. Regardless of terminology, the approach has been widely used to theorize and study a variety of phenomena in different research genres other than library and information science.

Sense making operated on certain fundamental assumptions: (a) humans operate within a time and space to construct sense out of their internal (cognitive, mental) and external (observations, societal, cultural) worlds. The conclusions (perceptions, understandings) manifest themselves in their behavior, (b) it assumed that humans and their worlds were constantly evolving, and (c) it assumed that all information was subjective. Given these assumptions, the approach posited information seeking and information use as 'constructing' activities. Sense making demands attention to process. The central activities of sense making were information seeking, processing, creating and using. According to Dervin "sense" includes not only knowledge, but also a host of other subjective factors that reflect an individual's interpretations of situation, such as intuitions, opinions, hunches, questions, etc.
The classic sense making model was portrayed as a “situations – gaps – uses” model. “Situations” were defined as the time-space contexts existing at the point when sense was constructed. “Gaps” were a lack of knowledge or understanding that people want to bridge, translated in studies as “information needs” or the questions people posed themselves, as they constructed sense and moved through time-space. “Uses” were translated in most studies as information “helps” and “hurts”. An individual in a moment defines that moment as a particular kind of gap, constructs a particular strategy for facing the moment, and implements that strategy with a particular tactic (Dervin, 1992). Contingent to this, Dervin suggested a qualitative examination of gap-defining and gap-bridging. The micro-moment time-line interview was one such technique. Research questions required the participant to detail the events of a situation step-by-step. Participants were required to reconstruct situations, detailing each step. The description was directed to the classic model of sense making. In a nutshell, sense making was a context-sensitive theory of information seeking and use.

Sense making has been widely applied in different streams of the professional arena. Jacobson (1991) applied the approach to user perceptions of search sessions using complex interfaces. Cheuk (1998, 1999) used the micro-moment time-line interview to elicit users’ perspectives in her study of professionals. As of 1999, some 100-plus individuals have been actively using sense making as a methodology for research, as theory about communication and as a guidance for communication design and practice (Dervin, 1999). To conclude, in Savolainen’s (1993) words, “sense making theory seems to be a good example of a modern research project, with its emphasis on the multi-disciplinary approach and the importance of cognitive factors in communications research” (p. 26).
2. The Research Activity Timeline (RAT): The RAT was developed to investigate both traditional and electronic information seeking activity. The technique draws from the critical incident technique (Flanagan, 1954, cited in Barry, 1997) that facilitated memory for forgotten details of events, and the sense making time line interview (Dervin, 1983). The former facilitated memory for forgotten details focusing on a single, specific situation. The latter required the participants to reconstruct an information need situation that was examined step by step to identify the gaps and the requirements to fill the gaps. The guiding principles behind the technique were to: (a) contextualize information activity and the use of information technology by producing real life examples set within the context of everyday work, (b) facilitate detailed recall of implicit and forgotten information activities, and (c) investigate change in individuals' information behavior.

The RAT has structured the research interview around a discussion of the participants’ specific work projects. For each project, descriptions and detailed information about the incidents of information activity are elicited. The main unit of analysis has been the sub-elements of each project (including research, proposals, articles, etc.). Barry developed seven stages to track and chart strands over a period of time. Although RAT is a very sound and sturdy technique, its application within this study is limited to a few concepts for data collection. This study tracked only a single project while RAT is a longitudinal technique, applicable for multiple projects over a period of time.

3. The Case Study Method: The case study method is often used for in-depth studies of a single case. According to Fidel (1984), Marshall & Rossman (1989), and Yin (1994), the case study is a specific field or qualitative research method and thus is an investigation "of
phenomena as they occur without any significant intervention of the investigators". As
(Fidel, 1984) has suggested, it seems to be appropriate for investigating the phenomena when
“(a) a large variety of factors and relationships are included, (b) no basic laws exist to
determine which factors and relationships are important, and (c) when the factors and
relationships can be directly observed”. The decision to select this method should be based
on the purpose of the study. Marshall & Rossman (1989) and Yin (1994) have supported the
use of case study as a research strategy when the purpose was exploratory, explanatory or
descriptive.

The case study is an ideal methodology when a holistic, in-depth investigation is
have been used in varied investigations, particularly in sociological studies, but increasingly,
in instruction. Yin (1994) and Stake (1994), who have wide experience in this methodology,
have developed fundamental procedures. When these procedures are followed, the researcher
will be following methods as well developed and tested as any in the scientific field. Case
studies are designed to bring out the details from the viewpoint of the participants by using
multiple sources of data.

Yin (1994) has identified some specific types of case studies: exploratory,
explanatory, and descriptive. In terms of application, exploratory cases were sometimes
considered a prelude to social research while explanatory case studies were used for
conducting social casual investigation. Stake (1994) has added to this knowledge base by
including three others: intrinsic – when the researcher had an interest in the case;
instrumental – when the case was used to understand more than what was obvious to the
observer; collective – when a group of cases were studied.
According to Tellis (1997), the selection of the case study should be done to maximize what could be learned in the period of time available for the study. A case study method is a specific field research method (Fidel, 1984). Becker (1970) referred to a case study as a detailed analysis of an individual case supposing “one can properly acquire knowledge of a phenomenon from intensive exploration of a single case” (cited in Fidel, 1984). Inherent in its definition are the advantages of the case study method. Not only is it conducive for the study of exploratory individual cases, but it also lends itself to “multi-perspectival analysis” in that it allows for the recording of interaction between the actors and other relevant groups. In this sense, it is akin to the flexibility afforded by the methodology.

In contrast to most survey research, case studies involve intensive analysis of a small number of subjects rather than gathering data from a large sample or population. A number of data collection techniques are usually employed – questionnaires, interviews, observation and the analysis of documents.

Some researchers considered the case study to be relatively low in internal and external validity (Paris, 1988, cited in Powell 1997), but it has the potential to be a valuable research tool. As Paris pointed out, the nature of the problem is the major determinant of the most appropriate research methodology, and the case study is well suited to collecting descriptive data. “The detailed observations that case studies provide are especially useful in documenting phenomena occurring over a period of time or whose implications are complex” (p. 138). This kind of detailed understanding provides a solid basis for creating hypotheses, which can be tested with other methods later. Despite the advantages, the case study methodology has been under microscopic scrutiny. Not trusted as a sound and scientific
method, it has raised questions with regard to validity, reliability and accuracy of results. This sensitive issue can be approached in different ways, such as ensuring that the data gathering instruments are reliable and impregnable. Dewdney (1992), Mellon (1990), and Lincoln & Guba (1985, cited in Powell, 1997), and Ely et al. (1991, cited in Powell (1997) have suggested ways and means of ensuring integrity.

Dewdney remarked, “field studies need not lack rigor and the field setting in itself does not necessarily imply deficiencies in control if the researcher develops systematic procedures for documenting the observed behavior” (1992, p. 122). Given the necessity of research within whatever setting was most natural for the subjects, the investigator could not escape bias and so must recognize its impact upon the study (Mellon, 1990).

According to Lincoln and Guba (1985, cited in Powell, 1997), certain activities increased “the probability that credible findings would be produced. These included prolonged engagement, persistent observation, and triangulation (which includes “different modes of data collection, using any that come logically to hand but depending most on qualitative methods” p. 160). They also advocated member check, whereby data, analytic categories, interpretations, and conclusions were tested with members of those groups from whom the data were originally collected. It could be either formal or informal. Indeed member checking was particularly vital as meaningful feedback from subjects could rapidly expose gaps or flaws in any data gathering technique, working hypothesis or emerging theory (Ely et al., 1991). Peer debriefing which “is a process of exposing oneself to a disinterested peer in a manner paralleling an analytic session and for the purpose of exploring aspects of inquiry that might otherwise remain only implicit within the inquirer’s mind” (Lincoln & Guba, 1985, cited in Powell, 1997, p. 161) has often helped in the research process.
The checks discussed above were incorporated and utilized during the study to add credibility. For example, the research instruments were developed in order to have systematic procedures for documentation. See Appendixes V - IX for the tools. An awareness of researcher bias enabled me to maintain objectivity and avoid over-responding to users' responses during meetings and interviews. Prolonged and persistent observation was not feasible. Triangulation was integrated into the research design through use of different types of instruments, member checking and peer debriefing.

Discussion of research instruments.

1. Interviews: A data collection instrument which is often used is the face-to-face interview. This is an effective way to study the process of an individual’s search behavior. While it allows for immediate and direct interaction and feedback, it also enables the researcher to probe into qualitative and cognitive aspects. Swain (1996) interviewed five students to focus on their problem-solving approach to searches, while Cheuk (1999) used this method to probe into the complex information gathering processes of her study population. Kuhlthau (1993), on the other hand, used the method to examine the patterns of uncertainty, complexity, and process in the perceptions of information users from differing work environments and high school students. Interviews are less constraining than questionnaires and allow the interviewer to pursue different directions if suitable. The interview method also encourages a higher participation rate. However, interviews can cost a lot of time and money. Yet, some studies have circumvented this by focusing on a very small study population. Tang and Solomon (1998) interviewed a single graduate student while Anderson (1998) examined only three experienced researchers.
2. Observation: Observation is often employed in conjunction with interviews. It is an important tool for examining the process of information search and retrieval because it allows the examiner to be in the midst of the process and to gather data s/he might not think to ask about otherwise. A difficulty with observation is the inability of the researcher to observe thought processes. Therefore, a number of the studies encouraged participants to think aloud as they searched (Anderson, 1998; Nahl & Tenopir, 1996; Tang & Solomon, 1998). Anderson has recognized the potential for this method to disrupt the workflow of the searcher but decided it was only minimal after testing it. Another difficulty was that it could contaminate the data and its reliability since the participant may be alerted to the researcher’s presence. Difficulty can be encountered also when more than one person was observing. In the study of search intermediary elicitations, three coders analyzed transcriptions of forty user interactions with one of four search intermediaries employed by Rutgers University Libraries. This inter-researcher discrepancy was a cause for weakness in the consistency of coding data because three different observers had three different perspectives. The researchers tried to minimize this effect by having some of the searches re-analyzed by another coder (Spink, Goodrum & Robins, 1998). The best researchers can do is acknowledge weaknesses in their methodology and attempt to minimize them as much as possible.

3. Diaries and Journals: The use of structured diaries is similar to observation in that the researcher asks participants to be conscious of their information search practices and to describe these practices while they are in the process of searching. Fabritius (1998) employed this method in his study of thirty journalists. This allowed him to gather data from a greater
number of subjects without the higher costs involved in directly observing thirty people
during their workday. The use of diaries, however, puts the burden upon the participant to
interrupt workflow in order to fill out the diary. In such a situation, the researcher may miss
out on data the participant failed to enter into the diary due to more pressing demands on
time. Similar to this method is the use of journals. Kuhlthau’s (1993) study required the
participants (high school students) to maintain journals that gave the students an opportunity
to include personal content that would not be otherwise observed. All journals reflected
changes in student understanding of the topic from the time that they first selected the topic.

4. Logs and Transactional Logs: Yet, another tool employed by information
researchers is the use of logs and the analysis of transactional log from a computer system.
Used on its own it proves to be fairly ineffective, as demonstrated by Meyer & Ruiz (1990)
in their study on end-user selection of business and law databases. After examining hundreds
of thousands of scans, they found no trends reflecting on user behavior. This was because
they failed to interview the users as to why they chose one database over another. However,
as Spink et al. (1998) all made use of logs and transactional log analysis in conjunction with
other instruments to gather data. Kuhlthau found that the search logs were effective for
tracking sources used and for relevance judgments. The data gathered through interviews and
observation gave meaning to the data gathered through logs. The strongest studies appeared
to be the ones that made use of a number of research methods to get a holistic picture of the
subject under study.
A factor to consider when analyzing the studies is the location. For instance, research could be conducted in a natural setting such as in the classroom or a library environment (Kuhlthau, 1993; Swain, 1996; Yang, 1997) or the work environment (Fabritius, 1998; Cheuk, 1999). Conversely, the research environment could also be contrived, such as the examination of seven novice on-line searchers during three or four scheduled sessions for an hour each time (Nahl & Tenopir, 1996). What is important to realize is that the context of the research environment may have a bearing on how relevant the data is to realistic situations. The results garnered from a highly controlled environment may vary widely from those gathered in a natural setting. This will have bearing once again on the validity and the reliability of the results.

**Creation of Research Instruments.** This study had three distinct methodological steps; the first two were qualitative, where logs and interview questions were used. The third step was quantitative, using a questionnaire for the whole class.

1. Logs: Step one of the data gathering technique entailed the use of logs. Due to time constraints of the students and the researcher, the researcher was unable to observe the students directly; logs seemed to be a logical alternative to record the data and the search activity when seeking information. An advantage of logs over observation was that the intrusive nature of observation might have contaminated the data. Logs also afforded the participants a degree of flexibility to fill in the data. The format developed for the study outlined four major areas: (a) the resources used with an analysis of the purpose for using it, (b) its importance, (c) the decision to select one over the other, and (d) the difficulties faced
with regard to each of those aspects. Other questions recorded the total time spent on the activity and the search strategy with an option to include their comments and results at the end of the activity. The main purpose of using logs for data collection was to glean a preliminary understanding of the user's searching and seeking process. An analysis of the data answered the first five research questions.

2. Meetings and Interviews: Weekly interactive meetings with the students enabled the researcher to verify the data in the log. Weekly analysis of the logs based on content analysis allowed the researcher to determine the stage the student analysts were at. This was a precursor to the next stage of the research design, namely the interview questions.

3. Application of the Micro-Moment-Time-Line Interview: One of the advantages of the interview method is the personal contact. Interviews can be more useful and better at revealing information of a complex nature. Of major importance is the bias factor in the interview that can result inaccurate responses.

The interview method was informed by Dervin’s (1983) Micro-Moment Time-Line Interview, which she had put forward in applying the sense making approach and one of the core techniques used in data collection. Accordingly, the participants were asked to detail the happenings during a situation step-by-step. For each step, called a “Time-Line Step”, the participants were asked what questions they had, what things did they need to find out, learn, come to understand, unconfuse and make sense of. Cheuk (1998) used the approach in her study of engineers, auditors and architects. The questions in this study were adapted from examples cited by Dervin and Cheuk.
Once the research areas had been determined, they had to be translated into the tools in the form of specific questions. In practice, the purpose and the objective of the study define the type of questions to be used. A combination of both structured and unstructured questions was most efficient, especially for this study as it was both exploratory in nature and delved into the process rather than description or facts. This does not negate the presence of facts though. The combination can work effectively for exploration and verification of answers/responses.

Open-ended or unstructured questions, as the name indicates, were designed to permit free responses from participants rather than ones limited to specific alternatives. They were especially useful for exploratory studies. Selltiz et al. (1959, cited in Powell, 1997, p. 93) maintained that these “are called for when the issue is complex, when the relevant dimensions are not known, or when the interest of the researcher lies in exploration of a process or of the individual’s formulation of an issue”. On the negative side, as there was almost no limit to the possible responses to an open-ended question, answers to these were usually more difficult to categorize and analyze than those for structured questions. Open-ended questions may tend to discourage responses, as they typically take longer to answer. Besides, such question also calls for the researcher to be objective and the skills for developing leading questions to elicit the correct responses or at least direct the conversation to evoke responses that will serve the purpose of the study.

Fixed-response or structured questions, on the other hand, limit the responses of participants to stated alternatives. The possible responses may range from a simple ‘yes’ or ‘no’ to a checklist of possible replies. Scales may be used to indicate various degrees of a particular response. Structured questions have several advantages. They accommodate pre-
coding more easily where possible responses are generally known and stated; these facilitate the analysis of the data gathered by the questions. Responses to such questions tend to have more reliability than those to unstructured questions. This occurrence is possible due to a limited set of responses leading to a diminished potential for variation. Fixed questions are ‘standardizable’, simple and easy to administer and more easily understood by the participant in terms of the dimensions along which the answers are sought. Having fixed responses eliminates ambiguities in that the answers will be given in the frame of reference that is relevant to the purpose of the inquiry. Among the disadvantages of the structured question is a possibility that a limited set of possible replies can force participants to select inaccurate answers, for none of the choices may correspond exactly with the participant’s stance or may not allow for further qualification. One way to circumvent this problem is the provision of the ‘other’ category but studies indicate that participants tend to limit their answers to the options provided. A closed question may also force a statement of issue about which the participant does not really hold an opinion. Once again, providing the option may be useful only to the extent that the participant does not feel compelled to give a definitive answer, which is not the case. Often, choices provided by the researcher can be biased, nullifying the research in a sense. In conclusion, “closed questions are more efficient where the possible alternative replies are known, limited in number, and clear-cut. Thus they are appropriate for securing factual information…and for eliciting expressions of opinion about issues on which people hold clear opinions” (Selltiz et al., 1959 cited in Powell, 1997, p. 95).

Step two of the research design used the unstructured, open-ended questions.
Thus the questions asked during the interview were:

- What questions flash through your minds in this particular stage?
- What strategies did you use to get answers to your questions? Why did you choose this strategy? Which strategies did you reject? Why?
- Did you face any problems in getting answers? What problems? How did you resolve the same?
- How does each answer help (or fail to help) you to carry on with your tasks?
- What is your feeling at this stage?

The interview technique served three main purposes: (a) to probe further into the qualitative aspects, (b) to identify a pattern and information search model, and (c) to verify the data in the logs.

4. Written Questionnaire: No questionnaire can be perfect in the true sense. But an awareness of the biases can help in attaining near-perfection. This can be done through various steps and precautions. According to Powell (1997) the main sources of error are: (a) researcher bias: a researcher may subconsciously develop a questionnaire such that it will increase the likelihood of obtaining the desired results; (b) sponsorship bias: an attempt to produce research results that will please the outside agency or the sponsoring agency maybe rooted in the subconscious of the researcher; (c) imperfections of design: a weakness in design can result in both biased and inaccurate responses. Such imperfections include haphazard sequencing, inadequate instructions, and a failure to explain the purpose and scope of the study; (d) participant interpretations: misinterpretations or differing interpretations can
result in inaccurate responses; (e) time lapse: it has been found that answers to same questions may vary over time. Perceptions and attitudes are dynamic, never static, hence this can account for varying responses; and (f) circumstances: factors such as the mood of the participant and ambiguous questions can cause errors.

Stage three used the written questionnaire as a technique to gather data to assess information needs of the student analysts. The questionnaire was administered to the study population. Close-ended questions with fixed responses were administered to determine: (a) the level of user satisfaction for present services, (b) to identify emerging trends/patterns regarding service areas that required further development, and (c) to establish the impact of information service-providers on decision-making.

Population and Sample.

1. Theoretical Population: Graduate students of Management Sciences at the Centre for Operations Excellence at the University of British Columbia.

2. Study Population: A class of 10 management sciences students at the Centre for Operations Excellence at the University of British Columbia participated in the study for the assessment of information needs.

3. Sample Population: Two graduate students of management sciences at the Centre for Operations Excellence at the University of British Columbia to track information seeking behavior for a particular project.

4. Participants' Demographics: The COE enrolls a certain number of students for the M. Sc program every semester. The class of 1999 had a total number of 10 students. Being a small group, all 10 students participated in the questionnaire for the assessment of
information needs and satisfaction levels with present services. The 10 students are further divided into 70 % males and 30 % females. The highest education level amongst 70 % is the Bachelors level while the other 30 % posses another Master’s degree. Nine out of 10 students belong to the Under 25 years age group. (see Table 4).

Two students working on one project participated in the overall study where the focus was tracking the information seeking behavior.

Table 4
Demographic Information

<table>
<thead>
<tr>
<th>Gender</th>
<th>N = 10</th>
<th>Responses</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>7</td>
<td></td>
<td>70</td>
</tr>
<tr>
<td>Female</td>
<td>3</td>
<td></td>
<td>30</td>
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</table>

<table>
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<td>-</td>
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<td>1</td>
<td>30</td>
</tr>
<tr>
<td>Bachelor’s</td>
<td>5</td>
<td>2</td>
<td>70</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Age</th>
<th>Male</th>
<th>Female</th>
<th>%</th>
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<td>Under 25</td>
<td>6</td>
<td>3</td>
<td>90</td>
</tr>
<tr>
<td>26-35</td>
<td>1</td>
<td>-</td>
<td>10</td>
</tr>
<tr>
<td>Above 36</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
5. Sample Design: A convenience sample, or what Babbie (1990) refers to as purposive or judgmental sample was selected for the study. Two masters students of management sciences working on a project at the Centre for Operations Excellence at the University of British Columbia were the subjects for the investigation. Although researchers (Creswell, 1994; Palys, 1997; & Powell, 1997) have commented on the pitfalls of a convenience sample, the scientific rigor for sample selection was not deemed necessary. The intention of the study was to explore the life cycle of the phenomena of information seeking, not to achieve results that could be generalized to a larger population. That does not eliminate the possibility of conducting longitudinal studies with the same group in the future, neither would it be a deterrent to postulating a hypothesis.

Data Collection Protocols. Instruments for data collection were designed for both the users and the researcher. Data was gathered using the following methods:
(a) Logs were used to maintain and record information on a day-to-day basis in a format developed by the researcher. An example of the blank log is included as Appendix V. Logs were completed by the two users.
(b) Weekly meetings between the researcher and both users validated the data collected in the logs. Data was compiled in the form of notes by the researcher. See Appendix VIII for researcher’s discussion topics.
(c) Unstructured interviews were used to get a deeper understanding of the way the users processed information. Each participant was individually interviewed at each stage. The interview at every stage lasted for 45 minutes. The total time for all the three stages for each participant was 135 minutes. The interviews resulted in notes which were taken by the
researcher. See Appendix VIII for the researcher's note-taking format and Appendix VII for the interview questions. The researcher tried to minimize researcher bias by maintaining objectivity and not over-reacting to responses. The researcher encouraged the participants to talk more and interrupted only when necessary. Other factors taken into consideration were maintaining an informal stance and holding the interview in a private setting.

(d) A questionnaire was administered to all ten students to assess their information usage-study the behavioral trends with regard to usage of different sources and type of information for their projects, their satisfaction levels with service providers and search intermediaries (such as computer systems, retrieval systems, databases), and to gauge the influence of factors such as location, time, etc.

Analysis

Data analysis. The purpose of any research and inquiry is to produce findings. In Patton's (1994) words, "the challenge is to make sense of massive amounts of data, reduce the volume of information, identify significant patterns, and construct a framework for communicating the essence of what the data reveal" (p. 371). This can be a rather intimidating task, especially since the onus lies on the researcher's shoulders to portray a true picture. Due to a lack of reliability and validity checks, it is of paramount importance for the researcher to fairly represent and communicate the data. Patton (1994) discriminates between description as a process of analysis and interpretation. Ideally, the latter follows the former, leading to a logical and systematic approach to the data gathered.
Application of content analysis for this study. Using the concept of content analysis, the data was segregated into primary patterns and categories. Logs were analyzed and interpreted for their content to determine the stages (initial, middle, and final) of the search process. The logs were analyzed on this basis. When the logs indicated that the users entered a new stage, the interview was administered.

Using inductive analysis, qualitative data from the log and the interview were analyzed into themes and categories. The information seeking situations were informed by studies conducted by Cheuk (1998), Cole (1998), Dervin (1983), Kuhlthau (1993), Leckie, Pettigrew & Sylvain (1996), Ross (1999), Vakari (1999), Wilson (1999), and Yang (1997) who have developed models for the Information Seeking Process. Since this research examines two participants working on one project, the numbers do not warrant codification of ideas and themes for tabulation. Descriptive written summaries brought together responses in the log. For the questionnaire, which is a quantitative tool, descriptive statistics were used to represent the data graphically in the forms of tables and diagrams.

Literature reviewed in the preceding section was constantly used as a means to focus the analysis and also in interpreting data for causes, consequences and relationships. Eventually, models were developed for the following purposes:

- To depict the search process, the logic and the pattern of the search behavior.
- To identify the usage of sources in the respective stages.
- To develop a model for improved searching and service delivery in management sciences.
Limitations of methodology. Problems encountered during the course of the study were: (a) small sample size from a small study population. The sample population consisted of two participants working on one project. A study of all the students working on different projects is expected to have elicited additional perspectives and revealed varying dynamics, (b) inability to access relevant information, namely there was restricted access to the client’s intranet which was integral to the student analysts’ work but not accessible to the researcher. This would have been a definite asset in the process of evaluation of the search behavior. An involvement with the project throughout its life cycle would have also enabled different outcomes and affected evaluation, and (c) time constraints did not allow the researcher to spend much time with the participants, neither did it allow the researcher to observe the participants’ search behavior during information retrieval or their interaction with the information service providers. The researcher had to rely on data provided by the participants. Weekly meetings with the participants ensured a rapport, but the meetings were brief, lasting 15 minutes with each participant.

Results may also reflect an instrumentation bias, especially defects implicit in qualitative methods where the researcher bias may play a role in interpretation/misinterpretation and the ability to account for the participants’ shortcuts with regard to the recall of their tasks and related search activity.

Procedures

Procedures. After having identified the scope of the study, a draft of the questionnaire was prepared. The questions were logically sequenced to systematically lead the participant from one stage to the next. The supervisor evaluated the draft three times prior to the final copy. The data gathering instruments were pre-tested on a random sample of three students
from different graduate programs. Participants understood and interpreted the questions with ease, which allowed the researcher to proceed with administering the same on the research population. In contrast, the log evolved and developed as the study progressed. Useful suggestions from the research population were included to facilitate accurate responses and also to further provide answers to the research questions. During the interview, the researcher made sure that the atmosphere was friendly. This was not a difficult task, since the researcher had already been interacting with the participants at regular intervals. Participants were aware of the purpose of the study even before the logs were given to them. Weekly meetings ensured three things: (a) a clarification and verification of the text in the log, (b) further qualification of the text to determine the stage of the life cycle of the information seeking behavior, and (c) an opportunity to build a rapport with the participants. At the time of the interview, the researcher once again gave a brief introduction to the study, stressed the importance of the person's participation, and assured anonymity and confidentiality. Following the interview, the researcher verified all the data briefly with the participant at the end of the session. This functioned more or less like a transcript for confirmation of accuracy of the answers.

Approvals and Permissions. Before undertaking the study, approval was sought from the Director, Centre for Operations Excellence at the University of British Columbia to explore the feasibility of the project. This meeting first took place in late August, 1999 followed by another meeting on October 19, 1999. Subsequently, an informal meeting with the other faculty member (the Associate Director) on November 5, 1999 resulted in permission to proceed with the study. Two students, who were then on the brink of a new
project, volunteered for the research. On obtaining informal approvals, formal approval was received from the Behavioral Research Ethics Board, The University of British Columbia as the study entailed human subjects.

Implementation

Data collection. Data was gathered using the combination of the methods outlined in the preceding sections. The blank logs forms (developed by the researcher) were handed over to the two students. During the first meeting, the purpose of the study and the way the log should be used was explained. This meeting also operated as an ice-breaking session. Students were also assured of their anonymity and confidentiality. Each week, the students e-mailed their completed logs before the weekly meetings. Data in the logs were verified during these meetings. Analysis of the logs was a constant process to determine the progress and stage of searching.

In the second period, interviews were administered on the basis of the step inferred from the analysis of the logs. Interviews were conducted with each participant individually. Each interview lasted for approximately 35 minutes. Participants at this step were once again informed of the aim of the study. Each interview started with asking the participants to reflect back on the project they were working on. They were encouraged to share their experience with the completion of their project. The indication for differentiating between the steps of information seeking were based on prior studies done by other researchers. For the purpose of this study, the periods were divided into three steps – Initial, Middle, and Final. The main questions pertaining to each step were:

(a) What questions flash through your minds in this particular stage?
(b) What strategies did you use to get answers to your questions? Why did you choose this strategy? Which strategies did you reject? Why?

(c) Did you face any problems in getting answers? What problems? How did you resolve the same?

(d) How does each answer help (or fail to help) you to carry on with your tasks?

(e) What is your feeling at this stage?

At the same time as the third step of the interview, questionnaires were administered to a class of 10 graduate students of Management Sciences to determine information usage. To eliminate the possibility of unreturned questionnaires, these were handed out when the group had a class and collected there and then. The researcher gave a brief overview of the study, its objective and purpose and assured the participants of their confidentiality and anonymity. An ID number identified the questionnaire. The participants did not have to put their names anywhere. Completing the questionnaire took approximately 15 minutes for each participant.

Problems encountered. In the process of gathering data, problems encountered were essentially with regard to time. During the data-gathering stage, much time was lost due to various breaks during the semester. This period may be considered a lax stage, where the information seeking activity came to a stand still. Due to this setback, the time schedule to administer the interviews and questionnaire was revised. Meetings with participants were cancelled a few times due to an unforeseen change in their time schedule when they had to meet with their clients. However, that problem was checked to an extent by rescheduling meetings with the participants on other days.
Chapter Summary

The case study method and the sense making approach were used to study the information seeking behavior and the resulting information needs of the master's students of management sciences at the Centre for Operations Excellence, University of British Columbia. Data gathering instruments such as logs, interviews using the unstructured questions and a questionnaire were used to delve and probe into the qualitative and quantitative aspects of the search behavior. Using content analysis, logs were analyzed to determine the stage of information seeking. Interviews further allowed the exploration of the cognitive, affective and physical aspects of the search process. The researcher engaged in constant evaluation at every stage and during the process of data collection. Weekly interactions between the researcher and the students enabled a continuous dialogue. Evaluation and analysis resulted in the interpreting and categorizing of data into concepts and themes and recommendations for further actions, research and studies.
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<tr>
<td>Revise questionnaire if necessary</td>
<td>January, 2000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethics Review Form</td>
<td>Submitted on January 31, 2000</td>
<td></td>
<td>Received approval</td>
</tr>
<tr>
<td>Cover letters</td>
<td>Submitted in January, 2000</td>
<td></td>
<td>Received approval</td>
</tr>
<tr>
<td>Consent forms</td>
<td>Submitted in January, 2000</td>
<td></td>
<td>Received approval</td>
</tr>
<tr>
<td>Administering interview</td>
<td>Stage 1 – Jan 31, 2000</td>
<td>45 minutes each participant</td>
<td></td>
</tr>
<tr>
<td>Administering Interview</td>
<td>Stage 2 and 3 – March 20, 2000</td>
<td>45 minutes each participant</td>
<td></td>
</tr>
<tr>
<td>Administering the questionnaire</td>
<td>March 31, 2000</td>
<td>15 minutes for each participant</td>
<td></td>
</tr>
<tr>
<td>Data entry and verification</td>
<td>Every week since January 14, 2000</td>
<td>4 months Up to March 24, 2000</td>
<td></td>
</tr>
<tr>
<td>Data analysis (from logs and interview)</td>
<td>Every week since January 14, 2000</td>
<td>4 months Up to April 18, 2000</td>
<td></td>
</tr>
<tr>
<td>Task</td>
<td>Dates</td>
<td>Duration</td>
<td>Status/Comments</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>------------------------------</td>
<td>-------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Data analysis (themes)</td>
<td>Every week since January 14, 2000</td>
<td>4 months</td>
<td>Up to April 18, 2000</td>
</tr>
<tr>
<td>Data analysis (integration)</td>
<td>March 19, 2000</td>
<td>Up to April 8, 2000</td>
<td></td>
</tr>
<tr>
<td>Preparing the final report (thesis)</td>
<td>February 1, 2000</td>
<td>Up to April 8, 2000</td>
<td></td>
</tr>
<tr>
<td>Printing and distribution</td>
<td>April 8, 2000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Findings

This chapter provides the findings and results of the data collection and analysis. Research data and questionnaire results are reported according to research questions. A summary of the findings is included at the end of the chapter. Wherever possible, descriptive statistics are presented in tables.

Research Design

The sense-making theories of Dervin and Kuhlthau have led to an exploration of research questions relating to the IS behavior. This research is a user study of graduate students in management sciences. Aspects of their information seeking behavior, including their perceptions, the value they place on different types of information sources and services, and their attitudes, feelings, and decisions were examined. Values and perceptions of a management class of 10 students were studied through use of a written questionnaire. The process of information seeking behavior of a sample of two students was studied in a more detailed manner through use of logs, weekly meetings and interviews. Tabulations of the data from the questionnaire presented a description of information usage; and illuminated a set of broad issues and problems. Comparing the data in logs, meetings and interviews triangulated these findings. Content analysis of the data was done to search for patterns. Results were compared with models and theories from the literature review; and two models were developed for this user group. The information seeking process model describes the stages of information seeking while a tentative user model is an attempt to enable users to make
decisions that will better focus their own research. Conclusions include recommendations for action and for future research.

The research goals were based primarily on Dervin’s and Kuhlthau’s theories, a research methodology was built from the sense-making approach and case study methodologies. The research questions established were:

The specific research questions explored were:

1. What patterns of IS behavior emerge from the logs and the minutes from the weekly meetings? How can these patterns be represented in a meaningful way?
2. What sources of information are the most important for the users, and on what criteria do they decide thus?
3. Can a connection be made with the concept of "zones of intervention?"
4. What are the implications for information literacy issues?
5. What problems and perceived barriers did the users encounter when attempting to access business information, and what else hampered their searches?
6. What are the implications for the UBC library system as an information service provider?

The methodology for this research into the IS behavior was based on case study and sense making methodology. An entire class of 10 students participated in the study through a written questionnaire, which was intended to be a snapshot of their information usage. The questionnaire is the only quantitative tool used in this research design. The qualitative tools (logs, meetings, and interviews) were built to amplify the results from the questionnaire, and
to probe into the process of information seeking. Analysis of the results from both tools produced insight into the users' information needs (IS+IR=IN).

Findings

Information Usage: Descriptive Data from Questionnaire

Appendix IX is the blank questionnaire that was administered to 10 students and their responses are reported and tabulated based on the following information usage variables:

- Sources of Information
- Importance of various sources
- Types of Information
- Satisfaction with Information Providers (i.e., UBC libraries)

1. Sources of information: frequency of usage: This data comes from question 4 of the questionnaire in Appendix IX. Books are used by 30% of the students to a great extent, and journals are used to a considerable extent. Findings reveal (see Table 5) that 60% used journals and electronic journals for research. This once again has implications on services offered by service providers.
Table 5
Sources of Information: Usage

<table>
<thead>
<tr>
<th></th>
<th>To great extent (e.g. weekly)</th>
<th>To considerable extent (e.g. Bi-weekly)</th>
<th>To some extent (e.g. Monthly)</th>
<th>To little or no extent (e.g. Once in 3 months)</th>
<th>N/A or No response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Books</td>
<td>3 30</td>
<td>2 20</td>
<td>3 30</td>
<td>1 10</td>
<td>1 10</td>
</tr>
<tr>
<td>Journals/ ejournals</td>
<td>2 20</td>
<td>6 60</td>
<td>- -</td>
<td>2 20</td>
<td>- -</td>
</tr>
<tr>
<td>Reports</td>
<td>- -</td>
<td>3 30</td>
<td>- -</td>
<td>4 40</td>
<td>3 30</td>
</tr>
<tr>
<td>Bibliographies</td>
<td>- -</td>
<td>1 10</td>
<td>2 20</td>
<td>5 50</td>
<td>2 20</td>
</tr>
<tr>
<td>News Bulletins</td>
<td>- -</td>
<td>- -</td>
<td>1 10</td>
<td>6 60</td>
<td>3 30</td>
</tr>
<tr>
<td>Newsletters</td>
<td>- -</td>
<td>- -</td>
<td>- -</td>
<td>7 70</td>
<td>3 30</td>
</tr>
<tr>
<td>Patents</td>
<td>- -</td>
<td>- -</td>
<td>- -</td>
<td>7 70</td>
<td>3 30</td>
</tr>
<tr>
<td>Trade publications</td>
<td>- -</td>
<td>1 10</td>
<td>4 40</td>
<td>3 30</td>
<td>2 20</td>
</tr>
<tr>
<td>Others</td>
<td>2 20</td>
<td>- -</td>
<td>- -</td>
<td>1 10</td>
<td>7 70</td>
</tr>
</tbody>
</table>
2. Importance of various sources: This data comes from questions 5 through 7 of the questionnaire in Appendix IX.

In the current environment, a combination of sources was used to obtain information, but some media held more value over others. Influenced by factors such as location of the resources, the perceived value and benefit of the sources, and the physical access point to the sources will determine the precedence of one media over the other. Tables 6–8 describe the favored media. Of course, other crucial factors such as time and availability were also at play as indicated by the comments. As one participant commented: “sources are used depending on type, source, time, etc…”

Table 6 suggests that UBC libraries were used to a great extent by 30 %, while 50 % used it to a considerable extent. The statistics are indeed pointers to the regularity with which the libraries were used as a location for information.

Table 7 indicates that the Internet, informal meetings with colleagues and email is used excessively to access information. A participant commented: “most of my research is done on the Web / Online – ABI Inform and INFORMS”.

Table 8 shows how students valued the importance of sources based on the benefit to them with respect to their projects. The Internet and informal meetings were considered highly beneficial, followed by browsing journals and formal meetings. An important finding though was that although 50% find the Internet highly beneficial, 40% find it only slightly beneficial. The numbers are very close, and warrant more research and delving to ascertain the reasons for this varying perception.
Table 6
Location of Information

<table>
<thead>
<tr>
<th></th>
<th>To great extent (e.g. weekly)</th>
<th>To considerable extent (e.g. Biweekly)</th>
<th>To some extent (e.g. Monthly)</th>
<th>To little or no extent (e.g. Once in 3 months)</th>
<th>N/A or No response</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>UBC libraries</td>
<td>3</td>
<td>30</td>
<td>5</td>
<td>50</td>
<td>1</td>
</tr>
<tr>
<td>Internal Resource Center</td>
<td>2</td>
<td>20</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>Public Libraries</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>6</td>
</tr>
<tr>
<td>Others</td>
<td>3</td>
<td>30</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
</tbody>
</table>

83
Table 7
Accessing Information

<table>
<thead>
<tr>
<th></th>
<th>To great extent (e.g. weekly)</th>
<th>To considerable extent (e.g. Bi-weekly)</th>
<th>To some extent (e.g. Monthly)</th>
<th>To little or no extent (e.g. Once in 3 months)</th>
<th>N/A or No response</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Internet</strong></td>
<td>8%</td>
<td>80%</td>
<td>1%</td>
<td>10%</td>
<td>-</td>
</tr>
<tr>
<td><strong>Online-Vendor</strong></td>
<td>2%</td>
<td>20%</td>
<td>1%</td>
<td>10%</td>
<td>-</td>
</tr>
<tr>
<td><strong>Databases</strong></td>
<td>1%</td>
<td>10%</td>
<td>2%</td>
<td>20%</td>
<td>-</td>
</tr>
<tr>
<td><strong>Intranets</strong></td>
<td>6%</td>
<td>60%</td>
<td>2%</td>
<td>20%</td>
<td>-</td>
</tr>
<tr>
<td><strong>Informal</strong></td>
<td>2%</td>
<td>20%</td>
<td>4%</td>
<td>40%</td>
<td>-</td>
</tr>
<tr>
<td><strong>meetings</strong></td>
<td>2%</td>
<td>20%</td>
<td>3%</td>
<td>30%</td>
<td>-</td>
</tr>
<tr>
<td><strong>with colleagues</strong></td>
<td>8%</td>
<td>80%</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Formal</strong></td>
<td>-</td>
<td>-</td>
<td>2%</td>
<td>20%</td>
<td>-</td>
</tr>
<tr>
<td><strong>meetings</strong></td>
<td>-</td>
<td>-</td>
<td>5%</td>
<td>50%</td>
<td>-</td>
</tr>
<tr>
<td><strong>E-mail</strong></td>
<td>-</td>
<td>-</td>
<td>3%</td>
<td>30%</td>
<td>-</td>
</tr>
<tr>
<td><strong>Faxes</strong></td>
<td>-</td>
<td>-</td>
<td>1%</td>
<td>10%</td>
<td>-</td>
</tr>
<tr>
<td><strong>Telephones</strong></td>
<td>-</td>
<td>-</td>
<td>3%</td>
<td>30%</td>
<td>-</td>
</tr>
<tr>
<td><strong>Others</strong></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3%</td>
<td>30%</td>
</tr>
</tbody>
</table>

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Table 8
Perceived Benefit: Importance of sources

<table>
<thead>
<tr>
<th>Activity</th>
<th>Highly Beneficial</th>
<th>Beneficial</th>
<th>Slightly Beneficial</th>
<th>Not Beneficial</th>
<th>Does not apply</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Browsing books</td>
<td>2  20</td>
<td>5  50</td>
<td>2  20</td>
<td>1  10</td>
<td>-</td>
</tr>
<tr>
<td>Browsing journals</td>
<td>4  40</td>
<td>5  50</td>
<td>1  10</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Reviewing industry reports</td>
<td>1  10</td>
<td>2  20</td>
<td>5  50</td>
<td>-</td>
<td>1  10</td>
</tr>
<tr>
<td>Scanning bibliographies</td>
<td>-</td>
<td>-</td>
<td>3  30</td>
<td>3  30</td>
<td>4  40</td>
</tr>
<tr>
<td>Reviewing in-house publications</td>
<td>2  20</td>
<td>1  10</td>
<td>3  30</td>
<td>-</td>
<td>4  40</td>
</tr>
<tr>
<td>Reviewing Patents</td>
<td>-</td>
<td>1  10</td>
<td>-</td>
<td>1  10</td>
<td>8  80</td>
</tr>
<tr>
<td>Scanning trade publications</td>
<td>-</td>
<td>4  40</td>
<td>-</td>
<td>2  20</td>
<td>4  40</td>
</tr>
<tr>
<td>Browsing the Internet</td>
<td>5  50</td>
<td>1  10</td>
<td>4  40</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Browsing Online databases</td>
<td>3  30</td>
<td>2  20</td>
<td>1  10</td>
<td>1  10</td>
<td>3  30</td>
</tr>
<tr>
<td>Browsing Intranets</td>
<td>1  10</td>
<td>2  20</td>
<td>-</td>
<td>1  10</td>
<td>6  60</td>
</tr>
<tr>
<td>Informal meetings with colleagues</td>
<td>6  60</td>
<td>3  30</td>
<td>-</td>
<td>-</td>
<td>1  10</td>
</tr>
<tr>
<td>Formal meetings</td>
<td>4  40</td>
<td>3  30</td>
<td>2  20</td>
<td>-</td>
<td>1  10</td>
</tr>
<tr>
<td>UBC Libraries</td>
<td>2  20</td>
<td>5  50</td>
<td>3  30</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Public Libraries</td>
<td>-</td>
<td>1  10</td>
<td>1  10</td>
<td>2  20</td>
<td>6  60</td>
</tr>
<tr>
<td>Consultation with librarian</td>
<td>1  10</td>
<td>1  10</td>
<td>1  10</td>
<td>1  10</td>
<td>6  60</td>
</tr>
</tbody>
</table>
3. Types of information used: This data comes from question 8 of the questionnaire in Appendix IX.

As shown in Table 9, student analysts used several types of information for their projects. But as statistics indicate, company information and numeric data was used most often. Seventy percent of students used these. The least likely type of information used were geographic information and legal and regulatory information. These findings should be taken into account when developing or even sustaining services and collections for the user group.

The fact that company information was used so regularly, such data should be readily available. Another type of information qualified by some participants was technical information on specific operations methodologies.

Table 9
Types of information used

<table>
<thead>
<tr>
<th>Types of information used</th>
<th>Responses</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company information (eg. financial statement, annual reports...)</td>
<td>7</td>
<td>70</td>
</tr>
<tr>
<td>Industry information</td>
<td>6</td>
<td>60</td>
</tr>
<tr>
<td>Competitor Information</td>
<td>5</td>
<td>50</td>
</tr>
<tr>
<td>Geographic information</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Economic information (eg. Forecasts, economic trends)</td>
<td>5</td>
<td>50</td>
</tr>
<tr>
<td>Numeric data (eg. statistics, stocks...)</td>
<td>7</td>
<td>70</td>
</tr>
<tr>
<td>Legal and regulatory information</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>Information on Technology</td>
<td>5</td>
<td>50</td>
</tr>
<tr>
<td>Administrative information</td>
<td>3</td>
<td>30</td>
</tr>
<tr>
<td>Other (Please specify)</td>
<td>3</td>
<td>30</td>
</tr>
<tr>
<td>“research methods / approach to modeling”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>“technical information on specific methodologies.”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>“work is mostly theoretical”</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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4. Satisfaction with Information Providers: This data comes from questions 9 and 10 of the questionnaire in Appendix IX.

To assess the value of information providers and the satisfaction levels with the same, data on the usage of services, the relevance, accuracy, currency and timeliness was gathered. When analysts were asked to comment on their initial contact with the librarian, 40% said that they were moderately satisfied, while another 40% stated that they rarely contacted the library. 20% did not comment or respond. Hence, only 60% used the library. The results are a little contradictory for even those who commented that they had not used the library, have commented on their satisfaction levels with regard to accuracy, relevance, currency and timeliness of the data. Table 10 describes the trend.
Table 10
Services / Satisfaction: (Relevance, Accuracy, currency and timeliness)

<table>
<thead>
<tr>
<th>Comments</th>
<th>Very Satisfied/Always</th>
<th>Satisfied/Almost always</th>
<th>Moderately Satisfied/Sometimes</th>
<th>Dissatisfied/Almost never</th>
<th>Very Dissatisfied/Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Rarely contact the library</td>
<td>1</td>
<td>10</td>
<td>2</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>2. Never asked for information.</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>3. Electronic journals</td>
<td>2</td>
<td>20</td>
<td>4</td>
<td>40</td>
<td>-</td>
</tr>
<tr>
<td>4. Internet</td>
<td>-</td>
<td>-</td>
<td>5</td>
<td>50</td>
<td>1</td>
</tr>
<tr>
<td>5. No publication of INFORMS</td>
<td>2</td>
<td>20</td>
<td>4</td>
<td>40</td>
<td>1</td>
</tr>
<tr>
<td>6. Online publication of INFORMS</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>30</td>
<td>4</td>
</tr>
<tr>
<td>7. Electronic journals</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>30</td>
<td>4</td>
</tr>
<tr>
<td>8. Internet</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Summary of Findings: the Questionnaire

The questionnaire demonstrated that:

- informal channels are used more avidly in information seeking than formal channels,
- information service providers are not consulted on a regular basis,
- UBC libraries are very rarely used,
- factors such as time, location, motivation, cost, perception, feedback play an integral role in information seeking and task completion,
- satisfaction with services of service provider are based on the relevance, currency, timeliness and accuracy of information provided, and
- usage of information is weighed against the benefit to analysts.

Information Usage: Data from Logs and Interviews

The qualitative data consists of logs filled out by the users and notes that the researcher took during meetings and interviews. Notes from 15 discussions (including meetings and interviews) include the questions from the worksheet (Appendix VIII), the researcher’s comments to the students and the researcher’s reflective log.

The data from the logs, meetings and interviews were analyzed for the same variables relating to information usage as in the questionnaire (in Appendix IX), and were analyzed for patterns of information seeking behavior.
The information usage variables are:

- Sources of information
- Importance of various sources
- Types of information
- Satisfaction with information providers (i.e., UBC libraries)

Analysts do not use the libraries as much as they use information gathered from personal contacts, peers and clients. Even when they used the library services, journals were used to a considerable extent followed by the usage of books. The location of access points made this task simpler. The university library was used to a considerable extent. Eighty percent used the library services as an access point. The information accessed was usually from the Internet and e-mails while the type of information considered beneficial was informal meetings with colleagues and clients and browsing the internet. In its totality, the satisfaction with services was still considerably low.

Patterns of IS Behavior: Observations from Logs

Following after Kuhlthau, Bruner, Kelly, and Taylor, the researcher analyzed the logs and meeting notes for cognitive, affective and physical aspects of the information seeking activity. Patterns were sought based on changes in these aspects. Examples enabled the researcher to develop a model of the information seeking behavior.
**Information seeking process.** The technique/strategy for information-seeking changed throughout the life of the project. In the beginning of the project, when the business problem was not yet or not well defined, the strategy was to look for any information that could give an overview of the client organization and its operations. No specific subject was defined, but a general search for higher-level information was used. As the consulting engagement progressed, the information gathering became more focused upon the problem. Any documentation that related to the topic of research, the case management process, was found to be useful. Even further into the project, most salient information was found through various contacts within the company who referred or recommended various information sources (be it an information system database, process documents, first person interview, etc.) As the project progressed, a need to find published information increased. Throughout the project, relevant information became progressively easier to find.

**Observations.** The two users, referred to as Analyst 1 and Analyst 2 for the purpose of this study went through various steps to complete their project. Analysts’ behavior changed throughout the project when gathering information to complete their tasks. Changes in three aspects (cognitive, affective, and physical) are described in a search for patterns. A model based on these patterns is proposed. Criteria for seeking information and strategies used are reported.

Significant changes observed in the data from the logs and interviews are described in numbered categories as follow:

1. **Cognitive:** The cognitive actions at this point were exploratory in nature. The analysts had prior information on the kind of project they would be working on. They knew the client, but
were to determine tasks associated with the completion of the project. Their very first step was to gather as much information as they could to have an overview of various activities performed by the client. With respect to this, the analysts went through an exploratory period where information was sought from published reports, the client’s intranet and other case studies on similar projects in other sectors like banking and finance. Analysts 1 and 2 share the questions that flashed through their minds when the project was announced:

<table>
<thead>
<tr>
<th>Thoughts of Users at start of their project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyst 1</td>
</tr>
<tr>
<td>• What is the project all about?</td>
</tr>
<tr>
<td>• It seems to be pretty broad in scope.</td>
</tr>
<tr>
<td>• Should I limit the scope? If so, How?</td>
</tr>
<tr>
<td>Analyst 2</td>
</tr>
<tr>
<td>• What does the client organization do?</td>
</tr>
<tr>
<td>• What is their mandate?</td>
</tr>
<tr>
<td>• Where to look for all this required</td>
</tr>
<tr>
<td>information?</td>
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<tr>
<td>• What information would be useful?</td>
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</tbody>
</table>

_Affective_: Observations of the affective aspect at the beginning of the project included feelings of apprehension and an uncertainty of the outcome. Analysts’ statements in the log and the interview express these emotions.

<table>
<thead>
<tr>
<th>Expressions of users’ feelings of at start of the project</th>
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<tr>
<td>• For example, Analyst 1 was concerned with defining the</td>
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<tr>
<td>problem and worried about how the project would</td>
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<tr>
<td>culminate into a thesis without a profound research</td>
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<tr>
<td>objective. S/he was also worried about satisfying the</td>
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<tr>
<td>client and the faculty.</td>
</tr>
<tr>
<td>• Analyst 2, on the other hand was apprehensive but also</td>
</tr>
<tr>
<td>excited with the range of problems in the client’s</td>
</tr>
<tr>
<td>system and thereby the numerous opportunities to select</td>
</tr>
<tr>
<td>a problem for the purpose of the consulting project.</td>
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Physical: The physical attributes at this point translated into exploratory tasks.

For example, the analysts defined the tasks as: investigation of e-files, researching protocols, interviewing executives, and reviewing cash outflows. Reviewing these would enable them to pinpoint a specific focus. The type of information required for the purpose was any information on financials and its analysis, and a lot of information from within the client's intranet. This would enable them to understand better the processing system, adapt better working models, and in general enhance understanding.

Over a period of time, subtle changes were observed.

(2) Cognitive: With regard to the cognitive aspect, users had succeeded in defining their tasks and they knew that they would be going through a lot of information once it was acquired. But they also realized that they had to narrow the focus to rule out objectives that did not appear to be feasible. Of particular importance is that the scope of the users' project was defined in their report at that time; that detail is not included in this study as it is confidential at the request of the client and the users.

As analyst 1 maintained the scope was clear and also the topic had been narrowed down to an investigation of only one branch of the client organization.

Affective: There were corresponding changes in the users' feelings at this point. Although feelings of uncertainty persisted, there was also a shift towards finding firm ground and thereby some certainty that they were moving in the right direction.

Physical: Users continued in the exploration of general information to get an overview of the topic. Resources consulted at this point were the client's intranet, process maps, internal presentations, reports, journal articles, drawing from the instructor's knowledge and also
from an analysis of informal meetings with peers. Readily accessible information continued to be important.

A turning point in their pursuit towards the project completion was the establishment of a focus for delimiting their approaches to a solution for the project. Armed with a focus, the users were able to reshape their approach resulting in changes in all three aspects.

(3) Cognitive: Following the focus activities of users was to keep abreast of previously identified topics and maintaining awareness of the different types of models and techniques that could be applied to their project. The information monitored was also reviewed constantly to make presentations to their peers and colleagues. Information on related topics was also regularly sought to keep abreast of developments.

- Analyst 1 mentioned in the log and the interview that maintaining a knowledge of the different models and techniques was important to decide on the most feasible course of action.
- Analyst 2, on the other hand, reviewed various software used for simulation purposes.

Affective: Analysts went through feelings of increasing confidence and certainty. But an element of frustration also crept in during this period. It was not so much so related to the progress on the project as to finding relevant information. At this stage, with the excessive use of sources such as texts and journals, analysts faced a lot of difficulty in (a) acquiring latest editions of texts and reference sources; (b) accessing electronic material, especially in their use of vendor-based online databases; and (c) finding sufficient information in print resources on their subject i.e., operations management and simulation techniques.
Analysts found the collection in the library lacking on these subjects as was expressed in their interviews.

**Physical:** Resources consulted at this stage were once again company intranets, published reviews, primary information in terms of consulting the staff at the client organization and professors and instructors. An important finding here is the use of libraries and their services. While this service provider was not used previously, the use of the same at this point of time have implications which are discussed in the next chapter. Both analysts use this intermediary to access information on reference texts, specific journal articles and specific software. Internet is also used effusively to make searches on various conferences in the field of management sciences.

(4) **Cognitive:** This activity was demonstrated by analysts’ actions with regard to the information they had gathered and assessed. From amongst the information, importance and relevance of the information was decided on the basis of their prior knowledge and applicability. Time, cost-effectiveness, relevance and prior knowledge were important factors enabling the decision to retain data.

For example, comments by Analyst 1 on using simulation as a technique was indicative of this statement. Analyst 1 was aware of a model and had knowledge of the same through the courses taught in the graduate program. The rationale for the selection was also based on the faculty’s expertise. In the analyst’s words, “narrowing down or selection of a particular model does not necessarily mean that other models were evaluated.” In fact, the analyst emphasized that the model was selected exclusively due to prior knowledge and faculty expertise.

**Affective:** The feeling associated with this period was one of confidence and in control of the situation.
Analyst 1 said that there was “reduced uncertainty, know a lot about the process hence feeling confident, comfortable ‘cause have learnt a lot over the past few months. Regardless of the end-product, the learning itself will hold in good stead for a long time due to its intrinsic value”.

**Physical:** Resources consulted at this point were primarily instructors, peers and resources available from the client organization. Data was verified with the instructors and against processes available on the e-files and information technology systems available at the client organization. The staff at the client organization was observed for verification of tasks and models.

(5) **Cognitive:** Data gathered was at this point was further interpreted for developing and determining the next phase of their project. This represented a very important aspect of the seeking process. The interpretation and analysis of the data determined the feasibility and the success of the project.

**Affective:** Analysts went through mixed feelings at this stage. They were at once confident and apprehensive since they would receive confirmation and approval on their interpretation and analysis of the problems and situations. In cases of misinterpretation or a failure to pinpoint the problems would result in the repetition of prior actions. A feeling of apprehension is not so much associated with the result itself, but with coming to terms with personal failure and high expectations of themselves.

Analyst 1 comments:
- Challenge is how to convey what you know and have learnt effectively to satisfy both UBC and the client.
- Confident that there is content there and data is good to make a case.
Physical: It is important to note that the key resources are the faculty and the client. They were of prime importance since faculty were the experts who would confirm solutions, while clients would confirm the feasibility of the solution.

(6) Cognitive: At this point in time, analysts were expected to showcase the project. An analysis, results and the report were presented to the client in all its totality.

Affective: This stage was accompanied with a feeling of excitement and confidence.

Analyst 1 comments, “Working on the project has been an interesting and a learning experience. Different executives and staff bring differing perspectives”.

Physical: This period is considered the ‘winding up’ period. There is no indication of the information seeking activity although there could conceivably be instances of fact checking and revision.

An examination and observation of the interplay of the three variables -- cognitive, affective and physical -- resulted in the information seeking process model for this user group of student project analysts. See table 11 for a visual representation and a description of the stages that comprise the process. At the point when the users decide their focus for their project, their behavior and related activities changed the most in terms of the entire process. Thus, the process is divided into the pre-focus phase and the post-focus phase. Most subtle changes have prompted the creation of stages within the phases. The pre-focus phase consists of the task defining and focus forming stages. The post-focus phase consists of the monitoring and reviewing, selecting, interpreting, and presenting stages.
Analysis

Information Seeking Process Model

Based on the changes observed in the logs, meetings and interviews, the following model of the information seeking process model of student analysts emerged.

Table 11

An Emerging Model of Information Seeking Process of Student Project Analysts

<table>
<thead>
<tr>
<th>Stage</th>
<th>Feeling</th>
<th>Choice of Sources</th>
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<tbody>
<tr>
<td><strong>Pre-Focus Phase</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task Defining</td>
<td>Anxiety, Frustration, Confusion, Overwhelmed</td>
<td>Internal sources. Ones handed over by instructor / professors. Easily available sources.</td>
</tr>
<tr>
<td>Focus Forming</td>
<td>Less anxiety, but same amount of confusion with the data</td>
<td>Reports and other published information available on the client organization’s intranet</td>
</tr>
<tr>
<td><strong>Post-Focus Phase</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitoring and Reviewing</td>
<td>Dissipating anxiety and increasing certainty but also frustration</td>
<td>Reference texts, Modeling and simulation websites. Internet, conference sites, primary and secondary sources</td>
</tr>
<tr>
<td>Selecting and Sieving</td>
<td>Confident, in control of the situation</td>
<td>Client organization’s case management processes, client organization’s database</td>
</tr>
<tr>
<td>Interpreting</td>
<td>Confident, comfortable and in control</td>
<td>Data gathered through primary collection, client organization staff</td>
</tr>
<tr>
<td>Presenting</td>
<td>Confident but anxious, excited due to the challenge and anxious that results work</td>
<td>Internal - to instructor and peers and client organization executives</td>
</tr>
</tbody>
</table>

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Like the users in Kuhlthau's study (1991), the focus forming stage was a turning point for the student project analysts which impacted their information seeking behavior. The changes were more pronounced in their affective aspects than the physical activities. The criteria used for seeking and the strategies applied exemplify this behavior.

**Users' Criteria for making Decisions within the IS Process**

The users encountered a decision-making opportunity during their pre-focus phase. During the task defining stage and the focus forming stage, they had an array of information available to them from the client's intranet, the various reports, manuals and policies as well as other consulting projects. All this information made it difficult for the analysts to decide on a focus and define the problem for the purpose of the project. At this point, their difficulties in making a decision on what sources or information should be used was even more pronounced. Criteria such as time, relevancy and availability were other factors that affected information seeking as emerged from the logs and interview and questionnaire. Of importance also was the influence wielded by instructors as was prior knowledge or experiences with information intermediaries. The importance of the resources consulted affected information seeking. When the realization dawned that there was a lot of searching and filtering to be done, it was decided to refer to information that was easily available and accessible. For example, Analyst 1 uses a technique for the project based on prior knowledge and instructor's expertise rather than looking for other techniques for comparison and decision. The analysts often decided to turn back to the reports for detailed perusal to glean information for the project. Time was of paramount importance in the searching activity. For example, the total time spent on the activity during the first three months on the project was
about 38 hours between the two analysts. This fact emerges from the data, although time spent on the project itself in terms of meetings, data gathering, processing the information, making internal presentations, etc. is factored in. If the information was found to be irrelevant, analysts abandoned their search. Similarly, when resources were not easily available when searching the online databases such as ABI Inform and the library catalogs, they did not pursue the searching any further.

The findings reveal that when students met with a problem with regard to searching the library catalogs or electronic resources, they settled for whatever was available and did not consider it worthwhile to pursue the search. There was a belief that all the information would be available from the intranet and that would suffice. Another disturbing fact is that when the students faced difficulties with regard to retrieving information from the catalog, it never occurred to them to contact the librarian.

Users' Information Seeking Strategies

A strategy is an approach used to perform an activity. In the pre-focus phase, the search strategy varied from source to source. The main approach was through subject and keyword searching. For example, when looking for annual reports and internal presentations on the intranet, keywords such as “process”, “case management”, and “productivity” were used. When searching backfiles at the Centre that are not indexed or scanned, searching was done alphabetically by title of the paper. In the case of acquiring a process map from the client organization, it was a simple case of asking for it. In a couple of instances the material was handed down by the instructor/professor or the client organization staff.
In the post-focus stage, the search strategy was more specific. Analysts used specific title or author searches. During the post-focus stage, it was important to verify information from informal sources against published information.

Summary of Findings

In the pre-focus phase (task initiation and focus formulation stages), resources most often consulted were the client organization’s annual reports; Intranet and the Internet; previous presentations made to the organization by COE; and process maps. Informal meetings and consulting the professor at this stage were common. Lastly, journal articles were referred to supplement information. Most of these resources were rated of high importance based on the purpose of the information the analysts required. Both published and confidential information was sought, but it was general and exploratory in nature. The idea was to get as much information as possible to enable the analysts to define and identify various problems for the client organization.

The purpose of consulting such resources at this time was exploratory in nature. Students were still to determine the objectives of the project. In the students’ words: “the purposes of referring to these resources are for: (a) initial data gathering, (b) for a better understanding of the system, enhance understanding, define and understand tasks, (c) to understand the process, (d) to adopt prior working models, (e) to ensure relevancy, and (f) to ensure project progress.

The difficulties they faced in the access of data ranged from too much information in some cases to too little in others. For instance, information from the client organization web site was considered too superficial. It did not have information that was proprietary in nature.
To access this they had to obtain permission to look through the intranet. This was tied in to the time factor. The delay in gaining access caused a delay in defining tasks and processes. Another area where time was a major constraint was in the access to journal articles. The analysts expected to find full text electronic articles. The analysts also found a vast range of information in reports and internal presentations, but they had trouble in the initial phases in deciding on relevant information. A feeling of confusion and uncertainty accompanied this phase.

In the post-focus phase (which includes monitoring and reviewing, selection, interpretation and presentation stages), once the analysts had decided on a focus, usage of resources was a little different. The most often consulted resources were the client organization manuals and policies. The Intranet and the Internet site of client organization was not as often used as it was in the earlier phase. Previous presentations made to the client organization by COE, process maps and the process database were used more prominently. Informal meetings and consulting the professor was also common during this stage. Additionally, the UBC libraries were used to access specific books and texts on methodology, processes and operations. Most of these resources were rated of high importance based on the purpose of the information the analysts required. The analysts were at a stage of verifying published information against practical processes. The purpose of retrieving all the information was focused on the tasks and problem identified in the prior phase. The analysts were now gathering primary information for the project.

The difficulties they faced in the access to data ranged from too much information in some cases to incomplete information in others. Most difficulties or barriers to acquiring information were imposed by the client organization itself. Most problems were related to
administrative areas, for example, (a) acquiring permission to access the process database took up more than three weeks, (b) when students needed staff to demonstrate the working of the system, they ran into staff too new on the job to be able to answer intricate questions. This was tied in to the time factor. The delay in gaining access caused a delay in verification of tasks and processes. Another area where time was a major constraint was in the access to books and resources from the UBC libraries. The main complaint related to the collection of books and texts on their topics. The library was lacking in its collections on operations methodology, basic texts, and updated books and new editions on software (especially the Statistical Analysis Software). They expected to find latest books that the analysts had seen on Amazon.com. Furthermore, too much information from reports and internal presentations made it difficult for the analysts to choose and select the relevant data.

Despite too much information, the student analysts knew the objectives; hence the accompanying feeling was that of reducing uncertainty and increasing confidence.

Conclusions

(a) Students lament the fact that UBC library is not well equipped with regard to print sources and information on research techniques in operations, modeling and simulation. One student comments, “The UBC sources (journals, books) on management science are very sparse. I used them frequently in my undergraduate program, but have had to resort to other media since I came to UBC”.

(b) The high usage of certain types of information over others illustrates the information need of the students on the one hand, and the services to be offered by the service providers, on the other. Students rate company, industry and competitor information combined with numeric
data and economic indicators very highly. Information on IT is sought with regularity as well. Since participants comment on the currency of print resources, service providers should have a balanced collection of electronic and print resources.

(c) Analysts go through 6 stages of information seeking – task defining, focus forming, monitoring and reviewing, selecting and sieving, interpreting and presenting. The stages are divided into pre-focus and post-focus stages and feelings and the type of sources used vary according to the stage.

(d) Analysts preferred information gathered through inter-personal channels. Information or even knowledge of resources often came from friends, peers and instructors. The nature of consulting being such, client organization’s intranets, internal IT systems, reports, policies and manuals are constantly used to gather data or check progress of the project. (e) Perceptions of relevance, accuracy, currency and timeliness were factors that played a role in the perception of the students towards service providers and also in decision making to retain information or seek information within sources.

(f) The main factor that influences behavior is the time factor. The time spent on searching during the stages is an indication that when the activity takes up too much time, students either abandon the activity totally or settle for whatever information is available.

(g) A number of students prefer the usage of electronic sources to the use of print sources.
(h) During the process of information seeking, barriers to access to information from the client's side were administrative in nature. In some cases, the information was too superficial resulting in frustration. Other barriers were drawbacks in the staff consulted for the project.

(i) Electronic information and accessing information remotely was considered time saving initially, but students ran into problems with regard to these when they could not find full-text articles.

(j) Findings also reveal that analysts hardly ever visited the library physically. They barely used the services of the library be it for instruction or needing help with searching various databases. In fact, even when searching was unsuccessful, it never occurred to the students to approach the librarian for help. Instead, they settled for whatever was available or abandoned the search totally.

Chapter Summary

Information seeking activity. The technique/strategy for information-seeking changed throughout the life of the project. In the beginning of the project, when the business problem was not yet or not well defined, the strategy was to look for any information that could give an overview of the client organization and its operations. No specific subject was defined, but a general search for higher-level information was used. As the consulting engagement progressed, the information gathering became more focused upon the problem. Any documentation that related to the topic of research, the case management process, was found to be useful. Even further into the project, most salient information was found through
various contacts within the company who referred or recommended various information sources (be it an information system database, process documents, first person interview, etc.). As the project progressed, a need to find published information increased. Throughout the project, relevant information became progressively easier to find.

Information retrieval and satisfaction with current services. Analysts do not use the libraries as much as they use information gathered from personal contacts, peers and clients. Even when they used the library services, journals were used to a considerable extent followed by the usage of books. The location of access points made this task simpler. The university library was used to a considerable extent. Eighty percent used the library services as an access point. The information accessed was usually from the Internet and e-mails while the type of information considered beneficial was informal meetings with colleagues and clients and browsing the internet. In its totality, the satisfaction with services was still considerably low.
Discussion of Findings, Conclusions and Recommendations

Major Findings

This investigation reports on a qualitative and a quantitative study of the information seeking behavior and needs of graduate students of management sciences. The purpose of the study was to examine the behavior in its entirety, taking into consideration the interaction of cognitive, affective, physical and situational processes and factors that give rise to the information needs and also play a role in the selection of intermediaries (such as computer systems and information service providers).

Patterns of Information Seeking

The findings revealed that the analysts went through a series of stages in information seeking to complete and attain the objectives of the project. Six stages were identified: (1) Task defining, (2) Focus forming, (3) Monitoring and reviewing, (4) Selecting and sieving, (5) Interpreting, and (6) Presenting.

These stages were recurrent and iterative. Under circumstances of insufficient information that did not allow the analysts to proceed with their project, a stage may be repeated prior to moving on to the next stage. Analysts demonstrated a range of seeking behaviors: exploratory, purposive, associative, but above all, it appeared to reflect the subjects’ intention and purpose. They typically engaged in exploratory behavior at the beginning of the project. Task definition was the central purpose. Exploring and surveying the information was important to gain a deeper knowledge and a better understanding of the
project. In the initial stages, especially during the pre-focus phase, activities focused around obtaining literature that gave them an overview and the status of the subject field. It was deemed important to find background information to determine the elements of a new project. Informal personal contacts and retrospective searches were the primary means of exploring. Retrospective searching was done by going through various manuals, policies, and annual reports of the client.

Once goals had been defined and the tasks were clear, the student analysts engaged in associative searching for related information to substantiate their knowledge. They engaged in proactive searching to interconnect their information. This was typical of the monitoring and reviewing stage. Both formal and informal channels of information were used to keep abreast of the progress of the project, reviewing techniques and software for the project, and various applications of techniques in similar situations or cases.

As student project analysts progressed from one stage to another, their searching was more focused. They knew what they were looking for. Information sought at this stage was deliberate. This was reflected in their strategies of using direct search (for example, by author and title fields, as against subject searching). Exploratory browsing declined and they engaged in associative searching and seeking.

During the post-focus stage of selecting and sieving, the relevance of the sources played an important role. Sources were consulted on the basis of how well these answered the questions. It was dependent on the analysts' perception and varied from project to project. Informal channels of information or primary channels of information superceded the importance of secondary channels. Information from sources was then analyzed and interpreted for the purpose of presenting it to the client.
Student project analysts went through a range of searching behaviors but accidental searching occurred very rarely in the course of their project. Their one objective was to find enough information with regard to their task. They weighed searching for information against the time it took. In cases that required too much exploration, they settled for second-best information, as they did not want to waste time in looking for any extra information. Typically, most information was weighed against cost and time. Students also believed that if they had more information, processing the bulk of the data would only take up time.

Thus, information seeking occurred in the context of task achievement and was affected by various factors such as time, cost, prior knowledge, feedback, motivation and experience and the perceptions of the analysts. Figure 1 portrays the information seeking stages, with the factors which have the most influence over the stages. Each stage is depicted in the ovals while the boxes in the periphery depict the factors. The arrows show the direction of the process. Stages lead to task completion.
Figure 1. Information Seeking And Factors Affecting Stages

TIME

Task Defining
Company information
Sources Recommended by
the instructor
Informal contacts

Focus Forming
Easily accessible sources
Internet
Client intranets
Annual reports
Historical data

MOTIVATION

Monitoring & Reviewing
Journals
Conference proceedings
Methodologies
Internet

Selecting and Sieving
Client reports, Policies,
Manuals and intranets
Primary information
sources (colleagues, peers,
instructors)

FEEDBACK

Interpreting
Client reports, Policies,
Manuals and intranets
Primary information sources
(colleagues, peers,
instructors)

Presenting
To peers, colleagues and
clients

PERCEPTION

COST

EXPERIENCE
Correlation Between Information Stage and Variables

As already noted, the information seeking process consisted of six stages. The following discussion illustrates the correlation between the stage several aspects:

(1) Sources: Analysts selected and weighed the sources based on the goals of the project. In the first two stages, they typically used sources that were both suggested by their instructors and client. Concurrently, they also searched the Internet and library catalogs to obtain an overview of the literature on their topic. The belief that any and all information would be useful also determined their choice of sources although the client’s databases and processing system was favored over other sources. During the pre-focus phase that comprised task definition and focus formulation, one would have expected the use of journals and other information that is available electronically. Surprisingly, the student analysts did not refer to these. Instead, they appeared to be satisfied with whatever was available from the client. But this activity of consulting information service providers occurred in the monitoring and selecting stage. Library catalogs, the Internet and vendor-based databases were used with more regularity than in the earlier stages. In the latter three stages that were a part of the post-focus stage, specific sources were used more diligently. Instructors, the client, and peers were consulted for verification and double-checking of the information gathered and analyzed for the eventual purpose of presentation and reporting.

(2) Strategies: Searching strategies were different only during two stages. In the preliminary stages, analysts browsed and sifted information, making relevance judgments and retaining whatever appeared to be important from the sources mentioned above. Keyword searching was prominently used. As analysts moved on to different stages, the searching became more
focused and specific, especially when they were monitoring information for confirmation of techniques, tools and models for their research. Searches were based on a particular author or a particular paper and particular systems and software.

(3) **Feelings**: At each stage, the analysts experienced a series of feelings. In the initial stages they wandered into the project with a feeling of apprehension and confusion. They were unsure of how they would define the problems for the client and how these would match up to their own expectations of the outcome. But as they progressed through the stages, acquiring information and making sense out of it, the feelings gradually changed to ones of certainty and clarity of their tasks and focus. At times the feeling of frustration accompanied the stage as some information was difficult to access and the pressure to perform always existed. As they neared the last two stages, although the feeling of confidence persisted, the feeling of doubt once again crept in. This was more to do with the acceptance of their ideas than not having some knowledge of the project. In the final stage, feelings of excitement and relief set in.

(4) **Needs**: Each stage was associated with a need for different types of information. The findings reveal that not only are sources unavailable to the analysts due to an inadequate collection, but in some cases the searching techniques in the electronic environment may be absent. The sources required for each stage may be divided into those that are acquired from formal channels and those acquired from informal channels of information. The findings reveal the excessive use of company information and numeric data, followed by industry
information. The qualitative data from the interview indicated the use of differing sources during the stages. These may be used as parameters for a service model.

**IS and Interpreting Models**

Drawing from quantitative and qualitative methods – interviews, logs and the questionnaire – recording the behavior of student analysts when approaching problem solving or completion of tasks, a model of the information seeking process was established. This model corroborates findings in the behavioral models determined by Cheuk (1998, 1999), Ellis (1997), Kuhlthau (1991), and Yang (1997).

Drawn from the various protocols, the model of information seeking is established to explore the dimensions among student analysts in a learning environment where the central issue is task completion. The emerging model hence centers on “tasks”. It describes the process used to search, assess, select resources and use them for decision-making. It also sheds light on the information needs in terms of process, and how these needs are actually met.

Yang’s (1997) classification scheme developed vis-à-vis a hypertext database system is applicable to the students search process in general. Yang describes three main categories: (a) different types of searching and retrieving, where users demonstrated eight types of searching in their processing which are prescriptive, purposive, exploratory, associative, intuitive, accidental, curious and tangential in nature; (b) evaluating the content for relevance and usability, where the users evaluated the content in terms of usefulness for long-term goals and their tasks to decide on retention or rejection; and (c) managing information load, where users managed the load by applying three means to regulate capacity, storing the
information and dealing with disorientation. Student analysts, the study population for the current study conformed to categories a and b as was revealed through the interviews and logs. With regard to category c, while students analysts did retain relevant information on their desktops in anticipation of requiring it later in their project, they did not reveal any patterns with regard to the other two aspects.

In the course of completing their project, the students engaged in constant goal-defining and redefining, modifying, and reflecting upon the information they had. These activities were similar to those described by Kuhlthau (1991, 1993) and Cheuk (1998, 1999). The study showed that the students progressed from what seemed to be chaos to order, from uncertainty to certainty, from fuzziness in thinking to clarity in their problem solving. It is essential that in the early stages of information seeking and making sense out of it, exploration be accompanied by these feelings. The study findings point to agreement with Yang who says, “before the learners can think mindfully and reflexively, some degree of confusion, disorder or disorientation is indispensable” (1997, p. 89). In addition, an exploration will add to the knowledge base by bringing awareness of the type of information available and eventually will lead to confidence and certainty.

Information Seeking (IS) is an integrative process of continuous reading, linking, and composing. It is dependent on the components of selecting, reading and extracting. IS is contingent upon a variety of thinking processes that include executive control (goal-setting, defining the task, reviewing), reflexivity and intertextuality (cross-referencing), reasoning and affective responses (Yang, 1997). Executive control pertains to activities with which students organize their plans for achieving their goals and schedule the activities they will need in accomplishing their tasks. They continually summarize and review their progress
toward their goals. They consciously keep track of what has been done, what remains to be done, and whether satisfactory progress is being made. The student analysts constantly made connective inferences to achieve their hypothesis. Reflexivity is a continuous process done by monitoring and reporting on the effectiveness of strategies in goal accomplishments.

Furthermore, the analysts constantly engaged in complex and subtle activities to filter and sieve information to identify the suitability for their tasks. Affective responses are integral and natural in any cognitive process and as the study findings reveal, it is accompanied by feelings such as anxiety, uncertainty, doubt, apprehension, frustration, excitement, relief and satisfaction.

The IS activities in the study were governed by and subject to goal attainment. Student analysts were involved in defining and refining their tasks to achieve the objectives of the project. They continually refined, expanded and modified their representation on the one hand, and also reviewed, verified, and tested their solutions to the problem. Information was also constantly recycled. It may be emphasized that these processes were evolving and iterative and in cases of insufficient information, the process was repeated.

**Summary of Analysis**

The study provides a model in the life cycle of a project and the role of information seeking within the framework. When working on projects, the activity takes place around task completion. Various stages demonstrate that information seeking is most extensive in the initial stages. Both formal and informal channels are extensively utilized. When analysts progress through preliminary stages to advanced stages and become more knowledgeable and specific about the problem, they also become increasingly selective. One-on-one
communication becomes dominant. Information seeking is iterative and new situations in the life of the project trigger the chain of searching.

Six stages of the information seeking process were identified:

- task defining,
- focus forming,
- monitoring and reviewing,
- selecting and sieving,
- interpreting and
- presenting.

Analysts went through a range of feelings and emotions during these stages when seeking and gathering information. The need for both internal and external sources was intertwined. Strategies used to access and seek information were dependent on and changed from stage to stage.

The findings of a questionnaire demonstrated that:

- informal channels are used more avidly in information seeking than formal channels,
- information service providers are not consulted on a regular basis,
- UBC libraries are very rarely used for consultation with the information professionals,
- factors such as time, location, motivation, cost, perception, feedback play an integral role in information seeking and task completion,
- satisfaction with the services of the service provider are based on the relevance, currency, timeliness and accuracy of information provided, and
- usage of information is weighed against the benefit to student analysts.
Conclusions

(a) Information seeking is a complex cluster of problem solving processes ranging from the thoughtful orchestration of defining, selecting, organizing, using and deploying information. The nature of the process is "adaptive, recursive, multifaceted, opportunistic and affect-linked" (Yang, 1997, p. 89). It calls into play a broad range of processes such as surveying, monitoring, reasoning, filtering, evaluating, and interpreting – all accompanied by affective responses. Information seeking is a complex activity that starts off with an exploratory stage accompanied by feelings of anxiety and uncertainty. But in the progression of one stage to the other, when tasks were determined, the analysts seemed to move into a different stage characterized by confidence and self-assurance.

(b) Information seeking is situation-based; the process is always situated in context. The students' information seeking activity was guided and mobilized by [a] the completion of the tasks to attain the objectives, [b] the time factor, and [c] influenced by the accessibility and availability of information from various service providers and intermediaries. The analysts' decision with regard to the kind of information to be accessed, selected, and retained was governed by the overriding goals envisioned for the project.

(c) The analysts' exploratory behaviors and their differing navigating patterns reflected the strategies that seemed best suited to their purpose.
(d) The analysts did not follow a prescriptive, pre-determined plan. At best, their behavior can be described as purposeful but extemporaneous. They did not follow any linear course of action, rather, actions were based on the 'need of the hour', adapting to the current situation.

(e) Student analysts gathered information from numerous sources such as colleagues, journal articles, etc. but primarily rely on the instructor, the client as a source, and colleagues and peers for information. Information from other sources such as the Internet and from other search intermediaries, are of secondary importance and supplement their knowledge.

(f) Information seeking is based on the awareness of sources. The study verified that an awareness of resources (online database, library, etc.) and prior experience with the same, either adds to or mars the analysts' perception, and thereby, the usage and seeking of information. According to Leckie et al. (1996), four variables that affect the process are (a) prior success with the resources (results obtained from strategy or source), (b) trustworthiness (how reliable or helpful), (c) packaging (convenience and usefulness), and (d) timeliness (found when needed), cost (relative cost-effectiveness), and quality (level of detail and accuracy). All these factors played a role to some extent or the other in the analysts' behavior.

Recommendations

Recommendations for Action

(1) Information Literacy and Bibliographic Instruction: Information literacy has emerged as one of the key issues as determined by responses from the logs and the interviews with
student analysts. The concept has been in existence since the 1960s but has more recently come to prominence. The term is commonly defined as “the ability to access, evaluate, and use information from a variety of sources” (Doyle, 1992 cited in Cheuk, 1998). Bruce (1997, cited in Cheuk, 1998) has shown that information literacy is seen as: (a) using information technology for information awareness and communication, (b) finding information from appropriate sources, (c) executing an information process, (d) controlling information, (e) building a personal knowledge base in a new area of interest, (f) maneuver knowledge to gain novel insights, and (g) use information wisely for the benefits of others. Bruce (1997) recommends an intermingling of approaches (i.e., behavioral and constructivist) to arrive at a relational approach to information literacy. The behavioral approach describes information literacy in terms of attributes of a person (skills, knowledge, attitudes). The constructivist approach describes how learners construct their own meaning. The relational approach focuses on how people experience a phenomenon. Related to this concept is the concept of bibliographic instruction. Findings reveal that analysts go through different stages in acquiring information. They use different resources and search strategies. Instruction and education thus should consider the overall process of searching in developing instructional programs for students. There is no “right” way of searching as the process is affected by different factors. But instruction on searching skills, especially with regard to searching the Internet, the online databases and the library catalog, will enable analysts to use the intermediary and service providers more productively, effectively, and efficiently in the context of providing better consulting service to their client.
(2) Lessons for Information Professionals and Libraries. The study identified three areas for service providers:

(a) Collection Development: The findings revealed that analysts are not very satisfied with the collection on their subject. They especially express dissatisfaction with the fact that the library does not have the latest editions of subject reference and text books, key journals, and reviews and manuals of software. Their prime concern was with the lack of important texts on research methodologies and models for management sciences. Since the Centre for Operations Excellence was established quite recently (i.e., in 1998), there is scope for the faculty and the librarian to work in partnership to develop a collection of print resources based on recommendations. Although the COE is an offshoot of the Faculty of Commerce, the very fact that the resources need developing, it may be easier to build a collection from scratch.

(b) Active Marketing: The findings demonstrate that amongst the students, 60% learned about the existence of the library through "word of mouth". While this speaks volumes of how well-known the library might be, librarians must consider marketing strategies appropriate to the services offered. For example, many analysts were unaware that the online services are a service of the library. This should be more fervently advertised on the website as banners.

The findings also demonstrated that analysts did not consult the librarians when in difficulty. At best, the library was used as a location to access some services such as the Internet and article indexes. Service providers, in this case the library, should have a mandate to provide a
session with students to teach effective searching techniques for specific assignments. It is important to ‘take the library to the users’.

(c) Partnerships with Departments: It is important that the faculty and the service providers work collaboratively to develop collections and arrange for regular in-class sessions for searching techniques.

(d) An Emerging Service Model: Based on the Information seeking stages that analysts went through, Table 12 attempts to provide guide lines for research which are adapted from Kuhlthau’s studies on the K-12 sector.
Table 12  
An Emerging Service Model

<table>
<thead>
<tr>
<th>Stage</th>
<th>Task</th>
<th>Thoughts</th>
<th>Feelings</th>
<th>Actions</th>
<th>Strategies</th>
<th>Recommended Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task Defining</td>
<td>Recognize that problems have to be identified for a project</td>
<td>Ponder on the problems. Understand the project. Relate to prior experience.</td>
<td>Anxiety, Frustration, Confusion, Overwhelmed</td>
<td>Consult peers, colleagues, instructors and the client. Browse collections within the organization and the university library. Make notes.</td>
<td>Discuss, Brainstorm, Accept feelings</td>
<td>Informal channels of information such as instructors and the client. Secondary sources like vendor databases and article indexes.</td>
</tr>
<tr>
<td>Stage</td>
<td>Task</td>
<td>Thoughts</td>
<td>Feelings</td>
<td>Actions</td>
<td>Strategies</td>
<td>Recommended Sources</td>
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<tr>
<td>Focus forming</td>
<td>Zero in onto a focus. Break up objectives into narrow tasks to be accomplished</td>
<td>Choose problem with a potential for success. Predict results. Weigh available cost and time.</td>
<td>Less anxiety, with some amount of confusion, Anticipation.</td>
<td>Browse library collections (such as books, journals, indexes and databases).</td>
<td>Discuss, Brainstorm, Contemplate, Evaluate and Analyze, Accept feelings. Use keyword searching and subject searching.</td>
<td>University library catalog, online indexes (such as ABI inform, Canadian Business and current Affairs, Econlit) and annual reports of the client organization.</td>
</tr>
<tr>
<td>Stage</td>
<td>Task</td>
<td>Thoughts</td>
<td>Feelings</td>
<td>Actions</td>
<td>Strategies</td>
<td>Recommended Sources</td>
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<tr>
<td>Monitoring and Reviewing</td>
<td>Keep abreast of information within the industry or depending on the problem, keep informed of tools, techniques and methods. Seek information to support focus</td>
<td>Predict usage, Identify themes. Correlate prior knowledge to current information</td>
<td>Dissipating anxiety and increasing certainty.</td>
<td>Correlate, Analyze. File away for further use. Read avidly. Ask and request for specific items from the library.</td>
<td>Make notes. Organize information. Use specific search terms to get key information.</td>
<td>University library catalog, online indexes (such as ABI inform, Canadian Business and current Affairs, Econlit, newspaper and periodical indexes) and annual reports of the client organization.</td>
</tr>
<tr>
<td>Stage</td>
<td>Task</td>
<td>Thoughts</td>
<td>Feelings</td>
<td>Actions</td>
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<tr>
<td>Selecting and</td>
<td>Supporting information.</td>
<td>Evaluate and assess</td>
<td>Confident, in control of the situation.</td>
<td>Evaluate material.</td>
<td>Make notes, organize data. Copy and highlight</td>
<td>Informal channels of information</td>
</tr>
<tr>
<td>Sieving</td>
<td>Discarding irrelevant data.</td>
<td>information</td>
<td></td>
<td>Organize into specific themes.</td>
<td>important aspects. Verify information.</td>
<td>(peers, colleagues, instructors)</td>
</tr>
<tr>
<td>Interpreting</td>
<td>Synthesis of information</td>
<td>Double-check outcomes.</td>
<td>Confident, comfortable and in control</td>
<td>Verify processes, techniques, models, etc.</td>
<td>Explain information. Present information</td>
<td>Instructors, peers and information</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Verification</td>
<td></td>
<td></td>
<td>internally to get feedback</td>
<td>from client organization’s intranets.</td>
</tr>
<tr>
<td>Stage</td>
<td>Task</td>
<td>Thoughts</td>
<td>Feelings</td>
<td>Actions</td>
<td>Strategies</td>
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</tr>
<tr>
<td>Presenting</td>
<td>Conclude the information search.</td>
<td>Exhaust resources.</td>
<td>Confident but anxious,</td>
<td>Make final drafts. Decide on the presentation technique.</td>
<td>Decision on visuals, graphics and oral presentations</td>
<td>Internal and client.</td>
</tr>
</tbody>
</table>
Recommendations for Further Study

Future research. Drawing on the present findings, further studies and research can validate, refine and enrich the current investigation. A number of directions for future studies are outlined as follows:

(1) A Service Model based on Zones of Intervention: In a technological and a virtual environment, the role of the computer system gains importance. Implications for professionals in this situation are: (a) to determine the level of zone for intervention, (b) to determine the questions for each zone, (c) to identify a computerized service model that emulates cognitive processes of the human mind, and (d) to develop an interface that is interactive and elicits responses from users to identify their information needs level.

Even as the user tries to use the database or the web site of the library or a service provider, the interface should be developed such that it projects a page where the users are required to answer a set of questions. These should enable the users to determine their level of requirements and accordingly search the resources which are listed against the zone. Kuhlthau’s suggestions on the ‘zone of intervention’ is extensively reviewed in chapter two of this document. This area warrants a lot more research. Since this study was exploratory in nature, longitudinal research would enable to expand on the results. The topic also extends to artificial intelligence and expert systems and thus is beyond the scope of this study.

(2) The suggested model (see Table 12) can provide a framework for new insights, or alternately, a revision maybe helpful to arrive at an effective model for the professional group, namely, management consultants. The model builds on the process model which can be further investigated.
(3) The current study is exploratory in nature, tracking the information seeking behavior of two graduate student project analysts for a particular project. The implications are that: (a) they may not necessarily be representative of the population, (b) behavior of other analysts may vary, (c) behavior of the same study group may vary with regard to a different project or when working on more than one project simultaneously. Longitudinal studies will enable to expand and enhance the current findings.

(4) As noted in the findings, analysts go through varying stages of information seeking. In the process, intervention from an intermediary would be useful based on the complexity of the tasks. Instruction on how to search and retrieve information from online databases is one of the concerns. The same group could be studied with a focus on their information retrieval behavior.

(5) Future investigations might follow a larger group of subjects throughout the entire process by using different approaches and methodologies and other data gathering instruments such as observation and maybe also shadowing. This would enable a comparison of subjects between different stages. After all, no two minds are alike. The intricacies and complexities involved and perceived allow some individuals to process things faster than the others. It would be useful to determine how subjects differ in these respects to create effective expert systems.
(6) Future studies could approach the activity with a different methodology that might yield different results. Suggested approaches maybe the application of the grounded theory and an expansion of the sense making approach.

(7) An examination of the situations that are conducive to certain behaviors would be helpful in determining efficient designing of software (expert) systems. Future studies can concentrate on strategies of effective students. This knowledge can be emulated in the retrieval system design to facilitate learning. Future research can concentrate on the practical application for professional intervention and system design.

(8) Future research could pursue a study of information seeking behavior of search intermediaries (information professionals) and compare the results with the current study population. A comparative study may shed light on behavior that might help in developing retrieval systems based on learning experiences of “keepers of knowledge”.

(9) Future research may also investigate the information seeking behavior of management consultants in the professional arena. The results of such findings may be used for a comparative study of professionals and students to reflect action at the educational level.
Summary

This chapter contains the summaries of each of the preceding chapters as follow:

Introduction

This chapter discusses the current trends in research in information seeking and behavior. It introduces the problem, the statement of purpose and the resulting research questions. Delimitations and the organization of the chapters is also laid out in the overall framework.

Review of Related Literature

The preceding literature review traces the development of the concepts and theories within the constructivist framework, borrowed theory from psychology, social sciences and communications and its application to the realm of information sciences. Early researchers in library and information studies examined the system rather than the knowledge constructs. Many researchers set out to examine the user behavior in its entirety. The user’s perspective and way of seeking was of paramount value to these researchers. Kuhlthau, Dervin and Wilson are amongst this group. Wilson (1977, cited in Kuhlthau, 1993) proposes that libraries and information systems be tailored to the way people use information in their daily lives. “Any policy for a library system should be based on an understanding of individual gathering behavior” (p. 1). Connections must be made between the ways people use information and the way libraries and information systems provide information. This more holistic view of information seeking and use is firmly embedded in the notions of cognitive change and behavioral change as central concepts.
Numerous studies have been reviewed, some focus more on information retrieval, while others focus on the process of retrieval and the factors giving rise to this need. The emerging trends are reflected in the information seeking and needs models. Some consider the individual as the starting point, others look at the organizational context, some others focus on a single work activity. The information user behavior tends to document patterns of what, how, how often, when and where of handling resources and access systems. Most studies though seem to terminate at the descriptive level.

Methods and Procedures

The case study method and the sense making approach were used to study the information seeking behavior and the resultant information needs of two Masters students of Management Sciences at UBC. Data gathering instruments such as logs, interviews using unstructured questions and a questionnaire were used to delve and probe into the qualitative aspects of the search behavior. Logs were analyzed to determine the stage of information seeking. The verbal protocol further enhanced the logs to allow for an exploration and to give an insight into the cognitive, affective and physical aspects of the search process. The researcher engaged in constant evaluation at every stage and in the ongoing process of data collection. Weekly interactions between the researcher and the students enabled a continuous dialogue. Evaluation and analysis resulted in the interpreting and categorizing of data into concepts and themes.

Findings

Information seeking activity.

The technique/strategy for information-seeking changed throughout the life of the project. In the beginning of the project, when the business problem was not yet or not well
defined, the strategy was to look for any information that could give an overview of the client organization and its operations. No specific subject was defined, but a general search for higher-level information was used. As the consulting engagement progressed, the information gathering became more focused upon the problem. Any documentation that related to the topic of research, the case management process, was found to be useful. Even further into the project, most salient information was found through various contacts within the company who referred or recommended various information sources (be it an information system database, process documents, first person interview, etc.) As the project progressed, a need to find published information increased. Throughout the project, relevant information became progressively easier to find.

Information retrieval and satisfaction with current services

Analysts do not use the libraries as much as they use information gathered from personal contacts, peers and clients. Even when they used the library services, journals were used to a considerable extent followed by the usage of books. The location of access points made this task simpler. The university library was used to a considerable extent. Eighty percent used the library services as an access point. The information accessed was usually from the Internet and e-mails while the type of information considered beneficial was informal meetings with colleagues and clients and browsing the internet. In its totality, the satisfaction with services was still considerably low.

Discussion of Findings, Conclusions and Recommendations

The study provides a nature of communication in the life cycle of a project and the role of information seeking within the framework. When working on projects, the activity
takes place around task completion. Various stages demonstrate that information seeking is most extensive in the initial stages. Both formal and informal channels are extensively utilized. When analysts progress through preliminary stages to advanced stages and become more knowledgeable and specific about the problem, they also become increasingly selective. Formal channels are discarded and one-on-one communication becomes dominant. Information seeking is iterative and new situations in the life of the project trigger the chain of searching.

Six stages of information seeking were identified: Task defining, focus forming, monitoring and reviewing, selecting and sieving, interpreting and presenting. Analysts went through a range of feelings and emotions during these stages when seeking and gathering information. The need for both internal and external sources was intertwined. Strategies used to access and seek information were dependent on and changes from stage to stage.

A user survey demonstrated that (a) informal channels are used more avidly in information seeking than formal channels, (b) information service providers are not consulted on a regular basis, (c) UBC libraries are very rarely used, (d) factors such as time, location, motivation, cost, perception, feedback play an integral role in information seeking and task completion, (e) satisfaction with services of service provider are based on the relevance, currency, timeliness and accuracy of information provided, and (f) usage of information is weighed against the benefit to analysts.

Recommendations for action and for further study were the outcome of the findings.
References


Appendix I

Glossary

Affective: That which concerns itself with feelings experienced.

Anomalous state of knowledge (ASK): Refers to a gap between a user’s knowledge about the topic and what the user needs to know to unravel the problem.

Bibliographic paradigm: Focused on collecting and classifying texts and devising search strategies for their retrieval, an approach characterized by certainty and order.

Case study method: Research which focuses attention on observing each individual, event or situation closely with the goal to understand the individual thing in a detailed manner rather than to understand characteristics of a group of people or aggregate of things or events.

Client organization: The organization with whom the user group under study worked for their consulting project.

Cognitive: "Thoughts concerning both processes and content" (Kuhlthau, 1991)

Cognitive aspect: That which concerns itself with areas of the mind

Cognitive gap: See ASK

Cognitive maps: Refers to the users’ mental picture of information gained from prior experience and education.

Computer system: Computerized information system.

Constructs: “A thing constructed, esp. by the mind” (Barber, 1998, p. 303); people understand the world through the constructs in their minds; these constructs guide their information seeking behaviors.

Constructivist approach: A research method based on constructionism, “the view that we actively construct reality on the basis of our understandings, which are largely, though not completely, culturally shared” (Palys, 1997, p. 412)

Convenience sample: A type of non-probabilistic sample, for "which the probability of selecting each sampling unit is unknown or unknowable" (Palys, 1997, p. 420)

E-Files: Electronic files accessible from the client organization
Expert system: "A software application that seeks to capture expertise in limited domains of knowledge and experience and to apply this expertise to solving problems" (Laudon & Laudon, 1998, p. 648).

Formal channels: Those channels of information that are documented and are accessible in a various media/format.

Grounded Theory: "Grounded theory seeks to generate theoretical statements and, ultimately, complex theories based on empirical evidence, although it can be used in different ways and reach various degrees of complexity" (Correia & Wilson, 1998, 1)

Human – computer interaction: The interaction between users and the computing system.

Inductive analysis: "Immersion in the details and specifics of the data to discover important categories, dimensions, and interrelationships; begin by exploring genuinely open questions rather than testing theoretically derived (deductive) hypotheses. (Patton, 1990, p. 40)

Informal channels: Those channels of information that are not recorded anywhere such as peers, colleagues, instructors.

Information: "Data that have been shaped by humans into a meaningful and useful form" (Laudon & Laudon, 1998, p. 649).

Information management: Managing and controlling information for easy access for the users. It usually comprises the acts of acquiring, organizing and disseminating data.

Information needs: Refers to needs arising for information to solve problems, find solutions, or the gap between a task and solution.

Information professionals: Individuals who have undergone rigorous training in Library Studies and who are professionals who work in the arena of information, bringing technology and users together.

Information resources: “Are the services, the packages and the support technologies and systems used to generate, store, organize, move, and display these packages". (Taylor, 1986, p. 8) or all sources that have a potential to generate information or those that contain information such as books, journals, etc.

Information retrieval (IR): Refers to searching and extracting information from a computer system, or "The tracing of information stored specially in a computer system" (Barber, 1998, p. 724).

Information seeking (IS): The activity of searching for information through various media.

Information seeking behaviors: The actions for and the process of searching for information.
Information seeking models: The graphic representation of a theory of the process of information seeking; models of information seeking intended to characterize the process of searching for desired information.

Information seeking processes: Involve construction in which the user actively pursues understanding and meaning from the information encountered over a period of time.

Information service providers: These encompass libraries and vendors of online or other information content services.

Information system: "A set of interrelated components that collect, retrieve, process, store and distribute information for the purpose of facilitating planning, control, coordination, analysis and decision making in organizations". (Laudon & Laudon, 1998, p. 649).

Intermediary: "Something acting between persons or things" (Barber, 1998, p. 735).

Inter-rater reliability: "The degree to which two or more people, using the same coding scheme and observing the same people, produce essentially the same results" (Palys, 1997, p. 416).

Intranets: "An internal private network based on Internet and Web technology" (Laudon & Laudon, 1998, p. 649).

Knowledge structures: Refers to the users' mental picture of information gained from prior experience and education.

Longitudinal studies: Studies carried out over a period of time.

Micro-Moment-Timeline Interview: A specific interview technique developed as part of the sense-making approach.

Naturalistic inquiry: "Studying real-world situations as they unfold naturally; non-manipulative, unobtrusive, and non-controlling; openness to whatever emerges – lack of predetermined constraints on outcomes" (Patton, 1990, p. 40).

Network: "Physical media and software that link two or more computers together to transmit voice, data, images, sound and/or video or to share resources such as a printer" (Laudon & Laudon, 1998, p. 651).

Networked services: Information services that are networked through the use of computerized systems.

Phenomenography: "The object of phenomenography is to explore people's different ways of experiencing or understanding or thinking about phenomena in the world" (Limberg, 1998, p.7)
Postmodernism: "A late 20th c. style and concept in the arts, architecture, criticism, which represents a departure from modernism and has at its heart a general distrust of grand theories and ideologies" (Barber, 1998, p. 1133) or ""

Qualitative approaches: "research methods characterized by an inductive perspective, a belief that theory should be grounded in the day-to-day realities of the people being studied" (Palys, 1997, p. 423)

Quantitative approaches: "research methods that emphasize numerical precision" (Palys, 1997, p. 423)

Reliability: "The degree to which repeated observations of a phenomenon – the same phenomenon at different times, or the same instance of the phenomenon by two different observers – yields similar results" (Palys, 1997, p. 424)

Remoteness: Isolated from the other professional groups or others in one's own profession or organization.

Research activity timeline (RAT): A technique built on the sense-making approach and the critical incident technique which sought to investigate information seeking behavior through the recovery of forgotten memories.

Sense making approach: a theory and methodology based on cognitive studies which examines the processes people use to search for information and meaning.

Situations-gaps-uses model: the classic model for sense making, which included the concepts of time-space context at the time sense was created, the knowledge that people were aware that they lacked, and information "helps" or "hurts".

Student project analysts: The user group for this study who are Master's students of Management sciences at the Centre for Operations Excellence, University of British Columbia.

Uncertainty: "Is a cognitive state that commonly causes affective symptoms of anxiety and lack of confidence" (Kuhlthau, 1993), and an awareness by the user/ information seeker of what they do not know.

Use studies: Refers to studies done on usage of various library services where the focus is the library service or program, such as a study of the usage of catalogs or the usage of books.

User studies: Refers to studies done on various user groups regarding their use of services, particularly information services. The focus is on user groups' perspective.

Validity: "A term that refers, in the most general sense, to whether the research measures what the researcher thinks is being measured" (Palys, 1997, p. 428)
Zone of intervention: Determined as the area where the information user can use advice and assistance.
CONSENT:

I understand that the participation of my Centre in this study is entirely voluntary and that I may refuse to participate or withdraw from the study at any time without jeopardy.

I have received a copy of this consent form for my own records.

I consent to participate in this study.

________________________________________
Administrator’s Signature   Date

________________________________________
Signature of Witness   Date

Page 3 of 3
CONSENT:

I understand that my participation in this study is entirely voluntary and that I may refuse to participate or withdraw from the study at any time without negative consequences.

I have received a copy of this consent form for my own records.

I consent to participate in this study.

________________________________________
Subject’s Signature   Date

________________________________________
Signature of Witness   Date
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<tr>
<th>RESOURCES</th>
<th>TOTAL TIME spent on the activity</th>
<th>SEARCH STRATEGY (How was the information acquired)</th>
<th>RESULT</th>
<th>COMMENTS</th>
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Appendix VI

QUESTIONS FOR WEEKLY INTERACTION WITH STUDENTS

Date: Name:

With regard to Resources:

❖ What resources did you consult?

❖ What was the purpose?

❖ How would you rate the source consulted in terms of importance on a scale of 1 to 5 where 1 is of least importance and 5 is of most importance?

❖ Did you face any difficulties with regard to the source when looking for information?

❖ What difficulties?
  - Access?
  - The information itself?
  - Unavailability of the source?
  - In Searching?
  - Did not know how to go about looking for it?

Total time spent on the activity:

❖ How much time did you spend?

❖ Why did you decide to stop at that point?
  - lack of usefulness?
  - Lack of time?
  - Found what you were looking for?

Result/Comments:
What were your feelings at the end of the activity or even while you were conducting the activity?

- Satisfied?
- Frustrated?
- Any other?

Search Strategy:

What strategy did you use to acquire information?

How did you decide on the sources you used?

- Instructor’s guidance?
- Searched the UBC web page?
- Already knew?
- Peers told you?
- Heard about it elsewhere?
- Informal conversations with staff at of client organization?

While searching what kind of keywords did you use?

- Phrases?
- Subject searching?
- Natural language?

Others:

Did you consult any resources for your enhancement and understanding of the topic for client organization?

Eg – If yu have to work on financial analysis, you would use certain techniques, did you use sources for the purpose, to double-check…
Appendix VII

Questions for the Interview

(Adapted from Bonnie Cheuk, 1999)

INITIAL STAGE

(comprises (1) the task initiating stage where participants perceive a situation in which they have a new task to work on and (2) the focus forming stage where the participants perceive a situation in which they have to gain a better understanding of how they are going to achieve the tasks.)

1. What questions flash through your minds in this particular stage?

2. What strategies did you use to get answers to your questions? Why did you choose this strategy? Which strategies did you reject? Why?

3. Did you face any problems in getting answers? What problems? How did you resolve the same?

4. How does each answer help (or fail to help) you to carry on with your tasks?

5. What is your feeling at this stage?
MIDDLE STAGE
(comprises (1) the ideas forming stage when the participants are formulating ideas and putting together a strategy to carry out the tasks. (2) Ideas confirming situation where the participants try to confirm the ideas they have formed. (3) Ideas rejecting stage where the participants reject ideas due to conflicting information or the uselessness of the information. This relies on the process of filtering and sieving of information.)

1. What questions flash through your minds in this particular stage?

2. What strategies did you use to get answers to your questions? Why did you choose this strategy? Which strategies did you reject? Why?

3. Did you face any problems in getting answers? What problems? How did you resolve the same?

4. How does each answer help (or fail to help) you to carry on with your tasks?

5. What is your feeling at this stage?
FINAL STAGE

(comprises (1) ideas finalizing situation where participants seek confirmation of their ideas to formally finalize the same. (2) Passing the ideas situation where the participants have reached the end of the processing stage. Ideas are presented to the target audience as strategies and solutions to the initial task.)

1. What questions flash through your minds in this particular stage?

________________________________________________________________________

________________________________________________________________________

2. What strategies did you use to get answers to your questions? Why did you choose this strategy? Which strategies did you reject? Why?

________________________________________________________________________

________________________________________________________________________

3. Did you face any problems in getting answers? What problems? How did you resolve the same?

________________________________________________________________________

________________________________________________________________________

4. How does each answer help (or fail to help) you to carry on with your tasks?

________________________________________________________________________

________________________________________________________________________

5. What is your feeling at this stage?

________________________________________________________________________

________________________________________________________________________
Appendix VIII

Weekly Meeting with Students - Notes

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<th>Date</th>
<th>Recordings</th>
<th>My Comments/ Suggestions to students</th>
<th>Reflective Comments to myself</th>
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Appendix IX

Assessing Information Needs Of Graduate Students of Management Sciences
A Questionnaire

*Please read through the questions carefully and check as appropriate.*

### Demographic Information

1. Please indicate your gender. (Check one)
   - Male
   - Female

2. Please indicate your highest educational degree. (Check one)
   - Ph.D
   - Master's
   - Bachelor's
   - High School Diploma
   - Other (please specify)

3. Please indicate your age. (Check one)
   - Under 25 yrs
   - 26 - 35 yrs
   - Above 36 yrs

### Sources of Information

4. Please indicate the frequency of use of the following formats for seeking information in the course of your current project in the past three months. (Check as applicable)

<table>
<thead>
<tr>
<th>Format</th>
<th>To great extent (eg weekly)</th>
<th>To considerable extent (eg Bi-weekly)</th>
<th>To some extent (eg Monthly)</th>
<th>To little or no extent (eg Once in 3 months)</th>
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<td>Journals/ ejournals</td>
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<td>Trade publications</td>
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<td>Others</td>
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### Location of Information

5. Please indicate the frequency of use of the following locations for seeking information in the course of your current project in the past three months. (Check as applicable)

<table>
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<th>Location</th>
<th>To great extent (eg weekly)</th>
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<th>To some extent (eg Monthly)</th>
<th>To little or no extent (eg Once in 3 months)</th>
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<td>Public Libraries</td>
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## Accessing Information

6. Please indicate the frequency of use of the following access points for seeking information in the course of your current project in the past three months. (Check as applicable)

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<th>To little or no extent (eg Once in 3 months)</th>
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7. Please check the appropriate column indicating the benefit to you in utilizing the following means of obtaining information.

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<th>Slightly Beneficial</th>
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Additional Comments:
8. Which of the following types of information do you usually seek for a particular project? (Check as applicable)

- Company information (eg financial statement, annual reports....)
- Industry information
- Competitor Information
- Geographic information
- Economic information (eg Forecasts, economic trends)
- Numeric data (eg statistics, stocks...)
- Legal and regulatory information
- Information on Technology
- Administrative information
- Other (Please specify):

9. Have you used the UBC Libraries?

- If YES, then please answer the subsequent questions
- If NO, then proceed to Q 11.

10. The following questions refer to the services of the Library/Information Centre at your organization.

(a) How satisfied were you with your initial contact with the Library/Information personnel? (Check one)

- Very satisfied
- Satisfied
- Moderately satisfied
- Dissatisfied
- Very dissatisfied

Comments:

(b) Were you informed of how long the process would take when you asked for library material? (Check one)

- Always
- Almost Always
- Sometimes
- Almost Never
- Never

Comments:

(c) Did you receive the material requested? (Check one)

- Always
- Almost Always
- Sometimes
- Almost Never
- Never

Comments:

(d) Did you receive the material on time? (Check one)

- Always
- Almost Always
- Sometimes
- Almost Never
- Never

Comments:

(e) Was the material you received complete? (Check one)

- Always
- Almost Always
- Sometimes
- Almost Never
- Never

Comments: