

INFORMATION SEEKING IN A VIRTUAL LEARNING ENVIRONMENT

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Duplicating a time series study done by Kuhlthau and associates in 1989, this study examines the applicability of the Information Search Process (ISP) Model in the context of a virtual learning environment.

This study confirms that students given an information seeking task in a virtual learning environment do exhibit the stages indicated by the ISP Model. The six-phase ISP Model is shown to be valid for describing the different stages of cognitive, affective, and physical tasks individuals progress through when facing a situation where they must search for information to complete an academic task in a virtual learning environment. The findings in this study further indicate there is no relationship between the amount of computer experience subjects possess and demonstrating the patterns of thoughts, feelings, and actions described by the ISP Model. The study demonstrates the ISP Model to be independent of the original physical library environments where the model was developed.

An attempt is made to represent the ISP model in a slightly different manner that provides more of the sense of motion and interaction among the components of thoughts, feelings, and action than is currently provided for in the model. The study suggests that the development of non-self-reporting data collection techniques would be useful in complementing and furthering research to enhance and refine the representation of the

ISP Model. Additionally, expanding the research to include the examination of group interaction is called for to enhance the ISP Model and develop further applications that could potentially aid educational delivery in all types of learning environments.

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## CHAPTER 1

### PROBLEM STATEMENT

#### Introduction

Working as a librarian in several academic institutions provided me with an opportunity to observe how people behave when facing situations that require them to find and use information. Over a period of years, I became convinced that there is a pattern to most information seeking behavior. In fact, information seeking behavior has been defined as the “complex patterns of actions and interactions which people engage in when seeking information of whatever kind and for whatever purpose” (Ellis, 1997, p.216). I also observed that many instructors do not take advantage of these complex patterns in designing assignments to facilitate successful information seeking behavior in their students and that many information tools are not designed in a manner that facilitates a successful learning experience for students faced with an information problem to solve. I became curious about models of information seeking behavior and how they might be used to assist instructors and instructional designers to facilitate learning experiences that require students to find and use information. This study examined one model of information seeking behavior in the context of a virtual learning environment.

As demand for virtual learning environments grows, it will become increasingly important to make decisions pertaining to the student's involvement in the learning process away from the physical presence of the instructor. Kuhlthau (1993) developed a model of information seeking behavior, the Information Search Process Model (ISP), that provides information about different stages of cognitive (thoughts), affective (feelings), and physical tasks (actions) individuals progress through when facing a situation where they must search for information to complete an academic task.

Stages	Task Initiation	Topic Selection	Prefocus Exploration	Focus Formulation	Information Collection	Search Closure	Starting Writing
<b>Feelings</b>	Uncertainty	Optimism	Confusion, frustration, and doubt	Clarity	Sense of direction/ confidence	Relief	Satisfaction or dissatisfaction
<b>Thoughts</b>		Ambiguity			Specificity		
<b>Actions</b>	Seeking relevant information			Increased Interest			

**Figure 1.** Model of the Information Search Process

If this model will accommodate virtual learning environments, instructors and instructional designers will have a protocol to assist them in designing educational materials for virtual environments that will help facilitate a successful learning experience for students faced with an information problem to solve.

### Problem Statement

Through a series of studies Kuhlthau (1993) developed the ISP Model. The ISP Model has proven to be good for describing and understanding the patterns of thoughts, feeling, and actions individuals go through when faced with a task involving an information seeking component. However, all of the existing studies to first develop and

then verify the model have taken place in the physical world – the studies were done in physical libraries. We do not know if this model of information seeking behavior is valid in different environments. For instance, do individuals behave differently when seeking information in a virtual world?

### Purpose of the Study

This study tested Kuhlthau's ISP in a virtual learning environment to judge the validity of the model in information seeking situations not tied directly to the use of a physical library facility. This model was chosen because (1) it effectively describes the student information search process in a physical environment and (2) the instrument used was validated with a large and diverse population (Kuhlthau, Turock, George, Varlejs, & Belvin, 1989).

### Significance of the Study

A movement in higher education toward distance learning, sometimes called distributed learning, has raised questions about best practices for delivering education and ensuring learning for students (Baker & Gloster, 1994; Reihardt, 1995; Twigg, 1994; Winner, 1997). This phenomenon often puts the learner in a situation where they do not rely on physical facilities traditionally associated with a college or university campus such as classrooms, laboratories, or libraries. Yet, as higher education moves to deliver education via a distance or distributed model, there are few measures in place to assist us in assessing the success of this educational delivery system. Examining how individuals function in this type of educational environment and if their learning behavior is the same as, comparable to, or different from what we know about the process of learning in

traditional educational settings would be valuable information to assist in the design of effective distributed learning (Graves, 1994).

Kuhlthau's model provides insight into how individuals seek, assimilate, and use information in a "real world" setting. This study attempted to determine if Kuhlthau's model is valid in a virtual environment. Answering this question will provide some insight into information seeking behavior that may assist in our understanding of best practices for crafting educational experiences in a virtual environment.

### Research Design

This study extends a time series study Kuhlthau conducted across school, public and academic libraries (Kuhlthau et al., 1989). This study used the same research instrument from Kuhlthau's original study in a different environment. Kuhlthau's original study was conducted in physical library facilities. This study was conducted in a virtual learning environment. Duplication of an existing study in a new environment minimized concerns of validity and sample size and still utilized an instrument that was validated with a large and diverse population. In addition, demographic data were collected from the subjects in this study in an attempt to further validate the ISP Model taking the reported computer knowledge of the participants into account.

### Research Questions

The primary research question for the study was: Does Kuhlthau's model of the Information Search Process provide an accurate description of the patterns of thoughts, feelings, and actions individuals go through when faced with a task involving an

information seeking component in a virtual learning environment? This research

question gave rise to the following specific questions:

When students use a virtual learning environment to work on a task involving an information seeking component:

1. Do participant's activities conform to the stages indicated in the ISP?
2. If the students do not demonstrate all the stages, is this behavior predictable based on assumptions in the ISP?
3. Does a student's amount of computer knowledge have any bearing on information seeking behavior in a virtual learning environment?

### Hypotheses

From the research questions above, the following hypotheses were derived:

**Hypothesis One:** Subjects given an information seeking task in a virtual learning environment will demonstrate the stages in Kuhlthau's Model of the Information Search Process.

Hypothesis One addresses research questions one and two. This hypothesis seeks to validate the ISP in a virtual learning environment.

**Hypothesis Two:** There will be no relationship between the amount of computer experience subjects possess and demonstrating the patterns of thoughts, feelings, and actions described by Kuhlthau's Model of the Information Search Process.

Hypotheses Two addresses the third research question and attempts to demonstrate that the ISP is independent of the learning environment and the particular tools used within that environment.

### Limitations and Assumptions

#### Limitations

1. The sample was a convenience sample.
2. The sample was also limited in that only students whose instructors had given an assignment with an information seeking component and had agreed to have their classes use a virtual learning environment were eligible participate in this study.

#### Assumptions

1. The instrument used is a valid instrument. The Process Survey for this study was a very slight modification of the Process Survey used by Kuhlthau in the study sponsored by the United States Department of Education Library Research and Demonstration Grant (Kuhlthau et al., 1989). In that study, Kuhlthau and her associates validated the instrument with a large and diverse sample of subjects. The only change to the Process Survey for this study was the removal of one question because it was not pertinent to the environment (Asking librarian questions) and the substitution of the words Virtual Collaborative University (the virtual learning environment used in this study) for the word library whenever it occurred.

## CHAPTER 2

### REVIEW OF THE LITERATURE

#### Introduction

The literature review outlines the theoretical framework for the ISP, examines the literature pertaining to the cognitive and affective aspects of information seeking, and traces the development of the ISP.

#### Learning as a Process

In developing the ISP, Kuhlthau based much of the theoretical framework on a constructivist perspective coming from the fields of education and psychology. John Dewey, George Kelly, and Jerome Bruner are the three primary authors whose ideas and theories form the major underpinnings of the ISP.

Dewey's work is significant on several levels. Dewey (1944) was the first educational theoretician to describe learning as an active and individual process as opposed to something that is done to someone. Dewey describes education as "not an affair of telling and being told but an active and constructive process" (p. 41). Dewey is recognized for the concept of "learning by doing" but he is also important for describing learning as a combination of both action and reflection. Dewey (1933) describes the interrelatedness of action and thought in his book How We Think. In this work he describes reflective thinking as occurring in five dynamic phases:

1. Suggestion. A state of doubt characterized by uncertainty and hesitation.
2. Intellectualization. The conceptualizing of the problem that causes phase one.
3. Guiding Idea (Hypothesis). A tentative interpretation of the suggestion that initiates or guides a search for information.
4. Reasoning. Interpreting the information and facts gathered.
5. Testing by Action. Taking some action, overt or imagined, to test the hypothesis. The results of which either produce resolution or begin the process again (pp. 106-114).

Although Dewey (1934) does not explicitly connect the interplay of thoughts, feelings, and actions, his concept of the “whole child” lays the groundwork for this view of learning with its insistence that learning takes place within the context of a whole experience in which the learner is completely engaged.

Kelly’s work as a clinical psychologist verified from a psychological perspective the constructivist theory Dewey wrote about in a philosophical sense. Kelly developed Personal Construct Theory from extensive investigation of real people acting in their real world environments.

Kelly’s Personal Construct Theory states that individuals build constructs based on their experiences to help them make sense of the world and anticipate future events.

Kelly (1955) defines constructs as:

Man looks at his world through transparent patterns or templates [sic] which he creates and then attempts to fit over the realities of which the world is composed. The fit is not always very good. Yet without such patterns the world appears to

be such an undifferentiated homogeneity that man is unable to make any sense out of it. Even a poor fit is more helpful to him than nothing at all. (pp. 8-9)

These patterns or templates are part of a person's perception and orientation toward events and help him or her to make sense of the world. They provide a frame of reference from which choices for action are made. They are highly individual. Learning comes from forming new constructs and reconstructing old ones. This is viewed as a continuous life-long processes. However, constructs are not easily discarded and adjusting a construct may be a major source of anxiety and threat. This points to one of the major contributions of Kelly's work. Kelly emphasized the influence of feelings in human behavior and decision making and described the process of construction as evolving through a series of phases identifying the predominant feelings common to each phase. For instance, Kelly states that "almost everything new starts in a some moment of confusion" (Maher, 1969, p. 151). Similar to Dewey's five phases of reflective thinking, Kelly identifies five phases of construction:

1. A new experience characterized by feelings of confusion and doubt.
2. A sense of mounting confusion and possible threat if the new experience is inconsistent with existing constructs.
3. The formulation of a tentative hypothesis characterized by feelings of clarity and relief as a direction to pursue is charted.
4. Testing the hypothesis characterized by feelings of confidence and certainty as the individual decides to accept or reject the new experience.

5. Reconstructing as the individual assimilates a new construct characterized by feelings of relief. (Bannister, 1977; Maher, 1969)

Also similar to Dewey is Kelly's use of the idea of formulating a hypothesis. This is what provides a direction of action to pursue. In Kelly's Personal Constructs Theory, the formulating of a hypothesis is vital for an individual "to break through his moment of threat to get on with the task of testing to confirm or reject the hypothesis" (Maher, p.151). Completing this phase in the cycle is vital to reaching the final phases of assessing the outcome of the hypothesis testing where new constructs are assimilated or old constructs are reconstructed into the individual's knowledge system (Bannister).

Bruner's work with perception further verifies and refines the constructive view of human thinking and learning. In particular, Bruner focuses on the following three themes: 1) knowledge, 2) knower, and 3) the knowledge-getting process. Again, similar to Dewey and Kelly, Bruner views individuals as actively involved in making sense of their environments, creating a personal understanding of information perceived, and formulating and testing hypotheses:

The perceiver is not seen as a passive and indifferent organism but rather as one who actively selects information, forms perceptual hypotheses, and on occasion distorts the input in service of reducing surprise and attaining valued objects.

(Bruner, 1973, p. 3)

Bruner (1986) views creating hypothesis as a process of interpreting and creating. Hypothesis generation allows people to "consider possible alternative personal perspectives on the world" (p. 54).

Bruner's work is also important for showing a preference for seeking redundancy in new information. People look for and recognize familiar patterns in new information that leads them to draw inferences and take action. Familiar patterns are internal models or theories that enable individuals to make predictions and take action. Unique information that does not fit neatly into an individual's already existing internal models causes tension and prompts feelings that play a critical role in motivation and learning. For instance, a high level of redundancy might result in a lack of interest and boredom while too much uniqueness may exceed the affective threshold and cause feelings of fear, threat, or being overwhelmed. Neither state is conducive to learning. The tension between uniqueness and redundancy is an important element that educators need to be aware of because the balance between them is linked to different emotional states and influences learning. "Such linkages bear upon the question of how we construct and construe the world in which we operate" (Bruner, 1986, p.113).

The work of Dewey, Kelly, and Bruner have influenced thinking and research in a number of fields including education, psychology, and library and information sciences. Kuhlthau (1993, p. 29) outlined the major concepts from Dewey, Kelly, and Bruner to show their influence on the development of the ISP in the following manner:

Table 1. Dewey – Phases of Reflective Thinking

PHASES	DEFINITION
Suggestion	Doubt due to an incomplete situation
Intellectualization	Conceptualizing the problem
Guiding Idea (Hypothesis)	Tentative interpretation
Reasoning	Interpretation with more precise facts
Action	Idea tested by overt or imaginative action

Table 2. Kelly – Five Phases of Construction

PHASES	DEFINITION
Confusion and Doubt	New experience
Mounting Confusion and Possible Threat	Inconsistent/incompatible information
Tentative Hypothesis	A direction to pursue
Testing and Assessing	Assessing outcome of undertaking
Reconstructing	Assimilating new construct

Table 3. Bruner – The Interpretive Task

PHASES	DEFINITION
Perception	Encountering new information
Selection	Recognizing patterns
Inference	Joining cluster and categories
Prediction	Going beyond the information given
Action	Creating products of the mind

In examining the literature relating to the cognitive and affective aspect of information seeking, it is easy to see the influence of the ideas and concepts from Dewey, Kelly, and Bruner.

### Cognitive and Affective Aspects of Information Seeking

Taylor's (1962) work with question negotiation began a shift toward investigating the cognitive aspects of information seeking in libraries in the fields of library and information sciences. Taylor proposed four different levels of need (visceral, conscious, formalized, and compromised) as a person works through an information seeking problem. Taylor (1968) further indicated that the individual's interest, motivation, personal characteristics, interaction with information sources, and the answer the individual anticipates or expects impact an individual's level of need. Taylor's later work in information systems design continued to emphasize the importance of understanding the user's situation – who a system was being designed for is one of the most important aspects of how a system should be designed (MacMullin & Taylor, 1984; Taylor, 1991).

Following on Taylor's work, Lancaster (1970) called for a new thrust for information science. Noting the exponential growth of published information and the amount of resources being put into the study and creation of information retrieval systems, Lancaster stressed the importance of studying the users of information systems.

Whittenmore and Yovits (1973, p226) developed a conceptual model of how uncertainty is reduced in decision making as an information seeker goes through the process of gathering and evaluating information. Their model identifies six different

types of uncertainty relating to the actions the users takes, the goals of the user, and the environment being used to locate information for the decision making:

Table 4. Types of Uncertainty

Uncertainty About	Execution of courses of action	Goals	Environment
Structural components of decision model	Structural-executional uncertainty	Structural-goal uncertainty	Structural-environmental uncertainty
Relationships among the structural components	Relational-executional uncertainty	Relational-goal uncertainty	Relational-environmental uncertainty

Yovits (Yovits & Foulk, 1985) later did a series of studies to validate the model.

This work is significant to other studies and Kuhlthau's work in particular because it links decision making situations to different stages of information gathering and assimilation.

Belkin and Robertson (1976, p.198) wrote about information science and the phenomenon of information from a cognitive perspective based on studying users. Their ideas about the spectrum and structure of information are represented in the following manner:

Table 5. The Information Spectrum

INFRA-COGNITIVE	Heredity Uncertainty Perception
INDIVIDUAL COGNITIVE	Individual concept-forming Inter-human communication
SOCIAL COGNITIVE	Social conceptual structures
META-COGNITIVE	Formalized knowledge

Belkin (1980) further expanded Taylor's concept of levels of information need in developing the framework for anomalous states of knowledge (ASK). ASK is dependent

on the individual's level of knowledge he or she brings to a topic as well as the environment and situation (Belkin, Brooks, & Oddy, 1982). Like Taylor, Belkin (1984) also worked with information system design specifically looking at using cognitive models, such as ASK, to assist with information transfer.

While Belkin's work points to the significance of emotional levels of comfort and discomfort in an individual's search for information, Bates (1979) examined "idea tactics." Idea tactics are defined as thoughts and actions that:

help to generate new ideas or solutions to problems in information searching.

These tactics are applicable to all types of searching, both bibliographic and reference searches, and in both manual and on-line systems. The focus of the tactics is psychological: they are intended to help improve the searcher's thinking and creative processes in searching. (Bates, 1979, p.280)

Working independently, different researchers began to examine the role of personal belief systems and perceptions in information seeking and publish about this topic in the 1980's. Ford (1979, p.23) pointed to the "assumptions that libraries are central to the process of learning" and noted the lack of empirical research evidence backing these assumptions. Ford called for research into "library learning" because of the advances in cognitive psychology and what was being discovered about human learning at that time. Ford (1986) examined psychological determinants of information needs and noted the different mental states and processes learners progressed through when trying to solve an information need. Ingwersen (1982) analyzed library user's search procedures and describes how user's personal knowledge structures impacted the

way they coped with the structure of the information system they were asked to use. He also found that user's expectations affected the outcome of their search for information. Similarly, Hall (1981) discussed different patterns in information seeking behavior based on the user's personal belief systems and how the information sought would ultimately be used. Blackie and Smith (1981) did a qualitative study using a series of interviews over a six week period in an attempt to uncover aspects of undergraduate students' information needs and their approaches to meeting them. James (1983), using mental mapping techniques, examined how users' perceptions of libraries impacted their information searching. Mellon (1986) did a qualitative study that explored the feelings of students using the library for research and proposed a grounded theory of library anxiety. Ellis (1989) took a behavioral approach in his study of information seeking. While the approach was different, the characteristics Ellis describes are similar to the patterns of behavior others have documented. Ellis describes six different characteristics of information seeking behavior. These are defined as:

1. Starting: activities characteristic of the initial search for information;
2. Chaining: following chains of citations or other forms of referential connection between materials;
3. Browsing: semi-directed searching in an area of potential interest;
4. Differentiating: using differences between sources as filters on the nature and quality of the material examined;
5. Monitoring: maintaining awareness of developments in a field through the monitoring of particular sources;

6. Extracting: systematically working through a particular source to locate material of interest. (p.178)

Ellis indicates these six features represent the generic patterns of information seeking and postulates that any individual pattern could be described by one of these six features.

Dervin, Jacobson, and Nilan (1982) did a comparison of quantitative and qualitative methodologies for measuring information seeking. Later, Dervin and Nilan (1986) wrote of the need for more user studies employing combinations of quantitative and qualitative methodologies. They point to a lack of models of information seeking based on real world studies of users and the potential this type of research could have for information retrieval design.

These studies are significant not only for the aspects of information seeking they examine, but also for the research techniques used. The methodologies employed include a variety of qualitative, quantitative, and combinations of qualitative and quantitative methods to attempt to examine and learn more about the information seeking process. In the section of this literature review dealing with the development of the ISP, one can see how Kuhlthau purposefully used a combination of research methodologies attempting to address some of the concerns expressed by earlier researchers of information seeking behavior.

The majority of studies about information seeking behavior take place in an academic environment. However, it is interesting to note that the few studies that have been conducted outside of an academic environment find the same types of patterns of information seeking behavior as the studies conducted in academic environments. This is

important when attempting to develop a model for predicting behavior. It is essential to determine if a model, such as the ISP, is only relevant to certain environments or situations or has wider applicability. Prentice (1981) conducted a qualitative study of selected professionals and their information seeking patterns related to their work. Prentice found differences in behavior based on knowledge level and how the information was to be utilized. Bystrom and Jarvelin (1995) also conducted a study of information seeking behavior outside of an academic environment with professional and administrative workers. Bystrom and Jarvelin reference Kuhlthau and indicate the ISP is a useful model for describing the behaviors documented in their study.

It is also interesting to note some current directions in psychology and education that have broadened the research agenda to include affective aspects of intelligence and decision making. Of particular relevance to Kuhlthau's ISP is the work of Gardner and Langer. Gardner's (1983, 1995) work with the concept of multiple intelligences has pointed to the importance of emotional and other competencies related to learning. Langer (1989, 1994) works with what has been described as the "illusion of calculated decisions" and examines the concept of responsible intelligence. Langer contends that most individuals simply follow mindless routines and other automatic behaviors without really thinking or being engaged. This is referred to as "premature cognitive commitment." Langer's work is important to consider in examining Kuhlthau's ISP because of its emphasis on emotional as well as cognitive states. Langer is able to describe cognitively how individuals commit to a certain thought path and then have grave difficulties seeing other alternatives and options because they are engaged in

emotional decision making. Emotional decision making is where an individual makes a decision based on an emotional state and then finds information to validate the decision or action after the fact. What Langer describes and her suggestions for creating a mindful state have definite implications for the areas of problem solving and information seeking.

#### Development of the Information Search Process Model (ISP)

Kuhlthau (1983) began developing the ISP with her dissertation research. This study was a longitudinal, qualitative study conducted with a group of twenty-five academically capable high school seniors with scores above ninety percent using national percentiles and grade point averages. A multi-layered approach was used for data collection including journals, search logs, short written statements, case studies, conceptual maps, the teacher's assessment of student performance, and a perceptions questionnaire. This research focused on using Kelly's Personal Construct Theory to develop a model of information seeking that incorporated the different stages of cognitive (thoughts), affective (feelings), and physical tasks (actions) individuals progress through when facing a situation where they must search for information to complete an academic task. Kuhlthau (1985, 1987, 1988a) reports further refinement of the model in a series of articles on the development of the ISP and the concept of a process approach in assisting individuals with their information seeking.

Kuhlthau (1988b, 1988c) did further longitudinal research with some of the original subjects from her initial study over a four-year time period. This study followed the subjects during four years of their undergraduate college experience. Like the original study, this study was also qualitative and employed case studies to examine the

subjects perceptions of their information seeking behavior in relationship to five different areas: selecting a topic, attitude toward academic assignments with an information seeking component, perceptions of searching for information, procedures used for gathering and organizing information, and the role mediators played in the process. Kuhlthau did find some differences that further strengthened the ISP. An important aspect of the ISP is that increased interest helps motivate individuals in their information seeking. Kuhlthau found that:

In college, the students expected to become more interested in a topic as they learned more about it in the process of a library search. The [ISP] model describes interest increasing as a search progresses. This perception provides the motivation for pushing on through the confusing, frustrating prefocus stage. (1988c, p.425)

Kuhlthau (1989, 1991) expanded development and began verification of the ISP in another longitudinal study with a sample of 147 subjects. In this study, Kuhlthau examined the ISP in relationship to high, middle and low achieving high school seniors. As in the initial study, subjects were identified as high, middle, or low achieving based on their scores according to national percentiles on standardized tests. Data from the low achieving group was incomplete and could not be used for the study, but Kuhlthau found no significant difference between the high and middle achievers other than their grades – the model of information seeking described by Kuhlthau in the ISP held for both groups.

Large scale testing and verification of the ISP was done with a grant from the United States Department of Education (Kuhlthau et al., 1989). 385 library users

participated in this study. The participants came from school library media centers, academic libraries, and public libraries. Three instruments were used for data collection, each of which had been pilot tested in a prior study: Process Surveys, Perceptions Questionnaires, and Flowcharts. The Flowcharts were used as a method for eliciting the subject's mental models of their information seeking. Qualitative and quantitative analysis was used with the Flowcharts (Kuhlthau, Belvin, & George, 1989). Quantitative analysis was used with the Process Surveys and Perceptions Questionnaires. The Process Surveys provided quantitative confirmation of the ISP:

In summary, the findings [from the Process Surveys] indicate that participants' thoughts about their topics became clearer and more focused as they moved through the search process seeking more relevant and focused information. Feelings accompanying the changes in thoughts matched those predicted in the [ISP] model, with confidence steadily increasing. Uncertainty, confusion, and frustration decreased during the process, as feelings of being satisfied, sure, and relieved increased. (Kuhlthau, Turock, George, & Belvin, 1990, pp. 22-23)

Following the large scale study for the United States Department of Education, Kuhlthau outlined a variety of directions for further research and problem application investigation. Two areas outlined for further investigation that have influenced this study are:

- Further verification and refinement of the Kuhlthau model: Does the model hold across disciplines, between novice and expert users within the same discipline, when

users move between libraries or from libraries to other sources of information in the course of a search?

- New technologies: How do the results of this study apply to the design of online catalogs, end-user bibliographic databases, [the Internet,] and search training?

(Kuhlthau et al., 1990, p. 29)

## CHAPTER 3

### METHODOLOGY

#### Introduction

This chapter describes the study's participants, the tasks performed by the subjects, the protocol and informed consent procedures used in compliance with the requirements for investigations involving the use of human subjects, the materials provided to the participants for training purposes, and the instruments used for data collection.

#### Subjects

The sample was a convenience sample drawn from students enrolled at the University of North Texas who had agreed to use virtual collaborative software or the Virtual Collaborative University (VCU). VCU is a virtual synchronous learning environment that allows students to access special tools, libraries, the Internet, and to pose questions and conduct exchanges with instructors and other students (Swigger, Brazile, Lopez, & Livingston, 1997). The sample included undergraduate and graduate students studying in the areas of education, geography, and library science.

#### Task

For the purposes of this study, only the courses using virtual collaborative software or VCU with assignments containing an information seeking component were

used. An information seeking assignment was defined as an assignment where the student must find and use materials beyond those provided by the instructor, e.g. lecture notes or required readings, to produce some type of report that was either shared with a group, the entire class, or the instructor. Three courses were identified that met the dual criteria of using virtual collaborative software or VCU and having an assignment with a information seeking component: a course in education (CECS 5210), a course in geography (GEOG 4250), and a course in library science (SLIS 5660). All three of these courses also required the students to work on the assigned academic task in groups. In each class, the groups worked together on the assigned task from initiation to completion.

In the case of the education course, CECS 5210, the students were asked to use a virtual collaborative software of their choice or VCU and worked in groups to produce an instructional design project to be turned in to the instructor. The geography course, GEOG 4250, required the students to use VCU and work in groups to locate weather pictures relating to general circulation patterns on the Internet, label the features on each image, and discuss the labeled images within their group. For the library science course, SLIS 5660, the students used VCU and worked in groups to locate a Federal Government Web site and evaluate the site based on defined criteria provided by the instructor. The students then reported about the Web site and their evaluation of it to the class. While the assignments were different, each one required the students to interact in a virtual learning environment and use materials in a virtual setting beyond the materials provided by the instructor to be successful.

## Procedures

### Training

For each class that met the criteria and agreed to participate, a training session that explained the survey instruments and how to use the VCU software was provided. The training involved an explanation of the Fund for the Improvement of Postsecondary Education (FIPSE), the work being done for that grant (Swigger, 1996), and an explanation of the doctoral research being piggy-backed off of the FIPSE research. Participants were informed that their work in the VCU was being logged for the FIPSE project, that they would be asked to fill out surveys, and that no analyses would be done that identified any individual.

The training involved a demonstration of the VCU software as well as a hands-on component where the participants actually used VCU to ensure they were comfortable with the software before they needed to use it to work on the assignment for their course. The VCU training materials are included in Appendices C - G. They consist of:

1. Fund for the Improvement of Postsecondary Education (FIPSE) Virtual Collaborative University (VCU) Consent to Participate (Appendix C). The cover sheet that informed the participants about the project and that if they consented to participate data would be collected from them for research purposes for FIPSE and this dissertation.
2. Virtual Collaborative University (Appendix D). A single page handout that provides information on how to get into the VCU system, what applications are available in the system, and how to get technical support.

3. About the VCU Tools (Appendix E). A multiple page handout that provides in-depth information about each of the tools available in the VCU and how to use them.
4. Saving Images from the Internet for Use in the VCU Whiteboard (Appendix F). A single page handout provided for the geography students to assist them with their assignment.
5. Tips for Teaming: Working Together to Achieve (Appendix G). A single page handout that provides some background information about working and learning together in cooperative groups.

The VCU software training session and materials were provided to all the classes. The students enrolled in CECS 5210 who chose to use a different form of virtual collaborative software than VCU, were provided with additional information about how to fill out the Process Surveys for the data collection phase of this study.

#### Demographic Survey

The Demographic Survey (Appendix B) was part of the data collection efforts related to the VCU FIPSE project. This instrument captured many different types of data elements that are part of the reporting requirements for FIPSE, but did not relate specifically to this study. For the purposes of this study, the only parts of the survey that were used were the responses to these questions:

- What types of operating systems have you worked on?
- How have you used a computer?

This survey was administered during the initial training session for VCU.

### Process Survey

The Process Survey (Appendix A) was administered three times during the course of the student's work on their assignment – at the initiation of the student's work on the assignment, at a mid-point of the student's work on the assignment, and at the conclusion of the student's work on the assignment. The Process Survey is a very slight modification of the Process Survey used by Kuhlthau in the study sponsored by the United States Department of Education Library Research and Demonstration Grant (Kuhlthau et al., 1989). In this study, Kuhlthau and her associates validated the instrument with a large and diverse sample of subjects. The only change to the Process Survey for this study was the removal of one question because it was not pertinent to the environment (Asking librarian questions) and a substitution of the words Virtual Collaborative University for the word library whenever this occurs. Subjects enrolled in CECS 5210 who chose to use a different form of virtual collaborative software than VCU were instructed to view the phrase Virtual Collaborative University as representing any type of virtual collaborative software when filling out the Process Surveys.

## CHAPTER 4

### DATA ANALYSIS AND RESULTS

#### Introduction

This chapter describes the sample collected for analysis, examines each of the hypothesis based on the results obtained, and compares the results to those obtained by Kuhlthau and her associates in the study sponsored by the United States Department of Education Library Research and Demonstration Grant where appropriate (Kuhlthau et al., 1989).

#### Sample

The sample was a convenience sample drawn from students enrolled at the University of North Texas who agreed to use virtual collaborative software to complete academic tasks containing an information seeking component. The sample included undergraduate and graduate students studying in the areas of education, geography, and library science. The sample was collected over the course of the following three semesters: Spring 1998, Summer 1998, Fall 1998. To be considered usable in the data set, each participant must have completed the Demographic Survey and completed the Process Survey a total of three times -- at the beginning, mid-point, and end of the work on the task. Eighty-one useable samples were collected.

### Analysis for Hypothesis One

**Hypothesis One:** Subjects given an information seeking task in a virtual learning environment will demonstrate the stages in Kuhlthau's Model of the Information Search Process.

This hypothesis seeks to validate Kuhlthau's ISP Model in a virtual learning environment. Hypothesis One addresses the following research questions:

1. Do participant's activities conform to the stages indicated in the ISP?
2. If the students do not demonstrate all the stages, is this behavior predictable based on assumptions in the ISP?

The analysis for Hypothesis One uses the Process Survey and duplicates the analysis done by Kuhlthau and her associates in the study sponsored by the United States Department of Education Library Research and Demonstration Grant (Kuhlthau et al., 1989). The results indicate participants given an academic task with an information seeking component in a virtual learning environment demonstrate the stages indicated by the ISP Model.

The first three questions on the Process Survey are designed to capture the cognitive aspects of the search question. The first question, "What are you looking for?" captured the level of information being sought at each of the three points the Process Survey was administered. The responses to the first question were coded into five categories: 0 = no response (no response), 1 = other/have not started search (not started), 2 = general information seeking (general), 3 = specific information seeking (specific), 4 = pertinent information seeking (pertinent). The second question, "Describe the topic in the

space below," sought evidence of change in the thinking process or depth of topic understanding over time. The responses to the second question were coded into four categories: 0 = no response (blank), 1 = general topic description (general), 2 = narrow topic description (narrow), 3 = focused point of view (focused). The third question, "What is the title of your project?" like the second question also sought to capture the level of thinking about the topic, but this time with a concise statement. The responses to the third question were coded into five categories: 0 = no response (none), 1 = no title yet (no title), 2 = vague title (vague title), 3 = clearer title (clear title), 4 = focused title (focused title). In keeping with the analysis done by Kuhlthau and her associates in their study, contingency tables and Chi Square were used to determine if there were any relationships and to look for any changes in the relationships over the course of the time series.

As expected from the ISP Model, a relationship is demonstrated between what the students were looking for and their topics with movement towards a more sophisticated relationship over the course of the time series. The first series especially demonstrates this with none of the participants indicating they were seeking pertinent information or had a focused point of view. The second series shows the participants were beginning to develop a more focused search for information and deeper understanding of their topics. The third series clearly shows a movement toward a search for pertinent information and focused point of view. Tables 6-8 illustrate these relationships:

Table 6. Series 1 What are you looking for? / Describe the topic

What are you looking for?	Topic			
Frequency Percent Row Pct Col Pct	Blank	General	Narrow	Total
No Response	2 2.47 66.67 16.67	1 1.23 33.33 1.72	0 0.00 0.00 0.00	3 3.70
Not Started	5 6.17 41.67 41.67	6 7.41 50.00 10.34	1 1.23 8.33 9.09	12 14.81
General	3 3.70 5.00 25.00	49 60.49 81.67 84.48	8 9.88 13.33 72.73	60 74.07
Specific	2 2.47 33.33 16.67	2 2.47 33.33 3.45	2 2.47 33.33 18.18	6 7.41
Total	12 14.81	58 71.60	11 13.58	81 100.00

Statistic	DF	Value	Probability
Chi-Square	6	22.424	0.001

Table 7. Series 2 What are you looking for? / Describe the topic

What are you looking for?	Topic				
Frequency Percent Row Pct Col Pct	Blank	General	Narrow	Focused	Total
No Response	3 3.70 37.50 23.08	1 1.23 12.50 5.00	3 3.70 37.50 6.67	1 1.23 12.50 33.33	8 9.88
Not Started	4 4.94 44.44 30.77	3 3.70 33.33 15.00	2 2.47 22.22 4.44	0 0.00 0.00 0.00	9 11.11
General	5 6.17 16.13 38.46	13 16.05 41.94 65.00	13 16.05 41.94 28.89	0 0.00 0.00 0.00	31 38.27
Specific	0 0.00 0.00 0.00	3 3.70 9.38 15.00	27 33.33 84.38 60.00	2 2.47 6.25 66.67	32 39.51
Pertinent	1 1.23 100.00 7.69	0 0.00 0.00 0.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	1 1.23
Total	13 16.05	20 24.69	45 55.56	3 3.70	81 100.00

Statistic	DF	Value	Probability
Chi-Square	12	36.511	0.001

Table 8. Series 3 What are you looking for? / Describe the topic

What are you looking for?	Topic				
Frequency Percent Row Pct Col Pct	Blank	General	Narrow	Focused	Total
No Response	4 4.94 30.77 33.33	2 2.47 15.38 11.76	4 4.94 30.77 16.00	3 3.70 23.08 11.11	13 16.05
Not Started	3 3.70 60.00 25.00	2 2.47 40.00 11.76	0 0.00 0.00 0.00	0 0.00 0.00 0.00	5 6.17
General	2 2.47 10.53 16.67	13 16.05 68.42 76.47	4 4.94 21.05 16.00	0 0.00 0.00 0.00	19 23.46
Specific	2 2.47 8.33 16.67	0 0.00 0.00 0.00	12 14.81 50.00 48.00	10 12.35 41.67 37.04	24 29.63
Pertinent	1 1.23 5.00 8.33	0 0.00 0.00 0.00	5 6.17 25.00 20.00	14 17.28 70.00 51.85	20 24.69
Total	12 14.81	17 20.99	25 30.86	27 33.33	81 100.00

Statistic	DF	Value	Probability
Chi-Square	12	64.183	0.001

Over the course of the time series, the relationship between what the students were looking for and the titles changes. This is predictable based on the ISP Model. The ISP Model predicts individuals start a project sure of what they are looking for, move through a stage of being unsure, and then become sure again as they gain experience and comfort with the topic. The time series for this study followed this pattern. The first

series shows a relationship, the second series shows no relationship, and the third series again demonstrates a relationship. Tables 9-11 report these findings:

Table 9. Series 1 What are you looking for? / What is the title of your project?

What are you looking for?	Title					
Frequency Percent Row Pct Col Pct	None	No Title	Vague Title	Clear Title	Focused Title	Total
No Response	3 3.70 100.00 16.67	0 0.00 0.00 0.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	3 3.70
Not Started	4 4.94 33.33 22.22	5 6.17 41.67 27.78	3 3.70 25.00 8.11	0 0.00 0.00 0.00	0 0.00 0.00 0.00	12 14.81
General	10 12.35 16.67 55.56	13 16.05 21.67 72.22	32 39.51 53.33 86.49	4 4.94 6.67 57.14	1 1.23 1.67 100.00	60 74.07
Specific	1 1.23 16.67 5.56	0 0.00 0.00 0.00	2 2.47 33.33 5.41	3 3.70 50.00 42.86	0 0.00 0.00 0.00	6 7.41
Total	18 22.22	18 22.22	37 45.68	7 8.64	1 1.23	81 100.00

Statistic	DF	Value	Probability
Chi-Square	12	31.056	0.002

Table 10. Series 2 What are you looking for? / What is the title of your project?

What are you looking for?	Title					
Frequency Percent Row Pct Col Pct	None	No Title	Vague Title	Clear Title	Focused Title	Total
No Response	2 2.47 25.00 9.09	1 1.23 12.50 8.33	0 0.00 0.00 0.00	5 6.17 62.50 20.83	0 0.00 0.00 0.00	8 9.88
Not Started	3 3.70 33.33 13.64	2 2.47 22.22 16.67	3 3.70 33.33 14.29	1 1.23 11.11 4.17	0 0.00 0.00 0.00	9 11.11
General	12 14.81 38.71 54.55	6 7.41 19.35 50.00	8 9.88 25.81 38.10	4 4.94 12.90 16.67	1 1.23 3.23 50.00	31 38.27
Specific	5 6.17 15.63 22.73	3 3.70 9.38 25.00	10 12.35 31.25 47.62	13 16.05 40.63 54.17	1 1.23 3.13 50.00	32 39.51
Pertinent	0 0.00 0.00 0.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	1 1.23 100.00 4.17	0 0.00 0.00 0.00	1 1.23
Total	22 27.16	12 14.81	21 25.93	24 29.63	2 2.47	81 100.00

Statistic	DF	Value	Probability
Chi-Square	16	18.392	0.301

Table 11. Series 3 What are you looking for? / What is the title of your project?

What are you looking for?	Title					
Frequency Percent Row Pct Col Pct	None	No Title	Vague Title	Clear Title	Focused Title	Total
No Response	3 3.70 23.08 21.43	1 1.23 7.69 10.00	1 1.23 7.69 7.14	5 6.17 38.46 22.73	3 3.70 23.08 14.29	13 16.05
Not Started	3 3.70 60.00 21.43	1 1.23 20.00 10.00	1 1.23 20.00 7.14	0 0.00 0.00 0.00	0 0.00 0.00 0.00	5 6.17
General	5 6.17 26.32 35.71	6 7.41 31.58 60.00	5 6.17 26.32 35.71	2 2.47 10.53 9.90	1 1.23 5.26 4.76	19 23.46
Specific	2 2.47 8.33 14.29	1 1.23 4.17 10.00	7 8.64 29.17 50.00	9 11.11 37.50 40.91	5 6.17 20.83 23.81	24 29.63
Pertinent	1 1.23 5.00 7.14	1 1.23 5.00 10.00	0 0.00 0.00 0.00	6 7.41 30.00 27.27	12 14.81 60.00 57.14	20 24.69
Total	14 17.28	10 12.35	14 17.28	22 27.16	21 25.93	81 100.00

Statistic	DF	Value	Probability
Chi-Square	16	43.218	0.001

As with the relationship between what the students were looking for and the titles of their projects, the relationship between the topic and the title changes over the course of the time series. This is also predictable based on the ISP Model again demonstrating the pattern of being sure, moving through a stage of being unsure, and then becoming sure again as experience and comfort with the topic are gained. The time series for this

study followed this pattern. The first series shows a relationship, the second series shows no relationship, and the third series again demonstrates a relationship. Tables 12-14 report these findings:

Table 12. Series 1 Describe the topic / What is the title of your project?

Topic	Title					
Frequency Percent Row Pct Col Pct	None	No Title	Vague Title	Clear Title	Focused Title	Total
Blank	6 7.41 50.00 33.33	2 2.47 16.67 11.11	1 1.23 8.33 2.70	3 3.70 25.00 42.86	0 0.00 0.00 0.00	12 14.81
General	10 12.35 17.24 55.56	13 16.05 22.41 72.22	33 40.74 56.90 89.19	2 2.47 3.45 28.57	0 0.00 0.00 0.00	58 71.60
Narrow	2 2.47 18.18 11.11	3 3.70 27.27 16.67	3 3.70 27.27 8.11	2 2.47 18.18 28.57	1 1.23 9.09 100.00	11 13.58
Total	18 22.22	18 22.22	37 45.68	7 8.64	1 1.23	81 100.00

Statistic	DF	Value	Probability
Chi-Square	8	24.314	0.002

Table 13. Series 2 Describe the topic / What is the title of your project?

Topic	Title					
Frequency Percent Row Pct Col Pct	None	No Title	Vague Title	Clear Title	Focused Title	Total
Blank	5 6.17 38.46 22.73	2 2.47 15.38 16.67	1 1.23 7.69 4.76	5 6.17 38.46 20.83	0 0.00 0.00 0.00	13 16.05
General	7 8.64 35.00 31.82	4 4.94 20.00 33.33	7 8.64 35.00 33.33	2 2.47 10.00 8.33	0 0.00 0.00 0.00	20 24.69
Narrow	9 11.11 20.00 40.91	6 7.41 13.33 50.00	13 16.05 28.89 61.90	15 18.52 33.33 62.50	2 2.47 4.44 100.00	45 55.56
Focused	1 1.23 33.33 4.55	0 0.00 0.00 0.00	0 0.00 0.00 0.00	2 2.47 66.67 8.33	0 0.00 0.00 0.00	3 3.70
Total	22 27.16	12 14.81	21 25.93	24 29.63	2 2.47	81 100.00

Statistic	DF	Value	Probability
Chi-Square	12	12.205	0.429

Table 14. Series 3 Describe the topic / What is the title of your project?

Topic	Title					
Frequency Percent Row Pct Col Pct	None	No Title	Vague Title	Clear Title	Focused Title	Total
Blank	5 6.17 41.67 35.71	2 2.47 16.67 20.00	0 0.00 0.00 0.00	4 4.94 33.33 18.18	1 1.23 8.33 4.76	12 14.81
General	6 7.41 35.29 42.86	7 8.64 41.18 70.00	3 3.70 17.65 21.43	1 1.23 5.88 4.55	0 0.00 0.00 0.00	17 20.99
Narrow	2 2.47 8.00 14.29	1 1.23 4.00 10.00	10 12.35 40.00 71.43	5 6.17 20.00 22.73	7 8.64 28.00 33.33	25 30.86
Focused	1 1.23 3.70 7.14	0 0.00 0.00 0.00	1 1.23 3.70 7.14	12 14.81 44.44 54.55	13 16.05 48.15 61.90	27 33.33
Total	14 17.28	10 12.35	14 17.28	22 27.16	21 25.93	81 100.00

Statistic	DF	Value	Probability
Chi-Square	12	57.705	0.001

The fourth question, "Who have you talked to about your project?" captures who the participants perceived as mediators during their work on their tasks. The responses to the fourth question were coded into seven categories: 0 = no response, 1 = no one, 2 = other (family or friends), 3 = peer (classmate or another person also doing the project), 4 = expert (professor or person who knows about the topic), 5 = peer and expert, 6 = information professional (person who knows about sources). In keeping with the analysis done by Kuhlthau and her associates, frequency counts were used to look for patterns and changes over the course of the time series. Kuhlthau and her associates reported that

among the respondents in their study, 39% consulted experts, 25% consulted with an information professional, 20% consulted with family and friends, and 13% consulted with peers. Further, Kuhlthau and her associates reported that there was no change in pattern from initiation to midpoint to closure of the task that the participants were working on (Kuhlthau et al., 1989). Here there are some differences between the results. In this study, as Table 15-17 illustrate, the participants most often consulted with peers or a combination of experts and peers.

Table 15. Series 1 Frequency Distribution: Who have you talked to about your project?

Talked to:	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Blank	8	9.3	8	9.3
No One	6	7.0	14	16.3
Peer	52	60.5	66	76.7
Expert	3	3.5	69	80.2
Peer & Expert	16	18.6	85	98.8
Information Professional	1	1.2	86	100.0

Table 16. Series 2 Frequency Distribution: Who have you talked to about your project?

Talked to:	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Blank	15	17.4	15	17.4
No One	1	1.2	16	18.6
Other	1	1.2	17	19.8
Peer	45	52.3	62	72.1
Expert	4	4.7	66	76.7
Peer & Expert	20	23.3	86	100.0

Table 17. Series 3 Frequency Distribution: Who have you talked to about your project?

Talked to:	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Blank	3	3.5	3	3.5
No One	2	2.3	5	5.8
Peer	52	60.5	57	66.3
Expert	3	3.5	60	69.8
Peer & Expert	24	27.9	84	97.7
Information Professional	2	2.3	86	100.0

There are several factors that may explain the different results. All the participants in this study were part of a group -- the participants worked in groups to complete their academic task. Previously, the research done with the ISP Model has been with individuals working on a task alone. However, even though the participants in this study were involved in group work, they still exhibited the stages anticipated by the ISP Model. The other factor was the environment where the participants were working. In the study conducted by Kuhlthau and her associates, the participants were working in a physical library setting. Given this, it makes sense to have a higher frequency of respondents indicating they consulted with an information professional since information professionals were easily available in the environment. The virtual environment the participants worked in for this study may have changed the perception of who was readily and easily available for consultation on the task that they were working on.

The fifth question, "Indicate your confidence level at this point in the project" captures affective aspects of the information search process. In keeping with the analysis done by Kuhlthau and her associates, ANOVA was used to compare and look for differences between variables over the course of the time series. Kuhlthau and her associates found "confidence steadily increasing with lowest confidence at Initiation,

confidence rising significantly at Midpoint, and with another significant increase at Closure" (Kuhlthau et al., 1989, p. 55). The confidence level is compared with the cognitive responses elicited from the survey questions discussed previously:

1. What are you looking for? (Look)
2. Describe the topic in the space below. (Topic)
3. What is the title of your project? (Title)
4. Who have you talked to about your project? (Talk).

Similarly to Kuhlthau and her associates, a rising confidence level was found. As predicted by the ISP Model, the first series indicates a relationship between the confidence level and what the participants were looking for, the second series shows a relationship between the title of the project and the confidence level, and the third series shows a very significant relationship among all the variables. These are reported in Tables 18-20:

Table 18. Series 1 ANOVA Confidence Level

Source	DF	ANOVA SS	Mean Square	F Value	Pr > F
Look	3	56.81358025	18.93786008	3.52	0.0197
Talk	5	9.38882088	1.87776418	0.35	0.8810
Title	4	28.52104485	7.13026121	1.33	0.2696
Topic	2	28.57319362	14.28659681	2.66	0.0777

Table 19. Series 2 ANOVA Confidence Level

Source	DF	ANOVA SS	Mean Square	F Value	Pr > F
Look	4	1.07994823	0.26998706	0.05	0.9958
Talk	5	39.13765432	7.82753086	1.36	0.2523
Title	4	80.11698333	20.02924583	3.47	0.0125
Topic	3	4.84064577	1.61354859	0.28	0.8398

Table 20. Series 3 ANOVA Confidence Level

Source	DF	ANOVA SS	Mean Square	F Value	Pr > F
Look	4	231.94540036	57.98635009	99999.99	0.0001
Talk	5	146.32004831	29.26400966	99999.99	0.0001
Title	4	219.50101010	54.87525253	99999.99	0.0001
Topic	3	155.53586057	51.84528686	99999.99	0.0001

The sixth question, "From the adjectives below, check those that describe how you feel at this point in the project" further examines affective elements in the search process. The participants were asked to choose from a list of ten adjectives (confident, disappointed, frustrated, relieved, sure, confused, doubtful, optimistic, satisfied, uncertain) taken from the ISP Model to describe their feelings at different points in the time series. The participants were instructed to select as many adjectives from the list as applied to them at that moment. In keeping with the analysis done by Kuhlthau and her associates, frequency counts were used to look for patterns and changes over the course of the time series. Interestingly, there were differences between the findings. Kuhlthau and her associates reported: "Confidence increased, as did the responses 'satisfied,' 'sure,' 'relieved,' 'confused,' 'frustrated,' and 'doubtful' decreased from Initiation to Closure" (Kuhlthau et al., 1989, p. 57). For this study, the selection of "confident" and "sure" from the adjective list remained relatively constant with a slight decrease in the third series. The selection of the adjectives "satisfied" and "relieved" decreased over the time series. The selection of "frustrated" from the adjective list remained relatively constant with a slight increase in the third series. The selection of the adjective "confused" increased over the time series. This is interesting because it does not match with the reported level of rising confidence the participants had indicated on the scale for the question previous

to this one -- "Indicate your confidence level at this point in the project." It is also interesting to note that in each series, the participants select "other" over ninety percent of the time. Since these results are not congruent with the results of the other questions dealing with the affective aspects of the ISP Model, this raises some questions that may be worth exploring in future research. Perhaps the adjective list developed for the Process Survey is not completely capturing the affective aspects of the information search process. Were the participants reacting to the virtual learning environment? Or perhaps reacting to working in groups? These questions will be explored further in the conclusion section of this dissertation. Table 21 reports the results from this study:

Table 21. Frequency Distribution:  
From the adjectives below, check those that describe how you feel  
at this point in the project

Adjective	Series 1 %	Series 2 %	Series 3 %
Confident	69.8	68.6	64.0
Disappointed	90.7	86.0	77.9
Frustrated	62.8	60.5	66.3
Relieved	94.2	82.6	66.3
Sure	87.2	90.7	82.6
Confused	59.3	66.3	80.2
Doubtful	81.4	79.1	81.4
Optimistic	66.3	59.3	68.6
Satisfied	87.2	82.6	69.8
Uncertain	65.1	74.4	77.9
Other	97.7	95.3	93.0

The final three questions on the Process Survey also provided choices taken from the ISP Model for the participants to choose from at the different points in the time series. In keeping with the analysis done in the Kuhlthau study, frequency counts were used to look for patterns and changes over the course of the time series.

The seventh question, "What is your task now?" examines the participant's perceptions about their task at the initiation, midpoint, and the closure of their work on the academic assignment. The finding for this study are similar to the findings Kuhlthau and her associates reported. In their study, the participants indicated they were primarily gathering information at the initiation and midpoint of the task. At closure, the participants indicated they were moving into the writing phase of their project. In this study, the same pattern is revealed. The participants stayed primarily in the information gathering phases during the first and second series. The third series shows the shift into the "other" category. This option on the survey allowed the participants to select the category and specify exactly what they were doing at this point. As in the study by Kuhlthau and her associates, the participants for this study indicated they were either shifting into writing mode for their projects or had actually completed their writing and were wrapping up loose ends prior to turning in their project. Tables 22-24 report these findings:

Table 22. Series 1 Frequency Distribution: What is your task now?

Task	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Gather Information	40	49.4	40	49.4
Investigate	12	14.8	52	64.2
Complete Search	2	2.5	54	66.7
Recognize Information Needs	3	3.7	57	70.4
Formulate Specific Topic	10	12.3	67	82.7
Identify General Topic	7	8.6	74	91.4
Other	7	8.6	81	100.0

Table 23. Series 2 Frequency Distribution: What is your task now?

Task	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Gather Information	43	53.1	43	53.1
Investigate	8	9.9	51	63
Complete Search	9	11.1	60	74.1
Recognize Information Needs	2	2.5	62	76.5
Formulate Specific Topic	3	3.7	65	80.2
Identify General Topic	1	1.2	66	81.5
Other	15	18.5	81	100.0

Table 24. Series 3 Frequency Distribution: What is your task now?

Task	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Gather Info	25	30.9	25	30.9
Investigate	7	8.6	32	39.5
Complete Search	12	14.8	44	54.3
Recognize Info Needs	1	1.2	45	55.6
Formulate Specific Topic	1	1.2	46	56.8
Other	35	43.2	81	100.0

In response to the eighth question, "What action are you taking?," Kuhlthau and her associates found "the actions selected by the participants matched the model generally and changed significantly during the search process" (Kuhlthau et al., 1989, p. 60). The same types of patterns were found for this study. In general, over the course of the time series, actions increased as the participants became more involved with their topics. As would be expected, some of the actions did indicate a downward trend over time. "Making a summary search," "rechecking sources," and "recording citation" are examples of actions that tapered off over time and are expected to do so based on the ISP Model. Table 25 reports these findings:

Table 25. Frequency Distribution: What are you doing now?

Action	Series 1 %	Series 2 %	Series 3 %
Discussing	41.9	61.6	86.0
Comprehensive Search	72.1	76.7	93.0
Browsing	64.0	83.7	88.4
Outlining	73.3	73.3	86.0
Reading for Themes	81.4	89.5	87.2
Preliminary Search	65.1	81.4	90.7
Conferring	77.9	70.9	93.0
Talking	68.6	83.7	88.4
Summary Search	100.0	98.8	95.3
Skimming/Scanning	70.9	83.7	90.7
Writing	82.6	76.7	89.5
Reading about Topic	75.6	84.9	97.7
Detailed Note Taking	88.4	77.9	90.7
Brief Note Taking	76.7	91.9	95.3
Rechecking Sources	88.4	90.7	86.0
Recording Citations	100.0	97.7	96.5
Other	96.5	90.7	55.8

The ninth and final question on the Process Survey, "What are you thinking about now?" examines the participants thoughts about procedure and process. Kuhlthau and her associates reported their findings matched the ISP Model. Similarly, this study found the participants selected items in a pattern that is expected based on the ISP Model. Specifically, over the course of the time series, the participants reported they were "getting more interested and involved with ideas" (Becoming Interested) and "gaining a sense of direction and clarity" (Gaining Direction). In both instances, it was during the third time series that the most significant increase in these thought patterns was reported by the participants. Table 26 reports these findings:

Table 26. Frequency Distribution: What are you doing now?

Thoughts	Series 1 %	Series 2 %	Series 3%
Organizing	44.2	55.8	72.1
Identifying Topics	70.9	95.3	97.7
Becoming Informed About Topic	59.3	74.4	90.7
Exhausting Sources	89.5	83.7	88.4
Considering Topics	89.5	97.7	95.3
Choosing Topic	75.6	96.5	96.5
Comprehending Task	48.8	67.4	86.0
Seeking Closure	86.0	68.6	66.3
Time	89.5	98.8	98.8
Choosing Concentrations	82.6	69.8	95.3
Considering Topic Requirements	90.7	100.0	96.5
Confronting Inconsistency	89.5	88.4	91.9
Becoming Interested	74.4	74.4	89.5
Defining Topic	87.2	81.4	93.0
Gaining Direction	64.0	64.0	82.6
Recalling	95.3	96.5	94.2
Predicting	90.7	88.4	93.0
Identifying Areas	86.0	91.9	98.8
Personal Interest	98.8	97.7	96.5
Seeking Information	83.7	82.6	90.7
Other	97.7	87.2	68.6

The findings in this study confirm the ISP Model is valid for describing the different stages of cognitive (thoughts), affective (feelings), and physical tasks (actions) individuals progress through when facing a situation where they must search for information to complete an academic task in a virtual learning environment.

#### Analysis for Hypothesis Two

**Hypothesis Two:** There will be no relationship between the amount of computer experience subjects possess and demonstrating the patterns of thoughts, feelings, and actions described by Kuhlthau's Model of the Information Search Process.

This hypothesis seeks to demonstrate the ISP to be independent of the learning environment and the particular tools used within that environment. Hypothesis Two addresses the following research question:

1. Does a student's amount of computer knowledge have any bearing on information seeking behavior in a virtual learning environment?

The analysis for Hypothesis Two uses the Process Survey and the Demographic Survey to look for a pattern between a participant's demonstrating the stages of the ISP Model and amount of computer knowledge. The results indicate there is no relationship between demonstrating the stages of the ISP Model and the amount of computer knowledge the participants reported possessing. Over the course of the time series, regardless of the participants' reported computer skill level, everyone became more confident. Cross tabulation, Chi square, Kendall's Tau-b, and Pearson Correlation were used to determine whether or not there was a relationship. The confidence level was taken from the Process Survey. Information about the participants' computer skill level was derived from the Demographic Survey.

Cross tabulations were run to look for any pattern between demonstrating the stages of confidence in information seeking indicated by the ISP Model and the amount of computer knowledge the participants reported possessing. The results indicated no pattern over the course of the time series. Over the course of the time series, all the participants reported a rising confidence level (confidence level) regardless of their reported computer skill level (skill level), everyone became more confident. Looking at

the totals, this is especially noticeable in the third series. Tables 27-29 report these findings:

Table 27. Series 1 Cross Tabulation: Confidence Level by Computer Skill Level

Skill Level	Confidence Level										Total
	1	2	3	4	5	6	7	8	9	10	
0	0	1	1	0	0	0	0	0	0	0	2
2	0	1	0	0	0	0	0	0	0	0	1
3	0	0	0	0	0	0	0	1	0	0	1
4	1	1	0	1	0	1	0	3	0	0	7
5	0	0	1	2	1	1	2	1	0	0	8
6	1	0	1	3	3	1	1	1	1	1	13
7	1	1	1	3	1	1	0	2	2	0	12
8	0	1	5	2	1	3	3	2	1	1	19
9	0	2	1	1	2	2	1	2	1	0	12
10	0	0	0	0	1	0	1	1	3	0	6
Total	3	7	10	12	9	9	8	13	8	2	81

Table 28. Series 2 Cross Tabulation: Confidence Level by Computer Skill Level

	Confidence Level											
Skill Level	0	1	2	3	4	5	6	7	8	9	10	Total
0	0	0	0	1	1	0	0	0	0	0	0	2
2	0	0	0	0	0	1	0	0	0	0	0	1
3	0	0	0	0	0	0	0	1	0	0	0	1
4	0	1	0	0	1	1	2	0	2	0	0	7
5	1	0	0	1	0	3	1	0	1	1	0	8
6	0	0	0	4	1	4	0	2	1	0	1	13
7	0	1	1	2	1	2	1	3	1	0	0	12
8	1	0	0	1	2	4	1	1	4	5	0	19
9	0	1	0	0	2	2	0	2	2	2	1	12
10	1	0	0	0	0	1	1	0	2	1	0	6
Total	3	3	1	9	8	18	6	9	13	9	2	81

Table 29. Series 3 Cross Tabulation: Confidence Level by Computer Skill Level

Skill Level	Confidence Level											Total
	0	1	2	3	4	5	6	7	8	9	10	
0	0	0	0	1	1	0	0	0	0	0	0	2
2	0	0	1	0	0	0	0	0	0	0	0	1
3	0	0	0	0	0	0	0	0	1	0	0	1
4	0	1	1	0	1	0	1	1	1	0	1	7
5	0	0	1	0	0	0	3	1	1	1	1	8
6	0	1	2	0	3	1	1	2	1	1	1	13
7	0	2	0	1	1	1	0	2	3	2	0	12
8	1	0	2	0	0	0	1	2	2	6	5	19
9	0	2	0	1	1	0	1	1	0	3	3	12
10	0	0	0	0	0	0	0	1	0	3	2	6
Total	1	6	7	3	7	2	7	10	9	16	13	81

Contingency tables and Chi Square were used to confirm the cross tabulations and determine if there were any significant statistical relationships in demonstrating the stages of confidence (confidence level) in information seeking indicated by the ISP Model and the amount of computer knowledge (skill) the participants reported possessing and to look for any changes in the relationships over the course of the time series. The results indicated no statistically significant relationships over the course of the time series. Tables 30-32 report these findings:

Table 30. Series 1 Computer Skill by Level of Confidence

Skill	Confidence Level										Total
	1	2	3	4	5	6	7	8	9	10	
	Freq										
0	0 0.00 0.00 0.00	1 1.23 50.00 14.29	1 1.23 50.00 10.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	2 2.47
2	0 0.00 0.00 0.00	1 1.23 100.00 14.29	0 0.00 0.00 0.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	1 1.23
3	0 0.00 0.00 0.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	1 1.23 100.00 7.69	0 0.00 0.00 0.00	0 0.00 0.00 0.00	1 1.23
4	1 1.23 14.29 33.33	1 1.23 14.29 14.29	0 0.00 0.00 0.00	1 1.23 14.29 8.33	0 0.00 0.00 0.00	1 1.23 14.29 11.11	0 0.00 0.00 0.00	3 3.70 42.86 23.08	0 0.00 0.00 0.00	0 0.00 0.00 0.00	7 8.64
5	0 0.00 0.00 0.00	0 0.00 0.00 0.00	1 1.23 12.50 10.00	2 2.47 25.00 16.67	1 1.23 12.50 11.11	1 1.23 12.50 11.11	2 2.47 25.00 25.00	1 1.23 12.50 7.69	0 0.00 0.00 0.00	0 0.00 0.00 0.00	8 9.88
6	1 1.23 7.69 33.33	0 0.00 0.00 0.00	1 1.23 7.69 10.00	3 3.70 23.08 25.00	3 3.70 23.08 33.33	1 1.23 7.69 11.11	1 1.23 7.69 12.50	1 1.23 7.69 7.69	1 1.23 7.69 12.50	1 1.23 7.69 50.00	13 16.05
7	1 1.23 8.33 33.33	1 1.23 8.33 14.29	1 1.23 8.33 10.00	3 3.70 25.00 25.00	1 1.23 8.33 11.11	1 1.23 8.33 11.11	0 0.00 0.00 0.00	2 2.47 16.67 15.38	2 2.47 16.67 25.00	0 0.00 0.00 0.00	12 14.81
8	0 0.00 0.00 0.00	1 1.23 5.26 14.29	5 6.17 26.32 50.00	2 2.47 10.53 16.67	1 1.23 5.26 11.11	3 3.70 15.79 33.33	3 3.70 15.79 37.50	2 2.47 10.53 15.38	1 1.23 5.26 12.50	1 1.23 5.26 50.00	19 23.46
9	0 0.00 0.00 0.00	2 2.47 16.67 28.57	1 1.23 8.33 10.00	1 1.23 8.33 8.33	2 2.47 16.67 22.22	2 2.47 16.67 22.22	1 1.23 8.33 12.50	2 2.47 16.67 15.38	1 1.23 8.33 12.50	0 0.00 0.00 0.00	12 14.81
10	0 0.00 0.00 0.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	1 1.23 16.67 11.11	0 0.00 0.00 0.00	1 1.23 16.67 11.11	1 1.23 16.67 7.69	3 3.70 50.00 37.50	0 0.00 0.00 0.00	6 7.41
Total	3 3.70	7 8.64	10 12.35	12 14.81	9 11.11	9 11.11	8 9.88	13 16.05	8 9.88	2 2.47	81 100.00

Statistic	DF	Value	Probability
Chi-Square	81	70.710	0.786

Table 31. Series 2 Computer Skill by Level of Confidence

Skill	Confidence Level											Total
	0	1	2	3	4	5	6	7	8	9	10	
	Freq											
	%											
0	0	0	0	1	1	0	0	0	0	0	0	2
	0.00	0.00	0.00	1.23	1.23	0.00	0.00	0.00	0.00	0.00	0.00	2.47
	0.00	0.00	0.00	50.00	50.00	0.00	0.00	0.00	0.00	0.00	0.00	
	0.00	0.00	0.00	11.11	12.50	0.00	0.00	0.00	0.00	0.00	0.00	
2	0	0	0	0	0	1	0	0	0	0	0	1
	0.00	0.00	0.00	0.00	0.00	1.23	0.00	0.00	0.00	0.00	0.00	1.23
	0.00	0.00	0.00	0.00	0.00	100.	0.00	0.00	0.00	0.00	0.00	
	0.00	0.00	0.00	0.00	0.00	5.56	0.00	0.00	0.00	0.00	0.00	
3	0	0	0	0	0	0	0	1	0	0	0	1
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.23	0.00	0.00	0.00	1.23
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.	0.00	0.00	0.00	
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.11	0.00	0.00	0.00	
4	0	1	0	0	1	1	2	0	2	0	0	7
	0.00	1.23	0.00	0.00	1.23	1.23	2.47	0.00	2.47	0.00	0.00	8.64
	0.00	14.29	0.00	0.00	14.29	14.29	28.57	0.00	28.57	0.00	0.00	
	0.00	33.33	0.00	0.00	12.50	5.56	33.33	0.00	15.38	0.00	0.00	
5	1	0	0	1	0	3	1	0	1	1	0	8
	1.23	0.00	0.00	1.23	0.00	3.70	1.23	0.00	1.23	1.23	0.00	9.88
	12.50	0.00	0.00	12.50	0.00	37.50	12.50	0.00	12.50	12.50	0.00	
	33.33	0.00	0.00	11.11	0.00	16.67	16.67	0.00	7.69	11.11	0.00	
6	0	0	0	4	1	4	0	2	1	0	1	13
	0.00	0.00	0.00	4.94	1.23	4.94	0.00	2.47	1.23	0.00	1.23	16.05
	0.00	0.00	0.00	30.77	7.69	30.77	0.00	15.38	7.69	0.00	7.69	
	0.00	0.00	0.00	44.44	12.50	22.22	0.00	22.22	7.69	0.00	50.00	
7	0	1	1	2	1	2	1	3	1	0	0	12
	0.00	1.23	1.23	2.47	1.23	2.47	1.23	3.70	1.23	0.00	0.00	14.81
	0.00	8.33	8.33	16.67	8.33	16.67	8.33	25.00	8.33	0.00	0.00	
	0.00	33.33	100.	22.22	12.50	11.11	16.67	33.33	7.69	0.00	0.00	
8	1	0	0	1	2	4	1	1	4	5	0	19
	1.23	0.00	0.00	1.23	2.47	4.94	1.23	1.23	4.94	6.17	0.00	23.46
	5.26	0.00	0.00	5.26	10.53	21.05	5.26	5.26	21.05	26.32	0.00	
	33.33	0.00	0.00	11.11	25.00	22.22	16.67	11.11	30.77	55.56	0.00	
9	0	1	0	0	2	2	0	2	2	2	1	12
	0.00	1.23	0.00	0.00	2.47	2.47	0.00	2.47	2.47	2.47	1.23	14.81
	0.00	8.33	0.00	0.00	16.67	16.67	0.00	16.67	16.67	16.67	8.33	
	0.00	33.33	0.00	0.00	25.00	11.11	0.00	22.22	15.38	22.22	50.00	
10	1	0	0	0	0	1	1	0	2	1	0	6
	1.23	0.00	0.00	0.00	0.00	1.23	1.23	0.00	2.47	1.23	0.00	7.41
	16.67	0.00	0.00	0.00	0.00	16.67	16.67	0.00	33.33	16.67	0.00	
	33.33	0.00	0.00	0.00	0.00	5.56	16.67	0.00	15.38	11.11	0.00	
Total	3	3	1	9	8	18	6	9	13	9	2	81
	3.70	3.70	1.23	11.11	9.88	22.22	7.41	11.11	16.05	11.11	2.47	100.

Statistic	DF	Value	Probability
Chi-Square	90	76.753	0.839

Table 32. Series 3 Computer Skill by Level of Confidence

Skill	Confidence Level											Total
	0	1	2	3	4	5	6	7	8	9	10	
	Freq											
0	0	0	0	1	1	0	0	0	0	0	0	2
	0.00	0.00	0.00	1.23	1.23	0.00	0.00	0.00	0.00	0.00	0.00	2.47
	0.00	0.00	0.00	50.00	50.00	0.00	0.00	0.00	0.00	0.00	0.00	
	0.00	0.00	0.00	33.33	14.29	0.00	0.00	0.00	0.00	0.00	0.00	
2	0	0	1	0	0	0	0	0	0	0	0	1
	0.00	0.00	1.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.23
	0.00	0.00	100.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	0.00	0.00	14.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3	0	0	0	0	0	0	0	0	1	0	0	1
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.23	0.00	0.00	1.23
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.	0.00	0.00	
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.11	0.00	0.00	
4	0	1	1	0	1	0	1	1	1	0	1	7
	0.00	1.23	1.23	0.00	1.23	0.00	1.23	1.23	1.23	0.00	1.23	8.64
	0.00	14.29	14.29	0.00	14.29	0.00	14.29	14.29	14.29	0.00	14.29	
	0.00	16.67	14.29	0.00	14.29	0.00	14.29	10.00	11.11	0.00	7.69	
5	0	0	1	0	0	0	3	1	1	1	1	8
	0.00	0.00	1.23	0.00	0.00	0.00	3.70	1.23	1.23	1.23	1.23	9.88
	0.00	0.00	12.50	0.00	0.00	0.00	37.50	12.50	12.50	12.50	12.50	
	0.00	0.00	14.29	0.00	0.00	0.00	42.86	10.00	11.11	6.25	7.69	
6	0	1	2	0	3	1	1	2	1	1	1	13
	0.00	1.23	2.47	0.00	3.70	1.23	1.23	2.47	1.23	1.23	1.23	16.05
	0.00	7.69	15.38	0.00	23.08	7.69	7.69	15.38	7.69	7.69	7.69	
	0.00	16.67	28.57	0.00	42.86	50.00	14.29	20.00	11.11	6.25	7.69	
7	0	2	0	1	1	1	0	2	3	2	0	12
	0.00	2.47	0.00	1.23	1.23	1.23	0.00	2.47	3.70	2.47	0.00	14.81
	0.00	16.67	0.00	8.33	8.33	8.33	0.00	16.67	25.00	16.67	0.00	
	0.00	33.33	0.00	33.33	14.29	50.00	0.00	20.00	33.33	12.50	0.00	
8	1	0	2	0	0	0	1	2	2	6	5	19
	1.23	0.00	2.47	0.00	0.00	0.00	1.23	2.47	2.47	7.41	6.17	23.46
	5.26	0.00	10.53	0.00	0.00	0.00	5.26	10.53	10.53	31.58	26.32	
	100.	0.00	28.57	0.00	0.00	0.00	14.29	20.00	22.22	37.50	38.46	
9	0	2	0	1	1	0	1	1	0	3	3	12
	0.00	2.47	0.00	1.23	1.23	0.00	1.23	1.23	0.00	3.70	3.70	14.81
	0.00	16.67	0.00	8.33	8.33	0.00	8.33	8.33	0.00	25.00	25.00	
	0.00	33.33	0.00	33.33	14.29	0.00	14.29	10.00	0.00	18.75	23.08	
10	0	0	0	0	0	0	0	1	0	3	2	6
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.23	0.00	3.70	2.47	7.41
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.67	0.00	50.00	33.33	
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	0.00	18.75	15.38	
Total	1	6	7	3	7	2	7	10	9	16	13	81
	1.23	7.41	8.64	3.70	8.64	2.47	8.64	12.35	11.11	19.75	16.05	100.

Statistic	DF	Value	Probability
Chi-Square	90	89.607	0.492

Kendall's Tau-b and Pearson Correlation were used to further validate the Chi Square and confirm there was no significant statistical relationships in demonstrating the stages of confidence (confidence level) in information seeking indicated by the ISP Model and the amount of computer knowledge (skill) the participants reported possessing. The results indicated no statistical correlation over the course of the time series. Tables 33-35 report these findings:

Table 33. Series 1 Correlation of Computer Skill by Level of Confidence

Statistic	Value	ASE
Kendall's Tau-b	0.133	0.087
Pearson Correlation	0.225	0.107

Table 34. Series 2 Correlation of Computer Skill by Level of Confidence

Statistic	Value	ASE
Kendall's Tau-b	0.173	0.081
Pearson Correlation	0.199	0.101

Table 35. Series 3 Correlation of Computer Skill by Level of Confidence

Statistic	Value	ASE
Kendall's Tau-b	0.262	0.081
Pearson Correlation	0.308	0.096

The findings in this study indicate there is no relationship between the amount of computer experience subjects possess and demonstrating the patterns of thoughts, feelings, and actions described by the ISP Model.

### Summary

The findings from this study confirm the two hypotheses:

**Hypothesis One:** Subjects given an information seeking task in a virtual learning environment will demonstrate the stages in Kuhlthau's Model of the Information Search Process.

**Hypothesis Two:** There will be no relationship between the amount of computer experience subjects possess and demonstrating the patterns of thoughts, feelings, and actions described by Kuhlthau's Model of the Information Search Process.

While there were some differences between the findings of Kuhlthau and her associates and this study, these differences do not diminish the similarities which clearly point to the applicability of the ISP Model as a method of describing information seeking behavior in a virtual learning environment. The differences in fact, point to future areas for exploration and research which are further explored in the next chapter.

## CHAPTER 5

### CONCLUSIONS

#### Introduction

The movement in higher education toward distance and virtual learning has raised questions about best practices for delivering education and ensuring learning for students (Merisotis & Phipps, 1999; Russell, 1997). As higher education moves to deliver education via a distance or virtual model, there are still relatively few research studies available at this time to assist in assessing or measuring the success of this educational delivery system (Phipps 1999).

The purpose of this study was to examine the applicability of the ISP Model in the context of a virtual learning environment. As demand for virtual learning environments grows, it will become increasingly important to make decisions pertaining to students' involvement in the learning process away from the physical presence of the instructor. If the ISP Model will accommodate virtual learning environments, instructors and instructional designers will have more information about the patterns of thoughts, feelings, and actions involved in the learning process to assist them in designing educational materials for virtual environments that help to facilitate a successful learning experience for students faced with an information problem to solve. This study confirms

that students given an information seeking task in a virtual learning environment do exhibit the stages indicated by the ISP Model.

### Representing The ISP Model

One of the concerns expressed with the ISP Model is the sense that it represents a straightforward linear progression. While this is not the case, even Kuhlthau has pointed to the challenge of graphically representing the ISP Model to avoid the perception of a strict linear progression (Kuhlthau, 1993). While there is a definite sense of motion in the stages of thoughts, feelings, and actions the model identifies, to date there has not been a way to represent the motion without creating a sense of strict linearity. Figure Two provides a slightly different graphical representation of the model that provides more of the sense of motion and interaction among the components of thoughts, feelings, and actions:

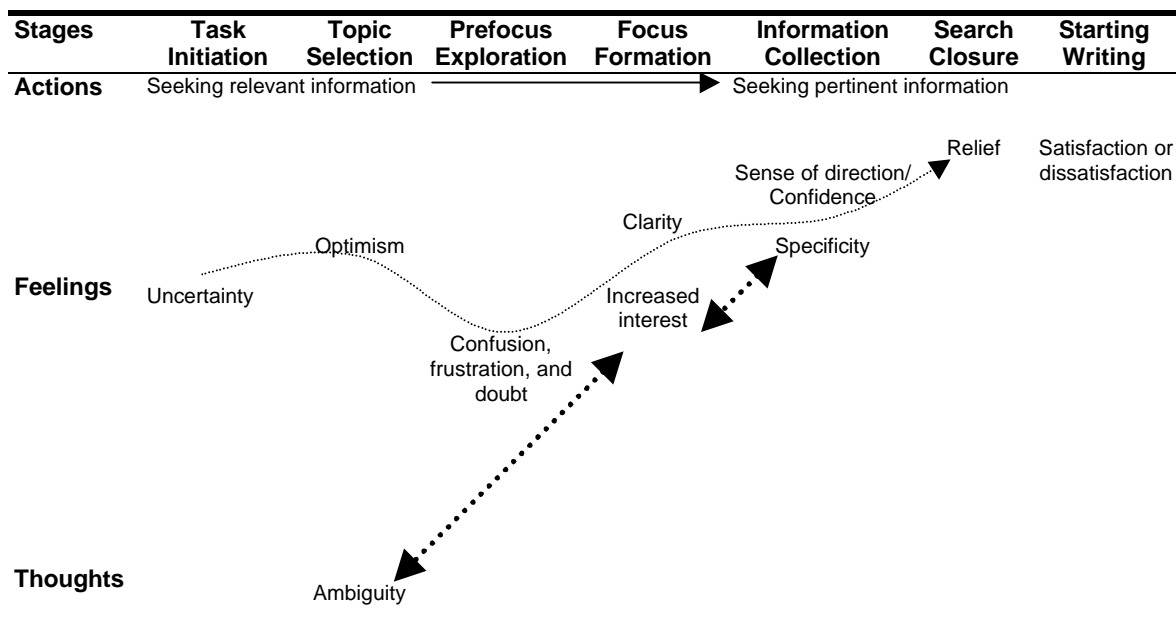


Figure 2. Revised Representation of the ISP Model

Certainly, as more is learned about the combined influences of thoughts, feelings, and actions in the learning process, finding a way to better represent the ISP Model that will assist instructors in making use of what the model tells us about the learning process would be useful. Figure Two represents a first attempt in this direction.

### Implications for Future Research

The development of non-self-reporting data collection techniques would be useful in complementing and furthering research to enhance and refine the representation of the ISP Model. The Process Survey used for this study was chosen because it is a valid instrument. However, it is a self-reporting instrument and therefore has the weaknesses and difficulties associated with that method of data collection. The development of additional data collection techniques and instruments that could be used in conjunction with the Process Survey would help to further validate the ISP Model.

One of the unexpected factors in this study was that all the participants were part of a group. The participants worked as groups to complete their academic task. Previous, the research done with the ISP Model has been with individuals working on a task alone. Even though the participants in this study were involved in group work, they still exhibited the stages anticipated by the ISP Model. One area for further study would be examining how groups work together in solving an information seeking task and what implications the ISP Model may have for this process. Given the interest in both education and industry for developing models that help people work together more effectively, this would be an interesting area for further exploration (Johnson, Johnson, & Holubec, 1994; Senge, 1990).

### Summary

This research confirms that students given an information seeking task in a virtual learning environment do exhibit the stages indicated by the ISP Model. This demonstrates the ISP Model to be independent of the original physical library environments where the model was developed. Further, this study indicates that students in a virtual learning environment, regardless of level of computer skill, do exhibit the stages indicated by the ISP Model.

The development of non-self-reporting data collection techniques would be useful in complementing and furthering research to enhance and refine the representation of the ISP Model. Additionally, expanding the research to include the examination of group interaction has the potential to add to our understanding of the ISP Model. This type of research could potentially be useful in examining how to best prepare and assist people in both education and industry who are faced with tasks involving information seeking for the successful completion of assignments or projects. More research to enhance the ISP Model and develop further applications for the model could potentially aid educational delivery in all types of learning environments.

APPENDIX A  
PROCESS SURVEY

ID #: \_\_\_\_\_

Date: \_\_\_\_\_

### Process Survey

1. What are you looking for?
2. Describe the topic in the space below:
3. What is the title of your project?
4. Who have you talked to about your project?
5. On the scale below indicate your confidence level at this point in the project.

1	2	3	4	5	6	7	8	9	10
<b>Low</b>					<b>High</b>				

6. From the adjectives below, check those that describe how you feel at this point in the project:

<p>____ (1) Confident</p> <p>____ (2) Disappointed</p> <p>____ (3) Frustrated</p> <p>____ (4) Relieved</p> <p>____ (5) Sure</p>	<p>____ (6) Confused</p> <p>____ (7) Doubtful</p> <p>____ (8) Optimistic</p> <p>____ (9) Satisfied</p> <p>____ (10) Uncertain</p> <p>____ (11) Other _____</p>
---------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------

7. What is your task now? Please check one.

\_\_\_\_ (1) To gather information pertaining to the specific topic.

\_\_\_\_ (2) To investigate information on the general topic.

\_\_\_\_ (3) To complete the information search.

\_\_\_\_ (4) To recognize an information need.

\_\_\_\_ (5) To formulate a specific topic.

\_\_\_\_ (6) To identify the general topic.

\_\_\_\_ (7) Other \_\_\_\_\_

(continued on back page)

8. What are you doing now? Check as many boxes as apply to you:

- ☐ (1) Discussing the topic.
- ☐ (2) Making a comprehensive search for information about the topic.
- ☐ (3) Browsing in the Virtual Collaborative University environment.
- ☐ (4) Outlining to organize information.
- ☐ (5) Reading over notes for themes.
- ☐ (6) Making a preliminary search for information about the topic.
- ☐ (7) Conferring with people who know about the topic.
- ☐ (8) Talking about themes and ideas.
- ☐ (9) Making a summary search in Virtual Collaborative University environment.
- ☐ (10) Skimming and scanning sources of information.
- ☐ (11) Writing about themes and ideas.
- ☐ (12) Reading about the topic.
- ☐ (13) Taking detailed notes on facts and ideas.
- ☐ (14) Taking brief notes on facts and ideas.
- ☐ (15) Rechecking sources for information initially overlooked.
- ☐ (16) Recording bibliographic citations.
- ☐ (17) Other \_\_\_\_\_

9. What are you thinking now? Check as many boxes as apply to you:

- ☐ (1) Organizing ideas and information.
- ☐ (2) Identifying possible alternative topics.
- ☐ (3) Becoming informed about the general topic.
- ☐ (4) Exhausting all possible sources of information.
- ☐ (5) Considering alternative topics in light of the information available to me.
- ☐ (6) Choosing the broad topic that has the potential for success.
- ☐ (7) Comprehending the task before me.
- ☐ (8) Recognizing ways to draw the project to close.
- ☐ (9) Considering alternative topics in lights of the time I have to complete the project.
- ☐ (10) Choosing specific concentrations within the general topic.
- ☐ (11) Considering alternative topics in light of the requirements of the project.
- ☐ (12) Confronting the inconsistency and incompatibility in the information encountered
- ☐ (13) Getting more interested and involved in ideas.
- ☐ (14) Defining and extending my specific topic.
- ☐ (15) Gaining a sense of direction and clarity.
- ☐ (16) Recalling a previous project when I searched for information.
- ☐ (17) Predicting the success of each possible concentration.
- ☐ (18) Identifying several possible areas of concentration in the broad topic.
- ☐ (19) Considering alternative topics in light of the things that are of personal interest to me.
- ☐ (20) Seeking information about my specific area of concentration.
- ☐ (21) Other \_\_\_\_\_

**Thank you for your time!**

THIS PROJECT HAS BEEN REVIEWED AND APPROVED BY THE UNIVERSITY OF NORTH TEXAS INSTITUTIONAL REVIEW BOARD FOR THE PROTECTION OF HUMAN SUBJECTS IN RESEARCH (940/565-3940).

APPENDIX B  
DEMOGRAPHIC SURVEY

Course: : \_\_\_\_\_ Section: : \_\_\_\_\_ Group: \_\_\_\_\_ ID: \_\_\_\_\_

1. Gender: ☐ Female ☐ Male                      2. Age: \_\_\_\_\_ Years

3. What Year are you in school? (Check only one)

<input type="checkbox"/> Freshman	<input type="checkbox"/> Masters Student
<input type="checkbox"/> Sophomore	<input type="checkbox"/> Doctoral Student
<input type="checkbox"/> Junior	<input type="checkbox"/> Post Graduate
<input type="checkbox"/> Senior	<input type="checkbox"/> Not enrolled
<input type="checkbox"/> Post Baccalaureate	<input type="checkbox"/> Other: _____

4. How many credit hours are you taking this term?

☐ undergraduate ☐ graduate

5. Have you ever been diagnosed with a learning disability?

☐ yes ☐ no

6. Do you have significant child or elder care obligations?

☐ yes ☐ no If yes, \_\_\_\_\_ avg. hrs/wk

7. Are you currently employed?

☐ yes ☐ no If yes, \_\_\_\_\_ avg. hrs/wk

8. If yes, do you use a computer in your work?

☐ yes ☐ no If yes, \_\_\_\_\_% of the time

9. Do you own a computer?

☐ yes ☐ no

10. If no, do you have easy access to one?

☐ yes ☐ no

11. What types of operating systems have you worked on? (Check all that apply)

<input type="checkbox"/> Macintosh	<input type="checkbox"/> Unix	<input type="checkbox"/> VMS
<input type="checkbox"/> DOS	<input type="checkbox"/> Windows	<input type="checkbox"/> Other: _____

12. How have you used a computer? (Check all that apply)

<input type="checkbox"/> word processing	<input type="checkbox"/> spreadsheet
<input type="checkbox"/> database	<input type="checkbox"/> e-mail

- ☐ graphics/presentation                      ☐ Internet/WWW  
☐ programming                                      ☐ simulation  
☐ statistical packages                              ☐ games  
☐ other: \_\_\_\_\_

13. Do you have an e-mail address?

☐ yes    ☐ no

14. Can (could) you access e-mail from home?

☐ yes    ☐ no

15. Do you have access to Netscape (or some web browser) from home?

☐ yes    ☐ no

16. For each type application that you use, please indicate how long you have been using the application.

Type of Application	0-6 Months	6-12 Months	1-3 years	More than 3 years
Word processing				
Spreadsheets				
Database				
Presentation/Graphics				
E-mail				
Web Browsing				
FTP				
News Readers				
Other Internet Tools				
Games				
Programming				
Statistical Packages				
Other				

17. Please put a check next to the statement that describes your reason for taking this

class:

☐ I am taking it as a general requirement for my degree.

☐ It is in my major or minor field of study.

☐ I am taking it as an elective or because of my interest.

\_\_\_ It was the only class available in this time slot.

\_\_\_ Other: \_\_\_\_\_

18. Would you prefer to take this class: (check only one)

\_\_\_ using technology

\_\_\_ without using technology

## APPENDIX C

FUND FOR THE IMPROVEMENT OF POSTSECONDARY EDUCATION (FISPE)  
VIRTUAL COLLABORATIVE UNIVERSITY (VCU)  
CONSENT TO PARTICIPATE

**Fund for the Improvement of Postsecondary Education (FIPSE)  
Virtual Collaborative University (VCU)**

**Consent to Participate**

Thank you for agreeing to participate in this study to assess learning outcomes, collaborative work, and information seeking in the Virtual Collaborative University. You will not receive any direct benefit from taking part in the study, but the study may help to increase knowledge that may help others in the future.

You will be asked to use your student ID number on several surveys for this project. It will take approximately one class period to participate in this project. However, all analyses for this project will be done without reference to you or any other individual. The information you provide will be kept confidential.

By using the Virtual Collaborative University and completing the surveys you are implying that you have consented to participate in this study.

Dr. Kathleen Swigger (940/565-2817) and Dr. Robert Brazile (940/565-4176) are the co-investigators for this study. Suzanne Byron (940/565-4812) is a doctoral student who will be using some of the data collected for her dissertation. Please contact any of them if you have any questions about the study or what you are expected to do.

You do not have to participate in this study if you chose not to do so, it will not affect your course grade or relationship with the University of North Texas.

THIS PROJECT HAS BEEN REVIEWED AND APPROVED BY THE UNIVERSITY OF NORTH TEXAS INSTITUTIONAL REVIEW BOARD FOR THE PROTECTION OF HUMAN SUBJECTS IN RESEARCH (940/565-3940).

APPENDIX D

VIRTUAL COLLABORATIVE UNIVERSITY

# Virtual Collaborative University

## How to Get In

**Find the blue VCU system icon.** If the VCU system icon is not on the desktop of the lab computer, you will need to find its path by clicking the “START” button located in the lower left corner of the station’s desktop. The path may be different in each General Access Lab (GAL). For example:

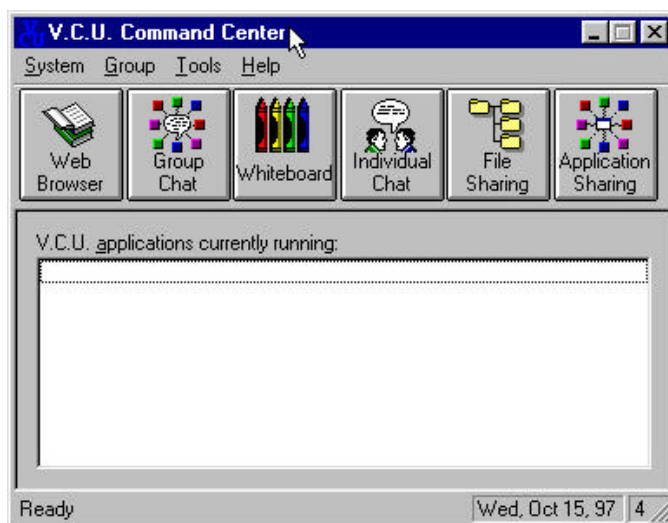
College of Arts and Sciences (CAS) Labs (GAB550, GAB330 and Terrill Hall 220)  
the path is:                \CAS Software \Communications\VCU

ISB 203 the path is:        \Programs\VCU

College of Education Lab (Matthews Hall, 309)  
the path is:                \Programs\Internet Communications\VCU

**Sign on to the system.** To sign on, double click the VCU icon. The sign on dialog box with the heading “Enter your VCU User ID” will appear. Your VCU User ID is your nine digit UNT Student ID. Enter your ID with no dashes, for example, 900100357. The VCU copyright page will flash on the screen and then the VCU Command Center will appear. All VCU applications can be started from the Command Center menu or the toolbar. Signing on allows you to use the following applications: browser, whiteboard and individual chat. You can do some preliminary work in this mode, such as using the browser to find and save files or images you want to share with the group later.

**When you are ready to collaborate with a group, you must log in.** From the VCU Command Center menu, select “System” and then “Log in”. The dialog box should display default settings for your current course, section and group. You may accept these settings (click OK) or elect to change them. You are now collaborating with anyone else who has logged into the same course, section and group. This means any application that the group is currently using will be automatically started for you. When you are logged in, you may use all the applications. Group chat, whiteboard, application sharing and, file sharing will be shared with the group. Individual chat and browser will NOT be shared with the group.



## What You Can Use

### Applications

#### **Browser**

The browser is a web browser based on Microsoft Internet Explorer. You can use it the same way you would use any browser. For example, you could visit the home page of your class to get the current assignment. You could visit the virtual office of your instructor to get her office hours.

#### **Individual Chat**

Individual chat allows you to talk to ONE other person.

#### **Whiteboard**

The whiteboard allows you to draw and/or load an image to the screen.

#### **Group Chat**

The group chat allows you to talk with all the other members of your group who are logged in.

#### **File Sharing**

File sharing allows you to send and receive files from other members of your group.

#### **Application Sharing**

Application sharing allows you to run a program with other members of your group. For example, you could run Microsoft Word and all members of the group would see the document you are working on.

## How to Get Support

### WWW

You can find the Virtual Collaborative University (VCU) on the WWW at:

<http://www.vcu.unt.edu>

Use this location to learn more about the software, the project, how to get and install your own copy of VCU.

### Problems Installing or Running VCU?

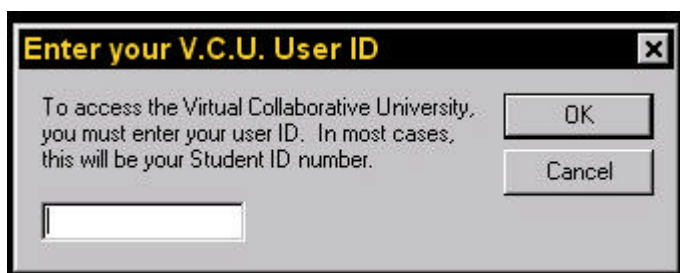
People to Contact:	Alan Livingston: <a href="mailto:aliving@vcu.unt.edu">aliving@vcu.unt.edu</a>
	Victor Lopez: <a href="mailto:vlopez@cs.unt.edu">vlopez@cs.unt.edu</a>
VCU phone number:	940/565-4260

APPENDIX E  
ABOUT THE VCU TOOLS

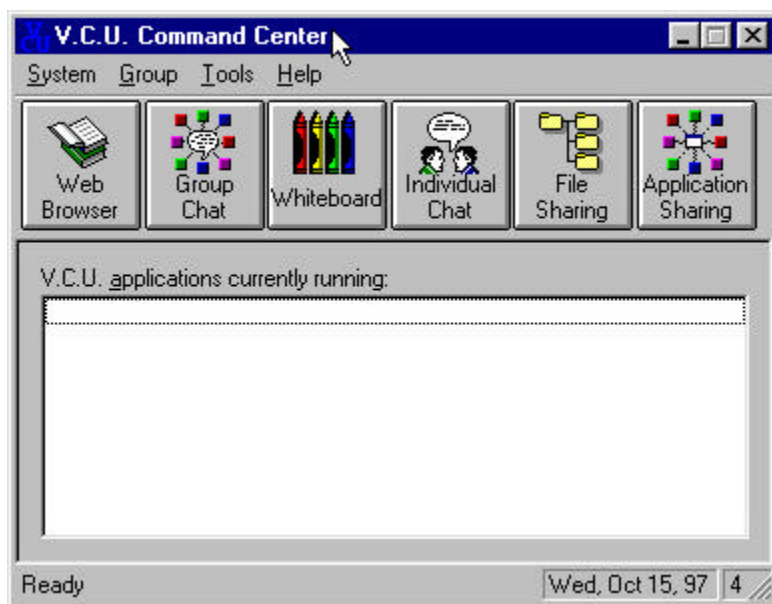
### *About the VCU Tools*

**Sign on to the System.** To sign on, double click the VCU icon. The sign on dialog box with the heading “Enter your VCU User ID” will appear. Enter your User ID, for example 900100. The VCU Staff will assign this ID to you. The VCU copyright page will flash on the screen and then the VCU Command Center will appear. Signing on allows you to use the following applications: WebBrowser, Whiteboard and Individual Chat. You can do some preliminary work in this mode, such as using the browser to find and save files or images you want to share with the group later.

This is a snapshot of the Sign On dialog that is shown to you once you have clicked on the VCU icon and the splash screen has disappeared.



This is snapshot of the Command Center. All VCU applications can be started from the Command Center Menu or the Toolbar.



**When you are ready to collaborate with a group, you must log in.** To log in, you select “Log in” from the System Menu of the Command Center and provide the Course, Section

and Group you want to work with. You may select default settings here. You are now participating with anyone else who has logged in to that Course, Section and Group. This means, any VCU Application that the group is currently using will be automatically started for you. When you are logged in, you may use all the applications. Whiteboard, File Sharing, Application Sharing and Group Chat will be used by the group. Individual Chat and the WebBrowser will NOT be shared by the group.

### ***Applications:***

**WebBrowser:** The browser is a web browser based on Microsoft Internet Explorer. You can use it the same way you would use any browser. For example, you could visit the home page of your class to get the current assignment. You could visit the virtual office of your instructor to get her office hours, etc.

**Individual Chat:** allows you to talk to ONE other person only.

**Whiteboard:** allows you to draw and /or load an image to the screen.

**Group Chat:** allows you to talk to all members of your group who are logged in.

**File Sharing:** allows you to send and receive files from other members of your group. This tool is still under development.

**Application Sharing:** allows you to run a program with other members of your group. For example, run MS Word and all members of the group would see the document you are working on.

### **Some Notes About Application Sharing**

As with the other collaboration tools (Group Chat, Whiteboard and File Sharing), Application Sharing requires you to be **logged** into a group (after you have signed on to the system) to be able to do some work with it. As soon as you log into a group, anyone in the group can trigger an application sharing session by selecting this tool from the Command Center. Only one person in the group needs to choose "application sharing" for it to be started at every group members' station.

After the Application Sharing tool has been started, make sure all the names of the "logged on" group members appear in the main screen of the Application Sharing tool. You are now in a "conference" with your group and ready to start using the tool to share/collaborate.

1. To Share an application, the application (e.g. MS Word) should be already up and running. Sharing is possible only if you have programs/applications to share and you are in a "conference" with your group. Remember to use the sub-option "Share

Applications" under the option "Share" of the Application Sharing tool. Select the application to share by clicking on the "App Code" value and pressing the "Share" button. To unshare an application, do as before but press the "Unshare" button. To update the state of applications being shared press the "Update" button.

***Share means:*** you can only "**see**" what your partner is doing. The person who selected the share option is in "control of the application" in the sense that that person is the only one showing or making changes.

***Collaborate means:*** either your partner or you decide to select the "**Collaborate**" option in the **Share Menu** of Application Sharing. When you collaborate, others can **take control** of your machine through the application you share/collaborate, as well as you can take control of somebody else's machine if he/she shares applications.

2. If you want to be able to "get control" of the application during the session, you need to be in Collaborate Mode (assuming your partner is already collaborating). Look at the Collaborate sub-option under Share option in the Application Sharing Menu.

You can know if your partner is collaborating by looking at the type of "Cursor" you have when moving the mouse over the application. If it is a "STOP" kind of symbol (a crossed circle), it means your partner is not collaborating but just sharing the application.

If you place your mouse over the application you would like to take control of, you may use "Right Mouse Click" to see if the ***Collaborate*** option that shows is available, if that is so then you may decide to activate Collaborate by clicking on it.

***\*\* This only applies to Collaboration:***

Double Clicking takes control of the application at any time during **collaboration**. This obviously can generate conflict over "who" is controlling the session (control shifts back and forth), and little work gets done. Based on this fact, we ***advise*** to use the Group Chat first to agree on who will take control and demonstrate the work first and who will follow. Avoid using Chat while "In Collaboration Mode" because it takes more time on network (there is a simplified chat capability you can use within application sharing to allow you to chat and share apps at the same time, just keep in mind that it is only a complement to this tools and not its main objective). You can still be in "Sharing" Mode and work with the rest of the tools.

## APPENDIX F

### SAVING IMAGES FROM THE INTERNET TO USE IN THE VCU WHITEBOARD

## Saving Images from the Internet For Use in the VCU Whiteboard

### Find an Image on the Internet


Once you have located an image you would like to use, follow these steps:

1. Select the image with a right mouse click.
2. Choose “Save Picture As” and follow the normal steps for saving (select where to save the file, the file name, and the file extension – this information will fill in for you automatically in most cases).

Note: Be sure to note **where** you have saved the image and **what** you have named the image.

### Paste the Image into the VCU Whiteboard

Once you have located and saved an image you would like to use, follow these steps to paste it into the VCU Whiteboard to allow you to share the image with your group:

1. Communicate within your group to have one person open the whiteboard.
2. Select  from the whiteboard tool palate. Use this tool to make a space on the whiteboard to insert your image.
3. Select from the top menu bar Edit – Insert Picture. Select the file that represents your image. The image should paste into the whiteboard.

Note: Remember in the whiteboard the “undo” command will erase the last action taken – regardless of who in the group did something in the whiteboard.



## APPENDIX G

### TIPS FOR TEAMING: WORKING TOGETHER TO ACHIEVE

## **Tips for Teaming Working Together to Achieve**

### **Elements of Cooperative Learning and Work**

#### Positive Interdependence

Team members must feel that they need each other in order to complete the group's task, that they "sink or swim" together. Positive interdependence is the perception that no member of the team can succeed unless the others do, and one member's work benefits another and vice versa.

#### Individual Accountability

Team learning is not successful unless every member has learned the material or has helped with and understood the assignment. Thus, it is important to frequently stress and assess individual learning so that group members can appropriately support and help each other.

#### Interpersonal and Small Group Skills

Individuals often do not come to school or work with the social skills they need to collaborate effectively with others. Time needs to be given to learning the appropriate communication, leadership, trust, decision making, and conflict management skills in order for groups to function effectively.

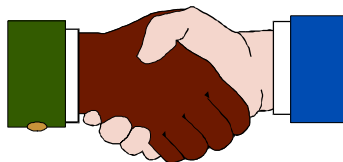
#### Group Processing

Processing means giving the team the time and procedures to analyze how well their groups are functioning and how well they are using the necessary social skills.

Taken from: The New Circles of Learning: Cooperation in the Classroom. D.W. Johnson, R.T. Johnson, and E.J. Holubec. Alexandria, VA: Association for Supervision and Curriculum Development, 1994.



## *Elements to Practice for Successful Cooperative Learning and Work*



### Specify Desired Cooperative Behaviors

- Encourage each other to participate.
- Have each member explain to their group how to get the answer.
- Check to make sure everyone in the group understands the material.
- Criticize ideas, not people.

### Practice The Behaviors The Team Decides It Values

- Have all team members present.
- Spend time developing the ground rules for working together.
- Enforce the ground rules (each member is responsible for this).
- Encourage and make it possible for team members to raise difficult, subtle, and conflictual issues relating to the team's work and performance.

Taken from: The Fifth Discipline: The Art and Practice of the Learning Organization.  
Peter M. Senge. New York: Doubleday, 1990.



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