

# SELF-REGULATED LEARNING STRATEGIES FOR THE POWER USER OF TECHNOLOGY

by

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(Under Direction the of Robert P. Bostrom)

## ABSTACT

Learning on one's own is the primary way in which users of technology learn. The specific learning strategies, the triggers to use these strategies and the motivations to learn have not been explored in the IS/IT context. This research explores the self-regulated learning strategies used by highly successful learners of information technology. These learners, power users, typically learn on their own, get more value from the technology than their peers, and serve as support for the organization in the use of the technology. The strategies used when learning on their own are the self-regulated learning strategies. Since these learners have been highly successful in learning the technology, the strategies that they have employed are of interest.

A complete list of self-regulated learning strategies found in the literature for the adult learner is established. Power users of ERP systems are then used as subjects to see which of these strategies are used. A critical incident technique is used to gather rich information related to learning technology with an emphasis on the learning of ERP applications. Using content analysis, additional strategies are found to be used in the IS/IT context. Key self-regulated

learning strategies used in the IS/IT context are defined and an initial view of how power users learn is presented.

Additional research in this area is required and research areas are offered.

INDEX WORDS: Training, Self-Regulated Learning, Power Users, ERP, Strategies

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TECHNOLOGY

by

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B.B.A., University of Mississippi, 1993

A dissertation submitted to the Graduate Faculty of the University of Georgia in Partial  
Fulfillment of the Requirements for the Degree

DOCTOR OF PHILOSOPHY

ATHENS, GEORGIA

2008

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## DEDICATION

This dissertation is dedicated to my wife, Elizabeth Emma Kadlec. She has shown me what courage and determination are.

## ACKNOWLEDGEMENTS

This dissertation took more than the effort of one individual. I have received the help from much of my family and wish to send a sincere thank you to all of them. They have supported me in ways that I cannot describe here.

My department also extended much support. I would not have made it through without the understanding of all the faculty in the Management Information Systems department at the University of Georgia.

Lastly, Dr. Robert Bostrom has been a great mentor, colleague and friend. He interviewed me for a job to support him and the other faculty long before I entered the doctoral program. He and I worked on an online program that cost him dearly. He supported my decision to apply to the doctoral program and he fought for me to get in, to get through, and to get out. I am ever indebted.

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## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 Self-Regulated Learning**

Organizations make large investments in information technology and are interested in getting value from the investment. Organizational training programs and methods have been the focus of many studies in Information Systems (IS). While IS training is shown to be effective, there are problems associated with it. Information systems are dynamic, increasing the amount of training that has to be done (Agarwal & Ferratt, 2002; Tsai, Compeau, & Haggerty, 2004). These changes come from information systems being upgraded, partially changed, or completely redesigned; each of which creates the need to inform the employees of the changes in function, form and integration with the business.

Training is usually designed to fit the needs of the group rather than the needs of individual users. Because the training is designed for the “group”, individual employees within the group may find the training:

- Too simplistic – the individual has some of the knowledge that is being presented.
- Too advanced – there is information that is assumed to be held by the individual that is not.
- Not specific enough for their job – The training is directed towards the technology versus integration of the technology with the individual’s job responsibilities.

- Irrelevant – The training introduces something that does not impact the individual. This could be training that is directed towards another individual in the group.
- Just right – The training introduces the technology at the level needed for the individual and goes specifically towards the individual's job.

Training may not be the solution for looking at the problem of the individual not having the information that is needed to use the IS effectively since training may not be “Just right.” Returning to the idea that organizations want employees to learn technologies so that value can be gained from the investment in IT, the focus of study should then be learning and not training. Training is one approach that can yield learning but it is not the only approach. There are many ways that an individual can learn and many different types of learning modes: trial and error, apprenticeship, reading books, reading articles and more.

Learning technology on their own is the primary way that individuals learn technologies and there is a trend towards more self-learning (Meares & Sargent, 2003). While learning technology on your own is the primary way, this process has not been explored and best practices have not been established. In an effort to fill this gap in the research, this study identifies strategies that yield successful learning of technology by employees on their own. To accomplish this, a group of individuals that learn on their own was identified and studied.

## **1.2 Power Users**

One group of users that has been identified as being self-learners that get more value from the technology is the power user. A power user is an individual who:

- Learns technologies quickly on their own (Baskerville, Pawlowski, & McLean, 2000; Lee, Lee, & Lee, 2003; Massa & Testa, 2005; Watson, Goodhue, & Wixom, 2002)

- Typically supports fellow users (quick questions, informal training and formal training) (Baskerville et al., 2000; Massa & Testa, 2005; Watson et al., 2002)
- Gets more value from technologies than typical users (Baskerville et al., 2000; Lee et al., 2003; Massa & Testa, 2005).

Information held by the power user needs to be shared with other users (Baskerville et al., 2000). One example of the importance of this sharing is that SAP and other companies suggest the strategic deployment of power users to help implement Enterprise Resource Planning (ERP) systems to disseminate information that they have gained and procedures that they have developed to coworkers (Massa & Testa, 2005). Power users are often the core to teams working with new systems (Olfman, Bostrom, & Sein, 2006). The United Nations has sponsored research on children that are general power users (Malyn-Smith, 2004), believing that they are indicators of economic health. Power users are a group that is seen as significant to information systems development and use in organizations. However, there has been very little research focused on them. (Baskerville et al., 2000) suggest that there needs to be research in this area.

### **1.3 Research Gap**

While many of the facets of the power user need to be investigated, learning is the focus of this study. Power users manage their own learning process and are motivated to learn (self-regulated learners or self-directed learners). They use self-regulated learning strategies in the learning process. “Self-regulated learning strategies are actions and processes directed at acquiring information or skill that involve agency, purpose, and instrumentality perceptions by learners” (Zimmerman, 1989). Research in this area has focused on the kindergarten-through-college (K-college) educational setting. This research offers an initial framework for IS/IT



research but because that research has been in K-college education, it may not transfer generally to adult learning outside of a classroom setting and, more specifically, to IS/IT. For example, a strategy that would seem to be relevant to adult learners learning technology on their own would be *Organizing and Transforming* but *Seeking Teacher Assistance* is not really applicable in this context.

The only study found in the IS literature on self-regulated learning strategies was conducted by Gravill (Gravill, 2004). She identified five strategies in the IS/IT context with some overlap with those from educational studies. Her study involved a training simulation where learning was tested immediately post-training. She found that self-regulated learning strategies were important to the learning process have a significant impact on self-efficacy, procedural knowledge and declarative knowledge.

Because the focus of her study was on the training method presented, only strategies that were relevant to that training method were introduced leaving any strategy outside of this area unexplored. The strategies available to the learner were again limited because the learners were all novice users. Since much of learning in the technology context relates to incremental change, users are usually not complete novices. Also, the need to learn was measured by the study and the amount of knowledge that could be gained along with all materials were also controlled by the study. Lastly, learning strategies were viewed as a single construct, not revealing which strategies were the most effective.

This study extends prior research of self-regulated learning of software applications by identifying self-regulated learning strategies and exploring which strategies have the greatest impact on the learning process of power users in a IS/IT context.

## 1.4 Research Questions

Learning is a constant process in IS and while there has been research into training, the outcome of training, learning, is not well understood especially where the individual manages their own learning process – self-regulated learning.

Major research questions guiding this study were:

- a) What are the key self-regulated learning strategies of power users in the IS/IT context? Learning strategies that are found in previous literature will be identified and then compared against what learning strategies are employed most often by power users.
- b) What are the key drivers for power users to choose strategies in an IS/IT context? Triggers to use or not use learning strategies will be explored in the IS/IT context.
- c) What are the key motivators of power users when they are learning in the IS/IT context? Motivations to learn will be identified in previous literature and then compared to what motivates the power user to learn.

Although the primary focus of my research is question (a), questions (b) and (c) will also be addressed. This will be done by gathering data from power users of technology about their learning strategies.

## 1.5 Research Approach

### 1.5.1 Overview

This study was designed to help define the area of power users, the learning strategies they use, and how and why they employ these strategies. A model of potential learning strategies employed in Information Technology is developed from existing models. An

exploratory approach is then used to test this model yielding a rich set of data. This data is gathered from a successful group of learners of Information Technology: Power users. The data collection technique, the Critical Incidents Technique, captured qualitative and simple quantitative data that was sufficient to explore the three research questions. Critical Incident Technique (CIT) serves as the methodology of data collection and analysis for this study. CIT is a qualitative method, used to gather information from individuals uniquely qualified to offer information on the subject area. It enables formulation of the critical requirements of a role and is especially useful in exploratory research designed to examine very specific, situationally relevant aspects of a role or behavior (Yukl, 2002). It has been used in thousands of studies (Fivars & Fitzpatrick, 2001) and has been shown valid and reliable when properly applied (B.-E. Andersson & S.-G. Nilsson, 1964; Bitner, Booms, & Tetreault, 1985).

In this study, semi-structured interviews of up to two hours were conducted with power users of an IS/IT employed by a large university system in the southern United States with multiple campuses. To make sure that the information system was complex enough for there to be rich data and multiple learning strategies that could be used, power users of Enterprise Resource Planning (ERP) systems were targeted. Individuals were identified by superiors or self-identified as power users after being contacted by the researcher. Identified individuals were asked to complete an online survey to gather background information and eliminate non-power users

Nineteen interviews were conducted face-to-face (eighteen) or by phone (one). Two of the interviews were discarded; one because of technical recording problems and one because the background survey was never completed. The interviews were transcribed and coded to identify motivations to learn, triggers to use learning strategies and learning strategies.

## 1.6 Importance of Research

This research helps to explore two areas. The first is in developing IS/IT workers that can manage their own learning. Since research has pointed out that self-instruction is the predominant way that IS/IT is learned, this area needs to be explored. Once “self-instruction” has been better identified, further research on how the learning process can be enhanced and or sped up can be undertaken. Instruments can be developed from the results of this study to measure self-instruction. Self-instruction, where more learning takes place, can then be tested in models where training has been used to see if the models can be refined. The learning of novice users can also be tested using the strategies identified in this study to see if they are effective in that context.

This research establishes a model of learning that can be applied to adult learners and provides a complete set of adult learning strategies filling out this model. A key set of learning strategies is identified for the power user.

The second area of exploration is the analysis of power users. This group has been identified as important to how organizations implement large enterprise wide information systems. The UN has identified power users as a key to the economic health of nations. While nation building is normally not associated with IS/IT research, the creation of economic value through IS/IT is. The importance of power users for IS/IT warrants investigation by researchers, but thus far, there is little attention. For academia, this research helps to define power users and explore how they learn. While research here does not completely define the power user, it is a start on research of this important group. For practice, defining how power users learn will allow for the support of their learning needs. Since power users are an important group of learners in

the organization, and they often help with the implementation of new information systems, supporting them is an important consideration.

Outside the realm of research and within practice, defining the key strategies to effectively learn technologies is keenly important. Using the results of this study, organizations can develop systems that will help the average learner by integrating support for the key learning strategies. Learners will then not only learn the technology that is the subject of the training, but may also learn strategies that will allow them to train themselves in the future. While training is significantly important, the primary way that users learn software is on their own (Meares & Sargent, 2003). Trainers can use the results of this research to help guide the design of training to facilitate the use of identified strategies. Trainers can also develop training to develop the use of these strategies. This research helps to shift the focus to learning on one's own and helps to define how self-learning is best practiced. This helps to extend training research and practice by defining strategies that trainers could train on and train to.

## **1.7 Overview of the Remaining Chapters**

Chapter 2 establishes the research framework and reviews the relevant research literature. Chapter 3 addresses the methodology used to address the research questions. Chapter 4 presents the data analysis. Conclusions and implications of the research are then presented in Chapter 5.

## **CHAPTER 2**

### **RESEARCH FRAMEWORK AND LITERATURE REVIEW**

#### **2.0 Chapter Overview**

This chapter establishes the research framework and reviews the relevant research literature. The power user research establishes the starting criteria for identifying and selecting subjects for the research. Adult education research is explored to help identify possible problems with some of the learning models that are presented. Two main learning models, Kolb Learning Cycle and the Self-Regulated Learner, are then explored along with the learning strategies that have been identified within them. An integrated model is then developed from these models to help guide this research.

#### **2.1 Power Users:**

There are many references to the term “Power User” in IS literature without a clear definition provided. Derived from the literature, a power user is a user of technology within an organization whom:

- Learns technologies quickly on their own (Baskerville et al., 2000; Lee et al., 2003; Massa & Testa, 2005; Watson et al., 2002)
- Typically supports fellow users (quick questions, informal training and formal training) (Baskerville et al., 2000; Massa & Testa, 2005; Watson et al., 2002)

- Gets more value from technologies than typical users (Baskerville et al., 2000; Lee et al., 2003; Massa & Testa, 2005)

These individuals may be found in technology departments, but they are often found in other areas of business. Practitioner literature does point out the importance of the power user and suggests that they are a key group in adoption of technologies in an organization, specifically in the adoption of ERP (Massa & Testa, 2005). They disseminate information about the technology, and the use of that technology to their co-workers (Baskerville et al., 2000; Massa & Testa, 2005; Watson et al., 2002). The information that these power users disseminate is key to the organization. Power users are not only training themselves but managing that training, making themselves experts in the use of the technology for their position in the organization. How they learn on their own is the focus of this study.

Power users and other adult learners differ from K-12 and undergraduate students often studied in the educational literature. They are no longer classroom-based students but adults in an organizational setting. Both of these groups, adult and non-classroom based students, need to be explored.

## **2.2 Adult Education:**

This research is set in the context of adult learning. Power users of IS/IT that are being investigated are those adults inside organizations. These users are not K-college students as represented in typical educational research but adults, similar to those represented in adult education research. This difference is significant because adults learn and are motivated to learn in different ways than students in K-college educational settings (Knowles, 1975, 1984).

Adult education is a growing area of research. There are two main areas of research in adult education: Knowles theory of andragogy and self-directed learning. Knowles used five assumptions to build the theory of andragogy:

1. *Self-concept*: As a person matures his/her self concept moves from one of being a dependent personality toward one of being a self-directed human being
2. *Experience*: As a person matures he/she accumulates a growing reservoir of experience that becomes an increasing resource for learning.
3. *Readiness to learn*. As a person matures his/her readiness to learn becomes oriented increasingly to the developmental tasks of his social roles.
4. *Orientation to learning*. As a person matures his/her time perspective changes from one of postponed application of knowledge to immediacy of application, and accordingly his orientation toward learning shifts from one of subject-centeredness to one of problem centeredness.
5. *Motivation to learn*: As a person matures the motivation to learn is internal.

The key concepts here are that adult learners become self-directed, goal-oriented, relevancy oriented and internally motivated (Knowles, 1984). The theory of andragogy is offered as a teaching method for adults as opposed to pedagogy being offered to children. Learners are driven by the goal and want the learning to be relevant to that goal. A learner being goal and relevancy-oriented points to possible problems with a training approach. The goal of the training is set by the designer of the training; it may miss the goal of the individual learner and some of the training may not be relevant to the tasks of the learner.

Another area of research in adult education is that of the self-directed learner. Self-directed learning is the process in which individuals, with or without help from others, analyze



and define learning needs, set learning goals, gather resources for learning, implement learning strategies, and evaluate their outcomes (Knowles, 1975). Self-directed learning (SDL) has seen large amounts of research attention in the past thirty years. It does seem to describe the learner of IS/IT, and the IS/IT worker who needs to further his/her skills as an adult learner. SDL directs much attention to how the individual is motivated to learn and does not describe the cognitive, and metacognitive strategies that underlie the learning process and it is these cognitive and metacognitive strategies and abilities that are of interest (Hrimech, 1995; Kerlin, 1992).

Andragogy and Self-directed learning both describe the learning process of the adult learner and are both taxonomies and not testable theories. They are used here to point out that adults learn differently than the K-college learner and research findings from the K-college area may not transfer to the adult learner.

## **2.3 Learning Models and Strategies:**

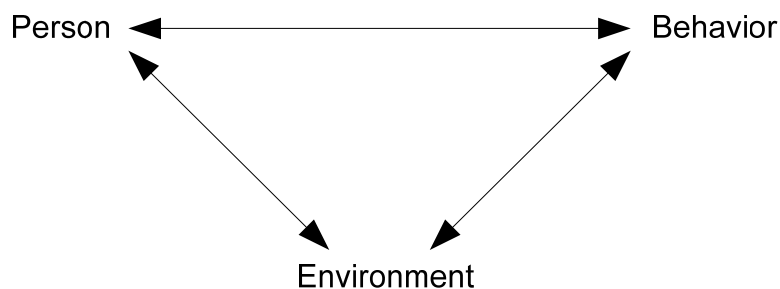
This study integrates two key models of learning, Self-Regulated Learning and the model of Kolb Learning Cycle, to describe the learning process of the power users. These models are based on Bandura's Social Cognitive Theory which is presented as the primary theory for this research. Self-regulated learning strategies from the context of K-college education, adult education and from an IS study are presented and compared. An integrated model is developed from the two models and self-regulated learning strategies are fit into the model. This new model is offered as the research framework for this study.

### ***2.3.1 Theory Base***

Bandura's Social Cognitive Theory (Bandura, 1977, 1986) is the base theory from which this research was built. Social Cognitive Theory is a framework describing human behavior. In

this theory, human behavior is one component in a triadic reciprocity model (See Figure 1).

The other two components are the person and the environment. Each of these three constructs has a reciprocal relationship with each of the other two. The behaviors of the individual impact the environment and the individual and the environment and the individual impact the behaviors of the individual.



**Figure 1** Social Cognitive Theory - Triadic Reciprocity Model (Bandura, 1986).

Learning is a key concept in this theory stating that individuals can learn by observing others, i.e. vicarious learning, or by observing themselves, i.e. enactive learning (Bandura, 1986). Vicarious learning is important for individuals so that they do not have to experience everything for themselves. In a training class, individuals can learn from instructors who may present concepts to them. Vicarious learning or behavioral modeling has been the main focus in IS/IT end user training research (for review of this literature, see Gupta & Bostrom, 2006). Enactive learning is learning associated with an individual modeling themselves as they interact with their environment.

(Bandura, 1986) suggests a mix of vicarious and enactive learning is the most effective. Enactive learning in the area of end-user training was the focus of only one experimental study. This study examined the learning of Excel by undergraduate students in an university Introduction to Information Systems class (Gupta, 2006). Since most of the self-regulated

learning strategies are enactive-based, this research adds much needed field research to the limited research on enactive learning in end-user training.

Enactive and vicarious experiences impact an individual's self-efficacy (Bandura, 1977) or the "belief in one's ability to organize and execute the courses of action required to manage prospective situations"(Bandura, 1995). Self-efficacy is a key component of an associated theory that is based on Social Cognitive Theory, the Social Cognitive Theory of Self-Regulation. Self-Regulation is the controlling of one's own behavior through self-observation, judgment of what is seen against some standard, and self-response (Bandura, 1991). If an individual's self-efficacy is low, their behaviors are less likely to control their environment or regulate themselves. If an individual fails at some task, their self-efficacy would go down related to the ability to do that task in the future, again the reciprocal relationship. Self-regulation theory provides the foundation for self-regulated learning research discussed in the next section.

### ***2.3.2 Self-Regulated Learning***

#### *2.3.2.1 Overview*

Learning on one's own, the learning without the direction of others, is then the primary focus of this study. Learning on one's own can be divided into learning by experience and learning with intent/outcomes and direction by the learner. Learning by experience is where someone learns something as a byproduct of doing some task or action. There is no intent to learn and the actions were not initiated to learn something. While this type of learning is an important area, it is not the focus in this study. This study focuses on the learning that is directed by the learner which is the primary way individuals learn software systems (Meares & Sargent, 2003). Some individuals are able to learn more and become power users through their learning activities. It is these learning strategies that are of interest.

The addition of intent and direction to learning on one's own is known in the academic research literature as self-regulated learning. Self-regulated learning is "... the process whereby students personally activate and sustain behaviors, cognitions, and affects, which are systematically oriented toward the attainment of learning goals." (Schunk, 2004). The active participation, the intent that the individual has in the learning process, has been shown to be significant in the learning of IS/IT (Gravill, 2004) and is therefore the primary focus of this study.

Self-regulated learning is based on Bandura's Social Cognitive Theory (Bandura, 1986), specifically the Social Cognitive Theory of Self-Regulation (Bandura, 1991). Self-regulated learning is an important theory in the field of Educational Psychology and has seen extensive research over the past 30 years (See reviews in Montalvo & Torres, 2004; Schunk & Ertmer, 2000; Zimmerman & Schunk, 2001).

Key to this theory is that a self-regulated learner has to have the *skill* and the *will* to learn or, in other words, the strategies and the motivation. Motivation in relation to self-efficacy has been studied extensively in self-regulated learning (Montalvo & Torres, 2004) as it has been in the IS/IT context (Compeau, Gravill, Haggerty, & Kelley, 2005; Compeau, Olfman, Sei, & Webster, 1995; Gravill & Compeau, 2003; Gravill, Compeau, & Marcolin, 2002; Marakas, Yi, & Johnson, 1998).

Self-efficacy is the belief by an individual about their ability to perform a specific behavior (Bandura, 1986). Self-efficacy in the IS/IT learning context has been shown to be positively correlated to the use of self-regulated learning strategies (Gravill, 2004). If the individual believes that they can use specific self-regulated learning strategies, they will use these strategies.

### 2.3.2.2 Self-Regulated Learning Model

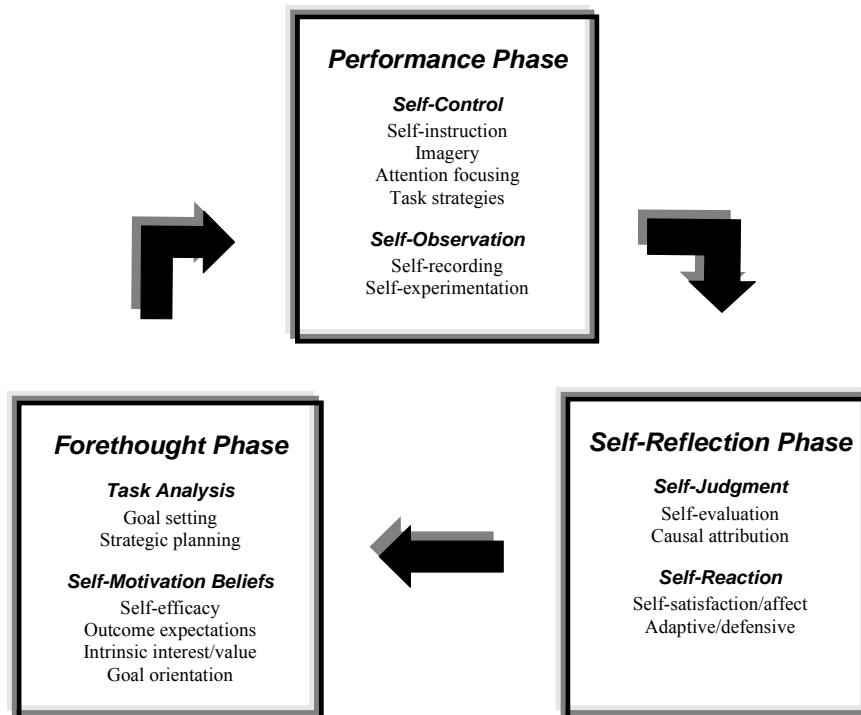
The focus of this study looks at the *skill* or strategies that are employed in the learning process and the motivations *will*, to learn. Learning strategies are processes and actions and directed at acquiring information or skill. For these strategies to be self-regulated learning strategies, they need to be directed and managed by the learner (Zimmerman, 1989). The use of self-regulated learning strategies has been shown to positively impact learning outcomes when they are employed independently or when they are taught (Gravill, 2004; Montalvo & Torres, 2004).

Zimmerman offers an iterative learning model (Figure 2) to describe self-regulated learning (Zimmerman, 2003). The model depicts individuals cycling through the learning process until learning goal is met. Since this is an iterative process, a learner would step out of the learning process at any point once there was no longer motivation to stay in the process. This points back to the *will* that was mentioned above and the goal is to gain the *skill*.

Zimmerman's model of self-regulated learning has three phases, each of which has two processes with general strategies in each of the processes. In the **Forethought Phase**, *Self-Motivational Beliefs* is offered as a process. While *Self-Motivational Beliefs* is seen as key to self-regulated learning, it is believed to be the driver or motivation for a learner to engage in self-regulated learning strategy. *Self-efficacy*, *Outcome expectations*, *Intrinsic Interest/value* and *Goal orientation* are different types of *Self-Motivational Beliefs* and are not learning strategies. Thus, in the integrated model, beliefs as influencing the entire process is depicted (See Figure 4).

In the **Self-Reflection Phase**, *Self-reaction* is offered as a process, yet, defined as affective outcomes; *Self-satisfaction/affect*, *Adaptive/defensive*. While there may be affect that is built up during learning, it is believed that this will impact the motivation to stay in the learning

cycle rather than impact one phase. Thus, like the *Self-motivational Beliefs*, *Self-Reflection* is seen to describe the entire model (See Figure 4). The remaining learning strategies are defined in Table 1.



**Figure 2** Self-Regulated Learner (Zimmerman 2003)

Table 1 Self-regulated learning strategies associated with the SRL model (Zimmerman 2003)

<b>Strategy</b>	<b>Phase</b>	<b>Definition</b>
Goal Setting	Forethought Phase	Learner decides upon the intended outcomes of a learning effort.
Strategic Planning	Forethought Phase	Learner selects or creates methods that are appropriate for the learning task and setting.
Self-instruction	Performance Phase	Learner “thinks aloud” as they move through a task describing what should happen at each step.
Imagery	Performance Phase	Learner produces mental images of successful learning or structures that are to be learned.
Attention focusing	Performance Phase	Learner improves concentration and screens out other covert processes or external events during learning.
Task strategies	Performance Phase	Learner reduces a task to its essential parts and reorganizes them so they are meaningful to the individual.
Self-recording	Performance Phase	Learner takes written and mental notes through the learning process.
Self-experimenting	Performance Phase	Learner systematically varies certain aspects of the learning objects when desired results are not attained.
Self-evaluation	Self-Reflection Phase	Learner compares results from performance with goals or standards and assess progress.
Causal attribution	Self-Reflection Phase	Learner makes judgments about the results of learning efforts.

In the **Forethought Phase** the main processes is task analysis. During this phase the individual is mentally preparing for the task. **Task analysis** relates to mental description of the task. The individual will look at what needs to be done (what they are learning about), set outcome oriented goals (*goal setting*), and strategize on how to achieve those goals (*strategic planning*). This is the individual preparing for the performance of some task.

In the **Performance Phase**, self-control and self-observation are the main processes. **Self-control** relates to the individual's focus on the task; how focused the individual stays on the task and how they manage the process of working through the learning process while attempting the task. A learner might present material to themselves (*self-instruction*), imagine successful learning (*imagery*), intently focus on the task (*attention focusing*), or break the task into smaller activities (*task-strategies*). **Self-observation** is the self-monitoring of an individual's performance. Here the individual would look at what they are doing, taking mental or written notes (*self-recording*), and modify past attempts to find an optimal level of performance (*self-experimenting*).

After the performance phase, the individual would then enter the **Self-Reflection Phase**. During this phase the individual would look back on the performance to see how they did. Again, there are two main processes: self-judgment and self-reaction. During **self-judgment**, individuals assess their performance, comparing the results of their efforts with their goals (self-evaluation), looking for causes of success or failures (causal attribution).

For example, if an individual was going to learn about Data Mining or some component of it, they would think about the particular part that they were trying to learn (**Forethought Phase**) and they would have to have some motivation to take on this learning. He/she would attempt to do the task, learning as the individual went through the process, strategizing, focusing



and remembering what happened as he/she did it (*Performance Phase*). The individual would then think about what was done. The individual would determine the successfulness and its impact on them (*Self-Reflection Phase*). If the individual decided to continue he/she would then return to the *Forethought Phase* and start again.

Zimmerman's model offers a significant start for a research model for this study. Certain aspects of the model limit the understanding of learning in the IS/IT context. "*Self-Motivational Beliefs*" and "*Self-reaction*" are presented as groups of strategies. While these are important to the learning process, it is believed that these are not strategies, as such, and impact the whole learning process, not specific phases. This is consistent with Bandura's Social Cognitive Theory of Self-Regulation (Bandura, 1991). Additionally, the model is built around the concept of learning but does not include the learning in the model. These issues are addressed in the development of a new model.

### 2.3.3 General Self-Regulated Learning Strategies

In addition to the first model (Figure 1), Zimmerman offered a group of self-regulated learning strategies in the educational context (Zimmerman & Pons, 1986). Some of the strategies listed in Table 2 have significant face validity relative to this study: self-evaluation, organizing and transforming, goal-setting and planning, keeping records and monitoring, self-consequences, etc. Others are specific to the K-college context: seeking teacher assistance, and reviewing tests. The strategies that have face validity are general in nature and need to be tested in the IS/IT context.

Table 2 Self-Regulated Learning Strategies (Zimmerman and Pons 1986)

Strategies	Definitions
1. Self-evaluation	Learner initiated evaluations of quality or progress of their learning.
2. Organizing and transforming	Learner initiated rearrangement of instructional materials to improve learning.

3. Goal-setting and planning	Learner setting of learning goals and planning for sequencing, timing and completing activities to reach these goals.
4. Seeking information	Learner efforts to seek information from non-social sources.
5. Keeping records and monitoring	Recording of events or results by learners.
6. Environmental Structuring	Arrangement of physical setting by the learner to make learning easier.
7. Self-consequences	Learner set rewards or punishments for success or failure in learning.
8. Rehearsing and memorizing	Learner efforts to memorize material through practice.
9. Seeking peer assistance	Learner efforts to solicit help in learning from peers.
10. Seeking teacher assistance	Learner efforts to solicit help in learning from teachers.
11. Seeking adult assistance	Learner efforts to solicit help in learning from adults.
12. Reviewing tests	Learner efforts to reread tests.
13. Reviewing notes	Learner efforts to reread notes.
14. Reviewing textbooks	Learner efforts to reread textbooks.

In the field of adult education, Hrimech identified eleven self-regulated learning strategies (Table 3), (Hrimech, 1995). Hrimech interviewed adult learners, asking them to identify learning strategies they used in an academic setting. Examining these strategies in contrast to Zimmerman's strategies, the adult learner additionally relies on prior knowledge and prior models as they learn. In addition to the strategies identified by Zimmerman, six additional strategies are identified (Table 3: boldface): Observing a period of latency, Establishing a climate of availability and openness, Devising visual schemata, Drafting a summary or abstract, Experimenting with practical applications, and Exploiting visualization. Although Hrimech's study examined at adult learners, the setting was an academic one and not an organizational setting.

Table 3 Self-Regulated Learning Strategies (Hrimech 1995)

<b>Strategies</b>	<b>Definitions</b>
1. Establishing links between the material to be learned and extraneous notions	Examples from past experience or from knowledge outside of the information presented are linked with the information presented.
2. <b>Observing a period of latency</b>	Allowing time between learning tasks to allow the subconscious to work on newly acquired knowledge and reduce stress and fatigue in the learning process.
3. <b>Establishing a climate of availability and openness</b>	Preparing an internal psychological environment that supports learning efforts.
4. <b>Devising visual schemata.</b>	Drawing pictures, diagrams and graphics to simplify the subject matter.
5. <b>Drafting a summary or an abstract</b>	Summarization of the material into a personal understanding of the concepts.
6. Restructuring the subject matter	Rearrangement of information from introduced form to an original form.
7. Seeking out various sources and different points of view	Getting information from different sources to get multiple perspectives on a subject.
8. Discussing with peers	Conversing with other learners about the subject matter.
9. Seeking outside assistance	Looking for help in the learning context from others.
10. <b>Experimenting with practical applications.</b>	Trying out of different concepts outside of the classroom setting that were offered in the classroom setting
11. <b>Exploiting visualization</b>	Creating vivid mental images of the concepts to be learned.

From his interviews, Hrimech anecdotally identified two of his strategies to be key to the adult learner: *Establishing links between the material to be learned and extraneous notions* and *Restructuring the Subject Matter*. These learning strategies are generally defined and if they are to be applicable in an IS/IT context, they need to be brought into the IS/IT context and made

specific. The goal of this research is to find and ground effective learning strategies along with any others that may be identified by the subjects of this study (Power Users in the IS/IT context).

#### ***2.3.4 Self-Regulated Learning Strategies in IS/IT Context***

In the IS/IT literature, there have been two studies that looked at self-regulated learning strategies (Chen, 2002; Gravill, 2004). In the first, (Chen, 2002) administered the Motivated Strategies for Learning Questionnaire (MSLQ) to 197 undergraduate students taking an introductory information systems course. From the MSLQ, Chen identified five strategies that were relevant to self-regulated learning: metacognitive self-regulation, time and study environment, effort regulation, peer learning, and help seeking. The link between self-regulated learning strategies and performance was inconclusive but she suggested that the MSLQ is not appropriate in addressing self-regulated learning in the IS setting she used. This study is of note since it was in the IS/IT context and the five strategies will be watched for but will not be included initially since the study was inconclusive.

In the second study, Gravill looked at strategies used in training (Gravill, 2004). Using an open interview methodology, she identified five strategies that overlap those found by Zimmerman. See Table 4 for a list of the strategies that were found and how they relate to those presented by Zimmerman.

Table 4 Self-Regulated Learning Strategies in IS training context (Gravill 2004)

<b>Gravill Strategy</b>	<b>Description</b>	<b>Zimmerman View</b>
Frustration monitoring	Learner monitors levels of frustration as an indication of need to change learning approach.	Self-evaluation
Taking notes	Learner records details in the learning process.	Keeping records and monitoring
Establishment of specific work task goals	Learner sets learning goals that relate directly to work needs.	Goal-setting and planning

Focus on time spent learning	Learner manages time in the learning process to make sure that time spent is achieving the end goal.	Self-evaluation
Self-reward	Learner rewards oneself when a goal is reached.	Self-consequences

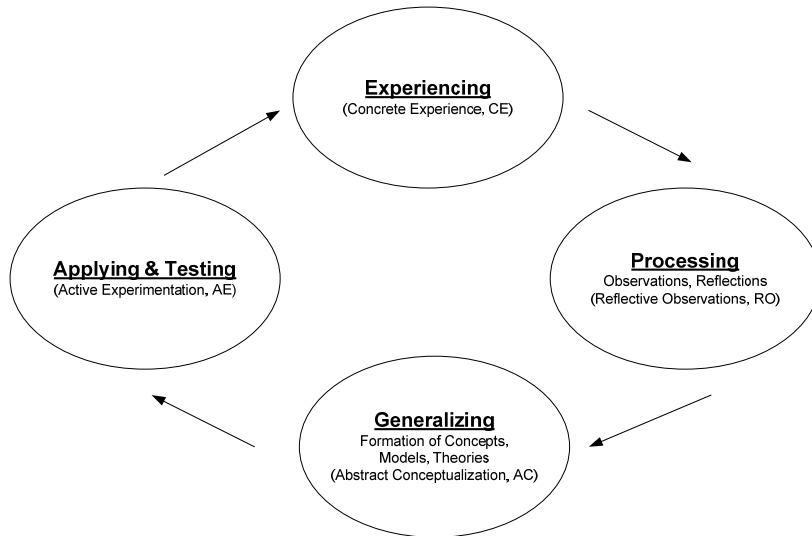
After identifying the strategies, Gravill found that self-regulated learning strategies, as a whole, were important to the learning process in an online computer software training context. Self-awareness correlated with self-regulated learning strategies (.24 at  $p < .001$ ) and self-regulated learning strategies correlated with declarative knowledge (.39 at  $p < .001$ ), procedural knowledge (.18 at  $p < .05$ ), and self-efficacy (.23 at  $p < .001$ ). While she found self-regulated learning strategies to be significant, the individual importance of each strategy could not be extracted because the strategies were treated as a single construct. Training was conducted, followed by a post-test to measure knowledge gained.

Because the focus was around the web-based training that was developed, all self-regulated learning strategies were not available to the learner. Gravill did identify strategies used in the IS/IT context but they were limited to an online learning situation. Strategies were found to be significant in the learning context but the individual strategies could not be identified because self-regulated learning strategies was tested as a one-dimensional construct. One of the goals of this study is to identify effective learning strategies for the power user grounded in an IS/IT context that is not bounded to the classroom nor operationalized as a uni-dimensional construct.

### 2.3.5 Kolb Learning Cycle Theory

Kolb introduced a learning process model in the Kolb Learning Cycle Theory (KLCT) that is iterative in nature (Figure 3), (Kolb, 1984). There are four stages that the learner goes through in this process: **concrete experience (CE)**, **reflective observation (RO)**, **abstract conceptualization (AC)**, and **active experimentation (AE)**. **Concrete experience** occurs when the learner gains experience through completing or attempting a task. **Reflective observation** occurs when the learner looks back at the experience that was just completed or attempted. **Abstract conceptualization** is either the building or maintaining of mental models for understanding. **Active experimentation** occurs when the learner formulates a plan to then go into the **Concrete Experience** again. Each step in this cycle is not equally weighted as the learner continues through this process. If an individual is well versed in using a specific IS/IT tool, they may not require as much reflective observation or abstract conceptualization as a novice user might.

Returning to the earlier example of data mining (p.16), if an individual was going to learn about data mining or some component of it, they might get initial information about the subject (AC) to build a mental model. This would be general information. The individual would then start to test this model (AE). They would then use the model (CE), monitoring how it worked as they used it. As the model was used, deficiencies would be identified and information about the subject gathered. The individual would then assess how the model worked and how it did not work (RO). This would then lead the individual to adjust or enhance the mental model (AC) and the process would be repeated until their understanding did not change.



**Figure 3** Kolb Learning Cycle Theory (Kolb 1984)

Like the Self-Regulated Learning model, KLCT views learning as an iterative process. This is important because of the constant need for change in the skills of the IS/IT worker. KLCT also portrays learning in the AC stage as the building of models. Mental models are a key concept in the IS/IT literature and this view of learning is helpful when looking at power users. Mental models are representations of the systems, technical and business found in organizations, and the more closely the mental representation captures reality, the stronger the mental model (Vandenbosch & Higgins, 1996). This important concept is missing or assumed in the self-regulated learning model.

If an individual does not have a previous model of a system, when they gain information about a system, they create a new mental model. When new information is gained about this system that does not conflict with the prior model, this new information is *assimilated*, building on the previous model. If new information conflicts with the prior model, the individual must *accommodate* the new information by adapting the model (Piaget, 1995, 2000). This gives us two additional learning strategies, accommodation and assimilation (only in the AC area, however).

The Self-Regulated Learning Model offers insight into individual management of the learning process but does not explicitly address learning in the model. KLCT is very helpful in understanding how an individual learns, but it is focused on the learning process generally and leaves out why an individual would move from one process phase to another and individual strategies that would be used throughout the learning process.

## 2.4 Research Framework

Both models, KLCT and Zimmerman's Self-Regulated Learning Model, offer a view that is important to describing the learning process related to technology: KLCT offers the development of mental models and self-regulated learning describes how the individual manages his/her learning process. Integrating the models gives further insight.

The KLCT is very similar to the Phases and Subprocesses of Self-Regulation (Table 5).

Table 5 Comparison of KLCT and Self-Regulated Learning

Phases and Subprocesses of The Self-Regulated Learning Model		Kolb Learning Cycle Theory
Performance Phase	Individual actively works with knowledge	Concrete Experience
Self-Reflection Phase	Individual looks at what was done actively	Processing
[Missing]	Individual incorporates what was observed and incorporates this into previous understanding	Generalizing
Forethought Phase	Individual looks ahead to next step	Applying and testing

**Applying & Testing** is basically equivalent to the **Forethought** phase in the Zimmerman model. **Processing** maps to the **Self-Reflection** phase. **Concrete Experience** would be the



**Performance** phase. The **Generalizing** in the KLCT is not directly represented in the Self-Regulated Learning Model, introducing the concept of working with mental models. Working with mental models for an individual is not only building a mental model from information that has been introduced to the learner through training, reading or exploration, but the integration of new information into previous mental models the learner already has (Vandenbosch & Higgins, 1996).

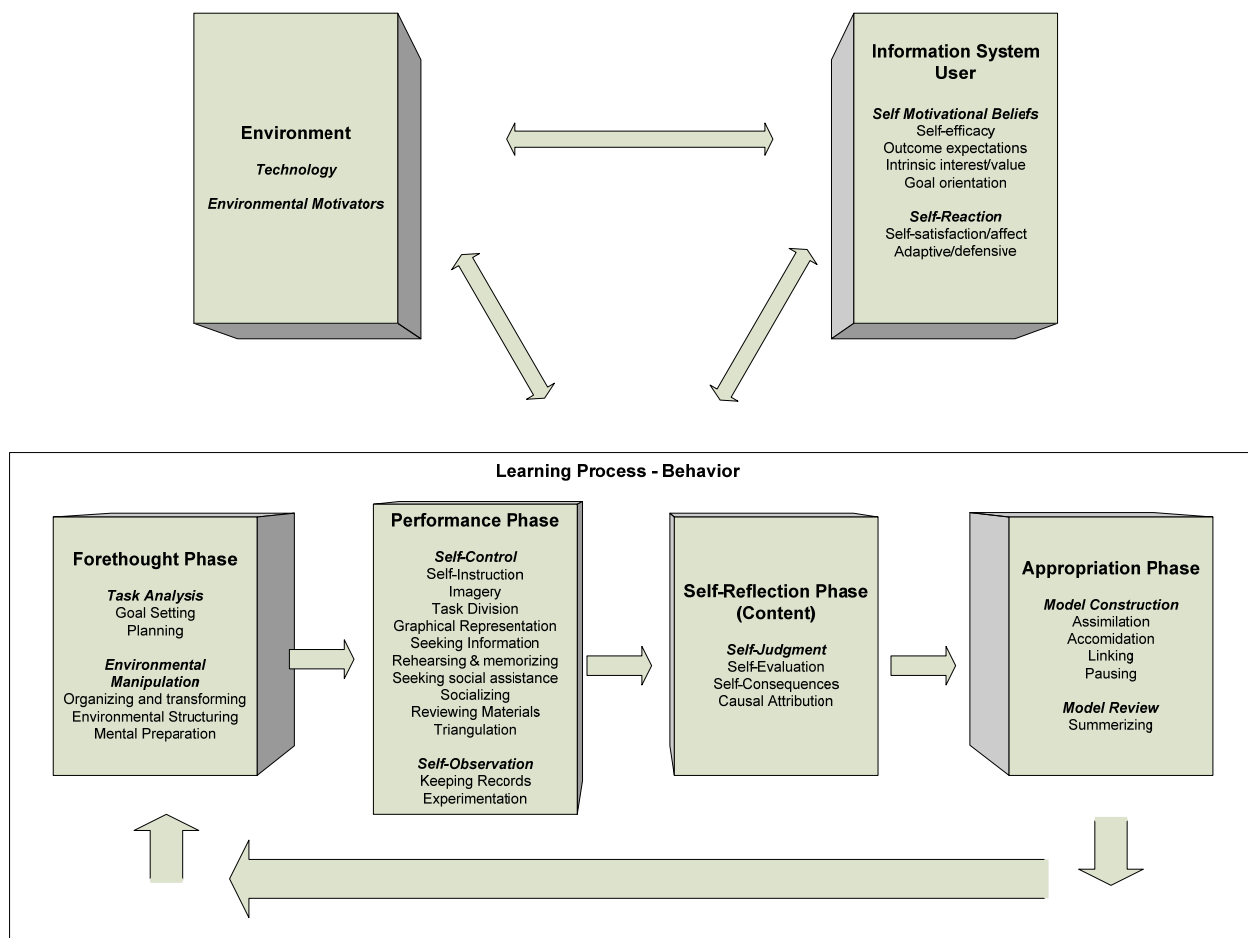


Figure 4 Self-Regulated Computer Learner

Two previous models are integrated, referring to the new model as self-regulated computer learner (See Figure 4). This model provides the conceptual framework for this study. In this model, the self-regulated learning process that an individual goes through is seen as a behavior and is represented in the box at the bottom of the model. From Social Cognitive Theory, a behavior, self-regulated learning, is in a triadic, reciprocal relationship with the person, the information system user, and the environment.

**Self-Motivation** and **Self-Reaction** are seen as measures of the individual **Information System User** and not of the learning (behavior) done by the individual. The relationship between the **Information System User** and the behavior of learning is reciprocal as posed by (Bandura, 1986): the individual is impacting the behavior and the behavior is impacting the individual. **Self-Motivation**, from (Zimmerman, 2002), is made up of *Self-efficacy*, *Outcome expectations*, *Intrinsic interest/value* and *Goal orientation* (See table 6). Goal orientation, as shown by (Gravill, 2004), impacts self-regulated learning strategies.

Table 6 Self-Motivational Beliefs

<b>Components</b>	<b>Definitions</b>
1. Self-efficacy	Learner's beliefs about the personal capability to learn.
2. Outcome expectations	Learner's beliefs about the consequences of learning.
3. Intrinsic interest/value	Learner's valuing of the task skill for its own merits.
4. Goal orientation	Learner's valuing of the process of learning for its own merits.

The affect measures of the individual are reflected in **Self-Reaction**. As seen by Zimmerman, the key components of **Self-Reaction** are Self-satisfaction/affect and Defensive (Zimmerman, 2002) (See Table 7).

Table 7 Self-Reaction

<b>Components</b>	<b>Definitions</b>
1. Self-satisfaction/affect	Positive or negative feelings related to the learner's performance.
2. Defensive	Learner efforts to protect self-image by dropping out of the learning process

The **Environment** represents the context in which the individual learns. Key to this is the technology that they are learning and the motivators that come from the environment. The **Environment** has a reciprocal relationship with the behaviors of learning and the Individual.

The learning process is depicted in the box in Figure 4.

Individuals can start from any point in the process but would typically start at the **Forethought Phase**. Here an individual would prepare for the learning process by thinking about the task at hand and managing the learning environment around him/herself. In the **Performance Phase**, individuals would perform the learning task, collecting the raw information and monitoring the individual processes. The learner would then judge how they had done and start to put links together in the **Self-Reflection Phase**.

The individual would then generalize the information to construct representations of the systems they are trying to learn about in the **Appropriation Phase**. The term "Abstraction" from KLCT does not convey the building of knowledge as the theory of Self-Regulated Learning portrays, and thus was dropped. Appropriation, or the act of taking the information for the use by the individual, seems to be a more appropriate term. The learner would then enter the **Forethought Phase**, assessing if they need to continue or not. This process is driven by the motivation of the individual to learn. The successes and failures impact this motivation, positively or negatively, depending on the individual.

Strategies from SRL model, strategies for working with mental models, strategies from Zimmerman's inventory, and strategies from Gravill's work are can now be defined and put into the model. This is accomplished in the next section.

#### ***2.4.1 Self-Regulated Learning Strategies***

Self-regulated learning strategies summarized in literature review were integrated and placed into the primary phase where they would be used. The strategies were integrated by removing duplicates and merging similar strategies. The language used to describe the merged strategy was clarified to reflect the merged items. The strategies are described by phase.

In the Forethought Phase (See Table 8), the learner is preparing to actively bring in information. Here the learner prepares themselves, their surroundings, makes plans for the process to be undertaken and sets goals for themselves.

Table 8 Strategies of the Self-Regulated Computer Learner, Forethought Phase

Strategy	Definition	Reference
Goal Setting	Learner establishes learning objectives	Goal Setting and Planning (Zimmerman et al. 1986), Goal Setting (Zimmerman 2004), Establishment of specific work task goals (Gravill 2004)
Planning	Learner formulates a plan to achieve learning goal	Goal Setting and Planning (Zimmerman et al. 1986), Strategic Planning (Zimmerman 2004)
Organizing and Transforming	Learner initiated rearrangement of instructional materials to improve learning.	Organizing and Transforming (Zimmerman et al. 1986), Restructuring the subject matter (Hrimech 1995)
Environmental Structuring	Arrangement of physical setting by the learner to make learning easier.	Environmental Structuring (Zimmerman et al. 1986)
Mental Preparation	Learner mentally prepares for the learning process, clearing mental distractions and preparing for frustration during the learning process.	Attention Focusing (Zimmerman 2004), Establishing a climate of availability and openness (Hrimech 1995)

Once the individual has prepared for the active collection of information, they enter the Performance Phase (See Table 9). In this phase, the learner seeks actively gathers, and takes in information. This is the most concrete of the four phases and there are many different strategies that can be attempted.

Table 9 Strategies of the Self-Regulated Computer Learner, Performance Phase

Strategy	Definition	Reference
Self-Instruction	Learner “thinks aloud” as they move through a task describing what should happen at each step.	Self-Instruction (Zimmerman 2004)
Imagery	Learner produces mental images of successful learning or structures that are to be learned.	Imagery (Zimmerman 2004), Exploiting visualization (Hrimech 1995)
Task Division	Learner reduces a task to its essential parts and reorganizes them so they are meaningful to the individual.	Task Strategies (Zimmerman 2004)
Graphical Representation	Learner draws pictures, diagrams and graphics to simplify the subject matter	Devising visual schemata (Hrimech 1995)
Seeking Information	Learner seeks out information from a non social source.	Seeking Information (Zimmerman et al. 1986)
Rehearsing and Memorizing	Learner tries to memorize material through practice.	Rehearsing and Memorizing (Zimmerman et al. 1986)
Seeking Social Assistance	Learner seeks out help from another person.	Seeking Peer Assistance, Seeking Teacher Assistance, and Seeking Adult Assistance (Zimmerman et al. 1986), Seeking outside assistance (Hrimech 1995)
Socializing	Learner discusses subject matter with a peer.	Discussing with peers (Hrimech 1995)
Reviewing Materials	Learner revisits information sources.	Reviewing Tests, Reviewing Notes, Reviewing Textbooks, (Zimmerman et al. 1986)
Keeping Records	Learner takes written and mental notes through the learning process.	Keeping Records and Monitoring (Zimmerman et al. 1986), Self-Recording (Zimmerman 2004), Taking Notes

		(Gravill 2004)
Experimentation	Learner tries out material that was learned and varies the procedures to see the effects.	Self-Experimenting (Zimmerman 2004), Experimenting with practical applications (Hrimech 1995)
Triangulation	Learner gathers information from different sources to get different perspectives on the subject being learned.	Seeking out various sources and different points of view (Hrimech 1995)

After an individual has gone through the Performance Phase, they need to reflect on their progress generally and overall in the Self-Reflection Phase (See Table 10). In this phase, the individual assesses if they have met learning goals and measures the progress that they have made, rewarding themselves or punishing themselves overtly or subconsciously.

Table 10 Strategies of the Self-Regulated Computer Learner, Self-Reflection Phase

Strategy	Definition	Reference
Self-Evaluation	Learner judges the effectiveness of the learning process.	Self-Evaluation (Zimmerman et al. 1986) Self Evaluation (Zimmerman 2004), Frustration Monitoring, and Focus on time spent learning (Gravill 2004)
Self-Consequences	Learner rewards (or punishes) themselves for progress made (or not) on learning goals.	Self-Consequences (Zimmerman et al. 1986), Self-reward (Gravill 2004)
Causal Attribution	Learner looks for reasons for success or failure in the learning process.	Causal Attribution (Zimmerman 2004)

While individuals are constantly working with their own mental models of the system they are trying to learn, once they have gone through the Self-Reflection Phase, they make the information that they have gathered their own in the Appropriation Phase (See Table 11). Here the individuals work with the mental models; creating them, extending them, linking them, and evaluating them.

Table 11 Strategies of the Self-Regulated Computer Learner, Appropriation Phase

Strategy	Definition	Reference
Assimilation	Learner builds mental models from information gained, either new models of building off of old ones.	Piaget's theory (Piaget 1995)
Accommodation	When a learner is appropriating information that conflicts with information previously appropriated, learner adapts earlier mental models to accommodate new information or discards new information.	Piaget's theory (Piaget 1995)
Summarizing	Learner redraws what was learned to see if they understood material and look for holes in their understanding.	Drafting a summary or an abstract (Hrimech 1995)
Linking	Learners draw linkages to separate mental models and tangential experiences, extending this model and others.	Establishing links between the material to be learned and extraneous notions (Hrimech 1995)
Pausing	Learner intentionally allows time for information to be assimilated	Observing a period of latency (Hrimech 1995)

This aggregated list of self-regulated learning strategies, while extensive, is not exhaustive. In many cases, the strategies are not very specific. The strategies must be grounded in the IS/IT context to be sure that the list is as comprehensive as possible and to make each strategy as specific as possible to guide future research and practical applications.

## 2.5 Summary

Table 12 summarizes the gaps and problems in the literature as it relates to self-regulated learning of power users described in detail in this chapter. The table also shows how this research addresses these gaps and problems.

Table 12 Summary of Concerns to be Addressed in Study

Concerns in literature	Focus of current research
Learning technology on one's own has been pointed out as the primary way that individuals learn information technology but the process has very limited research.	This research lays out a model of self-regulated computer learning and reports on field study of power users self-regulated learning strategies.
Self-Regulated Learning Strategies identified in the literature are primarily K-college classroom based and are not IS/IT specific.	This research identifies self-regulated learning strategies used in the IS/IT context that are used for effective learning.
While SRL strategies have been identified in the literature, triggers to use these strategies have not been identified especially within the IS/IT context.	This research identifies triggers to use strategies in the learning of software applications.
There is limited research on power users	This research addresses one of the key tenants of the power user: how power users learn on their own.
Motivations of the power user to learn have not been identified.	This research looks at the motivations to learn for the power user.
Most end-user training research has focused on vicarious learning	This research adds much needed field research to the limited research on enactive learning in end-user training.

This research makes a contribution by addressing these research gaps, providing research to define how individuals learn and get the most value out of using information technology. The study of active engagement for the specific purpose of learning the technology is a significant shift away from the acceptance of technology which has been of primary concern of the IS/IT research community for many years (Vankatesh, Morris, Davis, & Davis, 2003).



## **CHAPTER 3**

### **METHODOLOGY**

#### **3.0 Chapter Overview**

This chapter defines the methodology used to answer the research questions and it establishes what research method could best ground self-regulated learning styles in the IS/IT context. Subject selection is explored and then designed to yield the richest data. The data collection methods and the analysis of the data are presented. Lastly, the deliverables for the research are discussed.

#### **3.1 Methodology Overview**

Specific guidance regarding methodological choices were limited in this study since the domain of self-regulated learning strategies and the domain of power users has not been fully explored in the field of IS/IT. There is research in the area of self-regulated learning strategies in the domain of K-College learners but it is unclear if these strategies are applicable to adult learners who learn software on their own. In addition, these strategies are often vague and even if applicable need to be grounded in IT/IS context.

The two attempts to look at self-regulated learning strategies in an IS/IT context had mixed results. Gravill focused on the strategies of the self-regulated learner but the training focus of the study limited the strategies that were available to the learner (Gravill, 2004). Chen found no significant results when looking at self-regulated learning strategies and attributed this to the measure that was used, i.e., it was not valid in the IS/IT context (Chen, 2002).

Investigations in Adult Education, and the two in IS/IT point out that the strategies will be context-dependent and need to be explored in that context. Triggers to use these strategies along with motivations to learn have not been previously researched and are addressed in this study. In addition, the domain of power users has not been researched, and thus, lacks prior research upon which to build.

Given the lack of prior research on the domains of interest in this study, a qualitative research design is the most appropriate choice. A qualitative design allows a researcher to study human behavior holistically (Galliers & Land, 1987; Glaser & Strauss, 1967; Guba & Lincoln, 1994; Kaplan & Duchon, 1988). While quantitative analysis could allow for greater generalizability, there is little prior research in this area that informs this type of design. Since there is a lack of clarity from the reference disciplines and the domains of SRL and since power users in the IS/IT context has yet to be explored, a qualitative approach was determined to be the most appropriate to answer the research questions. One of the strengths of this research is that it will explore these two domains, allowing for quantitative investigations to follow.

For this study, a Critical Incident Technique (CIT) will be used for data collection and analysis. CIT is a qualitative method, used to gather information from individuals uniquely qualified to offer information on the subject area. It enables formulation of the critical requirements of a role and is especially useful in exploratory research designed to examine very specific, situationally relevant aspects of a role or behavior (Yukl, 2002). It has been used in thousands of studies (Fivars & Fitzpatrick, 2001) and has been shown valid and reliable when properly applied (B.-E. Andersson & S.-G. Nilsson, 1964; Bitner et al., 1985).

The CIT was developed in the United States Army Air Forces Aviation Psychology Program during World War II to study individuals in specific roles to identify behaviors that lead

to a success or failure in a specific situation. CIT has been widely used since it was first developed (For reviews, See B. E. Andersson & S. G. Nilsson, 1964; Butterfield, Borgen, & Amundson, 2005; Butterfield, Borgen, Amundson, & Maglio, 2005; Flanagan, 1954; Gremler, 2004), including for IS research (Clawson & Bostrom, 1993; Kelly, 1996; Taylor, 2001; Thomas, 2005a).

In CIT, information is gathered from the individuals through interviews about extraordinary examples of the subject area and then content analysis is done on the data gathered (Flanagan, 1954). Key to this technique is that it allows research to be conducted in a natural setting with little if any manipulation: CIT identifies key events in the area of study, and provides rich information. In this study, power users were identified in organizations. These individuals were interviewed about particularly successful or unsuccessful learning episodes (the critical incidents), exploring critical learning strategies. Content analysis was conducted on the data gathered describing the critical incidents.

A critical incident in this study is defined as a time when an individual learned in a way that is directed by themselves. Power users described incidents when they learned and described the learning activities. The principal investigator asked for reasons why they started learning, strategies they used to learn and reasons why they chose or chose not to use specific learning strategies. For these learning episodes to be considered critical, it had to be a time when the power user learned on their own and it made a significant enough impact for them to recall the event (Flanagan, 1954). One learning process that will be left out of this study is that of specific training to which an individual was sent. If an individual is sent for training, they are not necessarily involved in self-regulated learning and therefore, this type of learning is excluded.

### ***3.1.1 Context and Power User Identification***

For a critical incident technique, the sample is purposeful as opposed to probability-based, allowing the researcher to gather incidents with the richest data. Power users included in this study were solicited from organizations that use significantly complex software systems (Boudreau & Seligman, 2005) so that learning and learning strategies were rich. The individuals that have the most successful strategies for learning these systems, power users, were then identified by the organization (discussed later) according to the following criteria:

- Learn software applications on one's own.
- Provides software application support to coworkers.
- Get more value from the software applications than typical users

Key to the study is the type of software systems used. These systems must be sufficiently complex (Boudreau & Seligman, 2005) to allow delineation between power users and typical users. Since ERP systems are sufficiently complex, difficult to learn, and dependent upon power user's support and implementation, being a power user of an ERP system will be the last criteria for selection of the power users. Power users were not limited to functional areas of the organization; however, power users outside of technology support departments were the target as they may better represent typical software application users. Individuals were identified by immediate supervisors, departmental coworkers, or from documentation in the organization that identifies power users. During the interview, power users were asked to identify other power users. See Appendix A for the instructions to participating organizations.

The subjects were drawn from the power users within institutions of the large university system. Several institutions are using PeopleSoft and Banner, both ERP systems: PeopleSoft is used to manage finances and personnel, and Banner is used to manage student enrollment and

student records. The state information technology support provides centralized support for these system's users at the various locations. Although each of these facilities installs the same core software system, each installation is unique in its implementation. At each of the schools, there are many different departments that use these systems. The use of PeopleSoft and Banner at each of the departments is, again, unique.

There is, then, commonality in the systems that are being utilized and learned about by the power users of these systems but significant differences between them. The commonality has helped in the collection of data and allowing for commonality in the language that is used by the power users but the differences in how the systems were used yielded significant richness in how power users learned.

### ***3.1.2 Sample Size***

The identification of power users of technology is key to the study. The power-user was first identified by the centralized support or by one of the institutions in the university system. The centralized support helped identify key contacts in thirty-five institutions. The contacts were then asked to identify power users of these systems at their institution. This constituted the first check to see if those that information would be gathered from power users.

Twenty-nine individuals, including two from the centralized support, were identified as power users by their institutions. These individuals were then sent a letter (Appendix B) asking if they would like to participate and to fill out an online survey (see Appendix C). Nineteen individuals agreed to be a part of the study and eighteen filled out the survey. The survey that the individuals filled out was used to gather background information to facilitate the interview and to screen out possible individuals that were not power users. All of the eighteen felt that they were looked to for guidance on how to use software in their organization and all supported

others use of technology. They spent from one to forty with an average of fifteen hours per week supporting others. They all used their computers more than twenty hours per week and felt that they learned and felt that they had learned most of their computing skills on their own. This constituted the second check to see if they were power users (see appendix D).

Interviews were set up between the primary researcher and seventeen of the eighteen that completed the online survey. One participant was extremely busy during the time when the researcher would have been able to interview and opted out of the study. The interviews were either in-person or over the phone. Only one interview was conducted over the phone. During the interview, the researcher described power users and asked directly if they were a power-user and all responded affirmatively. This constituted the third and final check.

The sample is learning episodes (critical incidents). The number of critical incidents, or the overall sample size depends upon the number of new “behaviors” or in this study “learning strategies” noted as the interviews continue. A guideline that (Flanagan, 1954) gives is that during that last critical incident being collected, the chances are one in fifty that a new behavior will be discovered. More specifically, during the interview of the last power user about the last learning episode, there would have been a one in 50 chance that there would be a new learning strategy revealed. For example, (Flanagan, 1954) suggests that in order to capture a complete picture of a supervisor job two to four thousand critical incidents are needed, and for a skilled worker one to two thousand critical incidents would need to be captured. The last identified learning strategy during the study, *testing and verification*, came during the eighth interview.

This study looked at, in detail, the learning of technology, a very narrow part of the job of an individual. Given the application of these guidelines in other studies in and outside IS that focus on narrow aspects of a job (Butterfield, Borgen, Amundson et al., 2005; Clawson &

Bostrom, 1993; Ellinger & Bostrom, 1999; Kelly, 1996; Taylor, 2001; Thomas, 2005b), it was initially believed that between fifty to one hundred critical incidents would need to be collected. There were ninety-six critical incidents collected. Thus, all evidence that supports that number of critical incidents was adequate.

It was initially believed that an individual would be able to give between five and eight of the incidents, therefore, between ten and twenty individuals would need to have been interviewed from the group of identified power users. During this study, an average of 5.65 critical incidents was collected per power user. In order to cover these critical incidents along with background questions, each individual was asked to commit two hours(Ellinger & Bostrom, 2002).

### **3.2 Data Collection**

Initial data collection occurred through an online survey. While one of the purposes of the survey was to confirm the individual was a power user, background information and information that would facilitate the interview was also gathered.

The interview was semi-structured based on the model developed in the prior chapter (See Figure 4). There were some background questions about the power users use of software along with open-ended questions about the learning of software. Probing questions about the learning of software were then used to clarify their motivation to learn, learning strategies and what triggered them to use specific strategies. A copy of the interview structure is in appendix E. The interviewer then identified the software for which the individual felt they were power users. Information was then solicited about the about the software (see appendix F).

Next, the interviewer asked the participant to describe the times that they learned about this software that was critical to their jobs. These times that the participant can recalled became the critical incidents of this study (Butterfield, Borgen, Amundson et al., 2005; Clawson & Bostrom, 1993; Ellinger & Bostrom, 1999; Kelly, 1996; Thomas, 2005a).

The power users were asked to recall critical learning episodes/incidents around each of the pieces of software. The interviewer allowed the power user to recall as much information about the learning episode as they recalled as outlined in the Learning Episode Form (Appendix E). The power users would then discuss with the researcher the learning episodes. The researcher would ask for clarification during the discussion of terms used and around the learning in an effort to achieve a level of detail in the discussion to analyze learning strategies, triggers to use strategies, and motivations to learn. Once the power user finished discussing the individual learning episodes, using the model developed in previous chapter (see Figure 4) the interviewer probed to see if other strategies not yet mentioned were used in any of the episodes. This probing was delayed to allow the free flow of information from the power user and not direct the recollection of the episode.

The interviewer then completed the interview, using the General Learning Form (Appendix F), by having the power user judge which three strategies that were the most important to them and what his/her general philosophy of learning is.

### **3.3 Pilot Study**

A pilot study was conducted with four participants known to the researcher or known to peers of the researcher and known to be power users. The interviews yielded 24 critical incidents



or an average of six per interview. During the pilot study, the interview and the method of conducting the interview were refined.

- Wording of the background questionnaire and the technology questionnaire was changed to clear up confusion. These were no content changes.
- Questions about learning episodes surrounding a technology were moved to right after the discussion of the technology to improve flow for the interviewee. Originally the discussion of all of the technologies was grouped together followed by interviews about all of the learning episodes. This was to help in the coding process but the flow of the interview takes precedence.
- The pilot helped to point out to the researcher the importance of maintaining control of the interview.
- The pilot gave the interviewer an opportunity to refine the process, allowing the interviewer to focus on the content and not the process of the interview when the primary study was conducted.
- Another important insight that was gained in this pilot study was that power users are important individuals to the organization and the time that they offer for this study is very generous.

The interviews were all transcribed and the final interview was analyzed using a content analysis software application, AtlasTI. In one critical incident from the final interview, eleven separate strategies with twenty-three occurrences were identified: *seeking information, goal setting, keeping records, experimentation, triangulation, assimilation, modeling, rehearsing and memorizing, seeking social assistance, socializing, and linking*. The pilot study helped refine

data collection and analysis techniques for the researcher. The addition of *modeling* as a self-regulated learning strategy also showed that research in this area was needed.

### **3.4 Data Analysis**

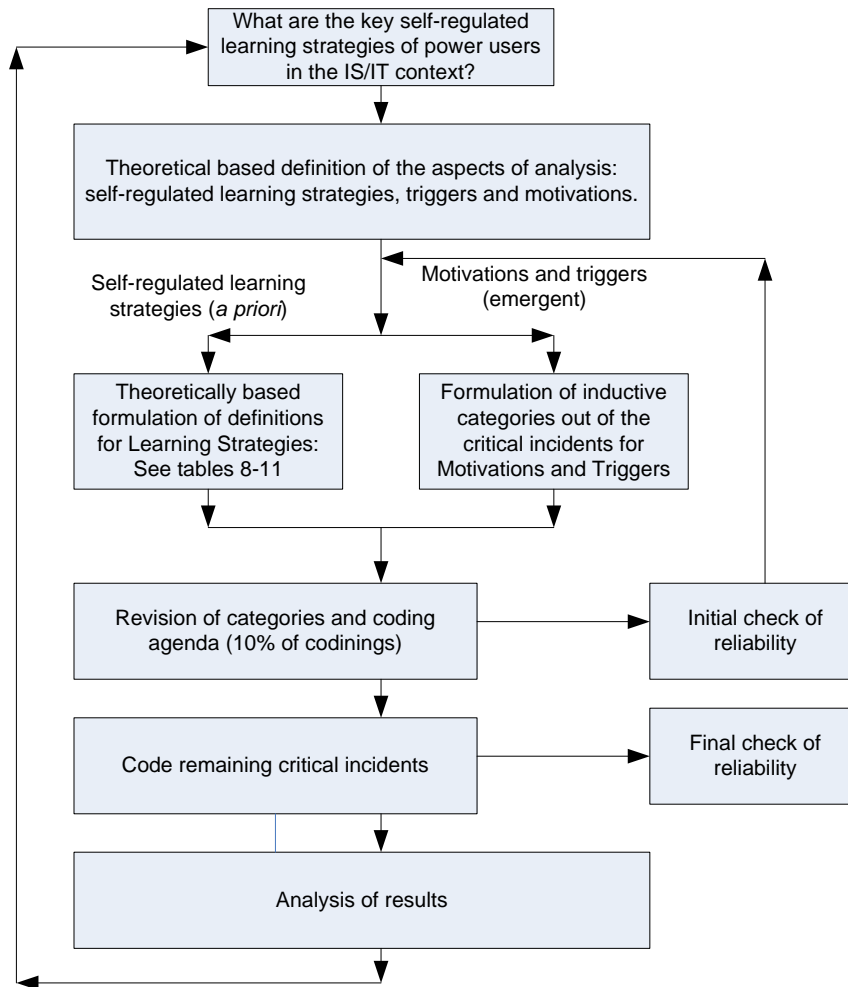
Each of the interviews were taped and then transcribed. These interviews were then divided into the critical incidents. The critical incidents were content analyzed using Atlas TI, identifying self-regulated learning strategies, motivations, and triggers related to the learning process of power users of software systems.

The textual data from the critical incidents, while very rich, is in a form that is difficult to yield meaningful implications. Content analysis is a technique that allows researchers to sift through large volumes of data, compressing many words into content categories. From these categories, inferences can be made that can then be corroborated using other methods of data collection (Stemler, 2001) in subsequent studies.

This study focuses three broad categories: self-regulated learning strategies, triggers to use and stop using strategies, and motivations to engage in learning. Given these broad categories, the text was analyzed, identifying items in the text.

There are four common ways to define coding units used in content analysis: physical, syntactical, referential, and propositional (Stemler, 2001). Physical units are defined by natural or intuitive borders; newspaper articles, speeches, letters, etc. Syntactical units are defined by the author; words, sentences, or paragraphs. Referential units refer to the way that a unit is represented, multiple ways of describing the same thing. Propositional units are interested in the underlying assumptions in the text. For this study, syntactical units, specifically phrases within the text, were used for each of the three categories.

These categories should be mutually exclusive and exhaustive (Stemler, 2001). For the categories to be mutually exclusive, coded data must fall within categories and not between categories and categories cannot overlap. While there are three general categories that were used to code the data, a finer granularity was sought. The triggers and motivations have not been identified in the literature and therefore an emergent technique was used (See Figure 5). A sample of ten percent of the total critical incidents was used to establish a coding agenda. This agenda was a guide for coders to code the critical incidents into categories in order to answer the research questions. After the interviews were transcribed and critical incidents extracted, text that fell into the definition of a trigger or a motivation (See Appendix G) was marked. These marked portions of text were then put into groups by the researcher. The researcher then attempted to subcategorize these two groups, the motivations and triggers. After ten percent of the incidents were coded, an initial check of reliability was conducted and is discussed below. This was conducted in conjunction with the *a priori* section (see below).



**Figure 5** Category Application (Mayring, 2000)

The coding for the self-regulated learning strategies was *a priori* as they have been identified in the literature (See Tables 8-11). While there is an initial definition, their validity in this context needs to be assessed, hence this study. The sample of the critical incidents used in the emergent procedure above has been coded using this initial coding agenda (See Appendix G). Different from the emergent technique, strategies were coded into the sub-categories, the specific strategies, initially. For the categories to be exhaustive, all recorded units had to be in a category. Since some of the strategies did not fall into the sub-categories defined by the

literature, the definitions and categories were refined during the coding process. The results of the emergent and *a priori* methods together yield an initial coding agenda.

A second coder, Coder2, used this coding agenda and coded the same 10 percent sample material. Coder2 made changes to the coding agenda as they worked through the coding of the critical incidents. When completed, differences between the two coding agendas were reconciled between Coder2 and the primary researcher. Modifications were then made to the coding agenda to match this reconciliation process. During this process, two new learning strategies, *taking notes for others* and *testing and verification* and one new trigger, *negative-trigger*, were added. These are discussed in the next chapter.

Another coder, Coder3, and the initial researcher then coded a five percent random sample of critical incidents. Inter-coder reliability was assessed to be .08. Coder3 had problems with the format of the coding agenda and while the content did not change, this formatting was addressed. Coder3 coded another five percent sample and the Cohen's Kappa was .62. This is considered to be substantial agreement (Landis & Kock, 1977).

After half of the documents had been coded, Coder2 coded a five percent sample of the critical incidents. Cohen's Kappa was calculated to be .78, still considered to be substantial agreement (Landis & Kock, 1977). While it was expected that there would be more changes to the coding document as the coding continued, there were no additional changes. Since there were no additional changes to the coding document, this second calculation was considered the final check of reliability. A fully coded critical incident is in Appendix H. This process is depicted in Figure 5 (Mayring, 2000). This same coding document was used to then code the answer to the final question of the survey; "Of all of the strategies that you have given me in this interview, what are the three that are the most important to you?"

## **CHAPTER 4**

### **DATA ANALYSIS**

#### **4.0 Chapter Overview**

This chapter presents the findings from this study. It begins with a description of subjects, the technologies that these subjects were interviewed about, and the critical incidents that were extracted from the interviews. The findings related to self-regulated learning strategies are then presented. The phases that were introduced in chapter 2.4 and illustrated in Figure 4 guide the discussion. After the discussion of each phase, findings related to the individual learning strategies are presented. The triggers to use, not to use, and specific strategies are then presented. Motivations of a power-user to enter the learning process are the last part of the model presented. This is followed by the presentation of a revised version of the study's research model.

#### **4.1 Description of Power Users Interviewed**

As discussed in Chapter 3, seventeen power users were included in the study. The individuals came from eight educational institutions and the centralized support. Table 13 shows how many of the participants came from each of the sites and the relative size of the institutions. A small institution has an enrollment of less than five thousand, a medium has an enrollment between five and ten thousand and a large institution is greater than ten thousand. There were three small sites, two medium sites, three large sites, and one support site. Each of the institutions used Banner, PeopleSoft Financials and PeopleSoft HRMS but all had different

implementations of these products. Table 13 shows that the participants were not from one location and the sites from which they came were varied.

Table 13 Site Descriptions

<b>Sites</b>	<b>Participants</b>	<b>Size</b>
Site1	1	small
Site2	2	medium
Site3	2	large
Site4	2	large
Site5	1	medium
Site6	4	small
Site7	1	small
Site8	2	large
Site9	2	(support site)

Of the seventeen participants, there were seven that primarily worked in human resources related activities, seven that worked in financial related activities and three that worked in technology support (See Table 14). Thus, fourteen participants were from business areas and three from IT. The learning strategies utilized by the individuals from the support area were not different from the other users. Ten reported use of PeopleSoft HRMS, ten worked with PeopleSoft Financials, three worked with Banner and two reported having used other ERP systems prior to working in the university system. There were five males and twelve females in the study and ages ranged from thirty-two to sixty-two with one not reporting their age.

All of the seventeen felt that they were looked to for guidance on how to use software in their organization and all supported others' use of technology. They spent from one to forty hours with an average of fifteen hours per week supporting others (see Table 14). Eleven of the participants felt that they were power users of PeopleSoft Financials, eleven of PeopleSoft HRMS, and four of Banner reflected in the X's in Table 14. They all used their computers more

than twenty hours per week and felt that they had learned the most of their computing skills on their own.

Table 14 Description of Participants

<b>Participant</b>	<b>Job Focus</b>	<b>PeopleSoft Financials</b>	<b>PeopleSoft HRMS</b>	<b>Banner</b>	<b>Weekly Support Hours</b>
Participant1	Human Resources	x	x		1
Participant2	Financial	x	x	x	12
Participant3	IT Support		x		40
Participant4	IT Support	x	x	x	20
Participant5	Human Resources	x	x	x	20
Participant6	Financial	x			35
Participant7	Human Resources		x		5
Participant8	Financial	x	x		5
Participant9	Financial	x			4
Participant10	Human Resources	x			5
Participant11	Financial	x			3
Participant12	Human Resources		x		15
Participant13	Human Resources		x		25
Participant14	Human Resources		x		20
Participant15	Financial			x	10
Participant16	IT Support	x			40
Participant17	Financial		x		1
<b>Total</b>	14 Bus; 3 IT	10	11	4	n/a
<b>Average</b>	n/a	n/a	n/a	n/a	15

#### 4.2 Categorization and Description of Self-Regulated Learning Strategies

This section and subsections answers the first research question – “What are the key self-regulated learning strategies of power users in the IS/IT context?” There were two different



methods used to look at learning strategies. The first utilized the critical incident technique and the second was a self-reported measure of what the participants felt was their most important learning strategies.

#### ***4.2.1 Self-Regulated Learning Strategies – Critical Incident Technique***

There were twenty-six strategies found in the literature and one added from the pilot study (*modeling*). *Modeling* is where an individual uses an external example as a starting point for a solution. In the learning of structured query language, many of the power users took existing queries and modified them to perform the tasks that they were looking to accomplish. Therefore, these existing queries served as models that the power users were able to recognize, adapt and learn from. During the primary study, three more learning strategies were added: *keeping records for others to learn*, *self-valuation* of content, and *testing and verifying*. Each of the individual strategies is discussed below. The data analysis yielded the results shown in Table 15.

Table 15 CIT Counts of Self-Regulated Learning Strategies

Strategy	Frequency	Users ( $\alpha$ )	Incidents ( $\beta$ )	Weighted Total
<b>Forethought Phase</b>				
Environmental Structuring	1	1	1	4.27
Organizing and Transforming	1	1	1	4.27
Mental Preparation	3	3	3	12.81
Planning	5	4	5	17.42
Goal Setting	7	6	7	25.96
<b>Performance Phase</b>				
Self-Instruction	0	0	0	0.00
Keeping Records for Others to Learn	1	1	1	4.27
Rehearsing and Memorizing	3	1	3	4.96
Imagery	4	2	3	8.88
Socializing	3	3	3	12.81
Triangulation	4	3	4	13.15
Task Division	6	4	6	17.77
Graphical Representation	7	4	7	18.12

Reviewing Materials	13	7	10	30.92
Keeping Records	13	8	12	35.54
Modeling	30	13	24	59.31
Experimentation	99	17	54	85.42
Seeking Information	105	17	57	86.46
Seeking Social Assistance	123	16	70	87.05
<b>Self-Reflection Phase</b>				
Self Consequences	0	0	0	0.00
Causal Attribution	1	1	1	4.27
Self-Evaluation	8	6	8	26.31
<b>Appropriation Phase</b>				
Pausing	6	3	6	13.85
Accommodation	8	5	8	22.39
Summarizing	9	6	8	26.31
Linking	15	7	11	31.27
Testing and Verification	9	8	9	34.50
Assimilation	15	8	11	35.19
<b>Total</b>	<b>499</b>	<b>n/a</b>	<b>n/a</b>	<b>n/a</b>

The frequency counts represent the number of times that each of the learning strategies was coded in the critical incidents. Using a weighted statistic can reveal combined prevalence in the coded data (Thomas, 2005b). Since this study is looking across power users, this research weighed the strategies that are used by more power users higher than those used less frequently. The formula for the weight statistic was:

$$\frac{\frac{\alpha}{17} + \frac{\alpha}{17} + \frac{\beta}{96}}{3} \times 100$$

Alpha represents the number of power users that utilized the learning strategy. Beta represents the number of critical incidents that used the learning strategy. Seventeen is the number of power users that participated in the study and ninety-six is the total number of critical incidents. The weighted statistic results in a number between 0 and 100 that reflects the prevalence of a learning strategy, counting the number of power users that used the strategy ( $\alpha$ ) as twice as important (reason for two  $\alpha/17$  in the formula) as the appearance of a strategy in a

critical incident ( $\beta$ ). For example, if a strategy was used by all participants and appeared in every critical incident, it would have a score of 100.

The number of users utilizing the learning strategy( $\alpha$ ), the number of incidents in which a strategy was found( $\beta$ ), and the weighted use of learning strategies is found in the last three columns of Table 15.

Strategies in all four phases were used by participants in the critical incidents but the **Performance Phase** strategies are clearly dominant. The top four strategies of the **Performance Phase** are the top four strategies overall and represent 71.54% of the total strategy count. The **Appropriation Phase** was the next most utilized group of strategies, followed by **Forethought** and **Self-Reflection Phases** respectively.

#### *4.2.2 Strategies viewed as most important by participants*

Participants in the study were asked after critical incidents were gathered what the three most important learning strategies were for them individually. One individual gave only two (See Table 16).

Table 16 Self Reported Most Important Learning Strategies

Strategy	Total	%
<b>Forethought Phase</b>		
Environmental Structuring	0	0%
Organizing and Transforming	0	0%
Mental Preparation	7	14%
Planning	0	0%
Goal Setting	1	2%
<b>Performance Phase</b>		
Self-Instruction	0	0%
Keeping Records for Others to Learn	0	0%
Rehearsing and Memorizing	0	0%
Imagery	0	0%
Socializing	0	0%
Triangulation	0	0%

Task Division	0	0%
Graphical Representation	1	2%
Reviewing Materials	0	0%
Keeping Records	0	0%
Modeling	3	6%
Experimentation	11	22%
Seeking Information	13	26%
Seeking Social Assistance	10	20%
<b>Self-Reflection Phase</b>		
Self Consequences	0	0%
Causal Attribution	0	0%
Self-Evaluation	0	0%
<b>Appropriation Phase</b>		
Pausing	0	0%
Accommodation	0	0%
Summarizing	0	0%
Linking	1	2%
Testing and Verification	0	0%
Assimilation	3	6%
<b>Total</b>	<b>50</b>	

The similarities to what was found in the frequency counts and weighted totals of the learning strategies (See Table 16) with the strategies self-reported as most important are evident in the **Performance Phase**. *Modeling, experimentation, seeking information and seeking social assistance* are the four most highly rated in both analyses.

One major difference was found for *mental preparation*. The weighted use was much lower than the number of times it was ranked as one of the most important.

Discussion of each of the phases and their associated learning strategies follow. The individual strategies found in the study are grouped by phase and are presented in the order of magnitude of the weighted totals.

### 4.3 Forethought Phase Strategies

In the **Forethought Phase**, an individual would prepare for the learning process by thinking about the task at hand and managing the learning environment around him/herself. The **Forethought Phase** was not heavily reported in this study. When asked what the participants felt was the most important strategies, the **Forethought Phase** received the second most highly cited group of strategies, primarily 14% reflected in mental preparation strategy. One possible explanation of this is that they believe it to be important but may not be able to recollect using the strategy when asked about it some period later. An alternative explanation, which is more supported by the data, is that they have standard template or approach that minimizes the use of forethought phase strategies. More on this explanation will be presented later. Below, in Table 17, are the ratings for the **Forethought Phase**.

Table 17 Strategies in the Forethought Phase

Strategy	Frequency	Weighted Total	Most Important Rank (%)
Goal Setting	7	25.96	2%
Planning	5	17.42	0%
Mental Preparation	3	12.81	14%
Organizing and Transforming	1	4.27	0%
Environmental Structuring	1	4.27	0%

#### 4.3.1 Goal Setting - Learner establishes learning objectives. [Freq-7; Weight-25.96; Rank-2%]

Goal setting is the most widely used of the strategies from the **Forethought Phase** with six participants using it seven times in the critical incidents. Two responses show how the focus of the participants was on action:

*Yeah. The goal was to fix the problem.*

*My first goal was to resolve the ticket without me having to pass it off to someone else.*

In each response, the learning goal originated from a problem that the participant faced. Thus, the participants would not actively set goals. The goals were set for them by the problem they were trying to solve.

**4.3.2 Planning** - *Learner formulates a plan to achieve learning goal. [Freq-5; Weight-17.42; Rank-0%]*

*Planning* was used by four of the participants on five occasions. One responded:

*Loosely in terms if I started at the highest level first and then started going down to more and more foundation level items.*

Based on the data, the best explanation for the lack of use of this strategy is that the participants have moved in and out of learning so many times that they have established general plans that are very effective. They would not have to plan as they already had a plan. In *goal setting*, it is shown that resolving problems is the major goal. The participants would learn more about the problem and the solution together, letting the problem and parts of the solution found dictate the process. They have a general plan or template to follow but detail actions steps will emerge from the results of their other learning strategies. Thus, there is a dynamic planning and adjustment going on as part of the actual performance of learning process. Thus, planning in forethought phase would be very minimal.

**4.3.3 Mental Preparation** - *Learner mentally prepares for the learning process, clearing mental distractions and preparing for frustration during the learning process. [Freq-3; Weight-12.81; Rank-14%]*

*Mental preparation* was used by three participants, one time each. One response was:

*And um, you procrastinate. You'll work on everything else that you need to be doing just so you don't have to work on that one thing...you have to have um so I have to get myself to the point that I have to make that priority and I have to get in there and dig.*

Here the user is making sure that they are ready to proceed with the learning task. The evidence from the critical incident technique is a little different from what was found when asking the participants what was their most important strategies. Mental preparation was seen as the fourth most important strategy when asked directly. This is one of the responses from the participants' three most important learning strategies:

*My most favorite is you have to be flexible. You have to be willing to learn anything whether it's sitting down and learning data just data entry. You've got to be willing to learn across the board..., you've got to be willing to learn as much as you can. Um, somebody told me one time that you never get enough knowledge about everything and that's true. I find that true in all that I work with.*

This user states that they must be ready at all times and not just as they enter the learning process. This may be why the critical incident technique did not reveal significant use. The critical incident technique was designed to capture when the participants entered the learning process and would not capture *mental preparation* if it was maintained over the course of their job. *Mental preparation* as evidenced by the critical incident technique is a moderately used strategy which seems to be in contrast to how the participants rated the strategy. Since the participants were often moving in and out of the learning process, they may not have had to prepare as often, still prepared from the last learning process. The reasoning why this strategy did not appear more frequently is not clear, but it is an important strategy for the participants.

#### **4.3.4 Organizing and Transforming - Learner initiated rearrangement of instructional materials to improve learning. [Freq-1; Weight-4.27; Rank-0%]**

*Organizing and transforming* differs from environmental structuring in that the individual would be arranging the materials to learn from. This strategy was utilized by two of the participants during two separate incidents. Both responses were marginal and did not lend much support for this strategy. They were:

*No, not really. Well, other than making sure that the form that I really need is on the very top, so that I can quickly find it - the one that has the most information that I need.*

*I would probably arrange them, um. There were certain things that I would have something I would go back to first. Um, like there are certain errors um error messages that once I was able to figure out what was the cause of those specific messages, I documented that and then I stored them in a particular area under troubleshooting documents and um then when I would see that error message again, like no matching buffer found kind of stuff.*

The nature of the computer organizes some of the materials for the individual and if the individual would move in and out of learning, the learner may organize over time and not in one specific learning episode. *Organizing and transforming* may also not be a learning strategy for the participants but an activity they handle outside of learning. The materials outside of the computer that participants might need to organize, were already organized, possibly from previous learning episodes. Since the participants set up their offices to perform their jobs, and one of the functions of the jobs was to resolve issues within the technology, organization may have been a function of the job and not the learning process.

**4.3.5 Environmental Structuring** - Arrangement of physical setting by the learner to make learning easier. [Freq-1; Weight-4.27; Rank-0%]

*Environmental structuring* was only utilized by one of the participants and for only one of their five critical incidents. The only response:

*Um, yeah typically I have to not answer my phone and shut my door because I get real easily sidetracked.*

Most of the responses, when probed were more like this response:

*No, as you can see here I just I tend to I grab what I need and I read it and then I throw it there and then I'll move it when I need something under it so I ... really didn't set up my desk when I was learning...*

Just as organizing and transforming, environmental structuring may happen outside of learning. As the participants offices were organized, they were conducive for the participants to



perform their jobs. Since many of their jobs were based on them learning, the environment was set up to facilitate this and this was done outside of an individual learning incident.

#### **4.3.6 Forethought Phase Summary**

The **Forethought Phase** strategies were not heavily reported in using the critical incident technique or using the direct question. This was surprising for the researcher(s) since it was suspected that power users would be more deliberate in how they approached learning. It appears from the data that because these are power users, they may have a structure already set up for them, mentally and physically, that does not require much preparation for the **Performance Phase**.

*Mental preparation* was chosen as the fourth most important learning strategy and only reported to be utilized three times. This suggests that the power user may have to prepare mentally for the learning process but would often already be prepared and ready to learn.

#### **4.4 Performance Phase Strategies**

The **Performance Phase** strategies were the most reported strategies in this study. There was one strategy added to this phase during the pilot study, *modeling*, and one more during the primary study, *keeping records for others to learn*. The participants were all busy people and spent considerable time supporting others in their organizations. These individuals were very action-oriented and it is therefore not very surprising that these individuals indicated much of their attention is focused on the **Performance Phase**. Below, in Table 18, are the results for the **Performance Phase** strategies.

Table 18 Performance Phase Strategies

<b>Strategy</b>	<b>Frequency</b>	<b>Weighted Total</b>	<b>Most Important Rank (%)</b>
Seeking Social Assistance	123	87.05	20%

Seeking Information	105	86.46	26%
Experimentation	99	85.42	22%
Modeling	30	59.31	6%
Keeping Records	13	35.54	0%
Reviewing Materials	13	30.92	0%
Graphical Representation	7	18.12	2%
Task Division	6	17.77	0%
Triangulation	4	13.15	0%
Socializing	3	12.81	0%
Imagery	4	8.88	0%
Rehearsing and Memorizing	3	4.96	0%
Keeping Records for Others to Learn	1	4.27	0%
Self-Instruction	0	0.00	0%

**4.4.1 Seeking Social Assistance** - Learner seeks out help from another person. [Freq-123; Weight-87.05; Rank-20%]

*Seeking Social Assistance* was reported by all of the participants in one hundred and twenty-three instances. This was the highest rated strategy in terms of frequency count, weighted total but third in rating as the most important. One of the interesting things about this strategy was that is typically not used first but when the participant felt “*stuck*.”

*Now if there was something that I really couldn't figure out, yes, I would have to ask someone, but that would be a last resort.*

Many also felt that they would learn things better if they had been able to complete the learning without *social assistance*. In contrast to this, the participants also believed that they needed to not “*overuse*” the individuals to which they would go. A typical comment would be:

*I might go to a systems person and say hey I'm researching you know I'm trying to understand more of how we do this. Um, this is what I found online. This is kind of my understanding but I'm really curious as to how this piece fits into it you know and usually somebody can kind of explain that piece um. Well oh, that piece is we link the two here at this table you know or you know we have a COBOL middleware COBOL program that will kind of do that piece of the system for us.*

**4.4.2 Seeking Information** - *Learner seeks out information from a non social source. [Freq-105; Weight-86.46; Rank-26%]*

*Seeking information* was reported by all of the participants in one hundred and six instances. This was the second most frequently used strategy and received the most votes as most important learning strategy. There were differences in where the individuals sought information but each location was typically where they had found information previously. Some of the locations where these individuals sought information were general reference books, application manuals, best practices guides written by the centralized information technology support office, websites, others notes, training manuals, and built-in help. The key was not the locations from which they sought information but the volume of locations they would use. They were not *triangulating* but searching until they found the information they needed. This was a typical quote:

*I knew where to I had a good library of technical manuals and books and so forth that for example books about Unix and SQL and all that database books um and um reference books and of course the internet so I had those things nearby if I needed them but...*

**4.4.3 Experimentation** - *Learner tries out material that was learned and varies the procedures to see the effects. [Freq-99; Weight-85.42; Rank-22%]*

*Experimentation* was reported to be used by all of the participants in ninety-nine instances. In terms of frequency counts, users and weighted totals, this was the third highest rated strategy. *Experimentation* and the other two, *seeking social assistance* and *seeking information* were all very close in all of these measures. Even though there were ninety-nine occurrences in the ninety-six critical incidents, there was not much variation in the answers. They were all very much like this one:

*Oh, I know, I'm not, I'll - I'll get on I'll play, I'll explore...*

The applications that the participants used were large and mistakes could be significant. One participant decided to test a new application on live data and cost themselves significant time. Two of the users were able to lock up entire ERP systems with queries they were trying out. Each of these individuals continued to use *experimentation* as a learning strategy. Again, the participants were action-oriented. They would use *experimentation* to help define the problem at hand and *experimentation* to guide them to the next strategy. They would try out possible solutions acquired through *seeking social assistance* or *seeking information*. This was one of the first strategies to be used in almost all cases.

**4.4.4 Modeling** - *The learner uses a related example is used as a base to be modified. [Freq-30; Weight-59.31; Rank-6%]*

*Modeling* was reported by thirteen of the seventeen participants in thirty separate instances. This strategy was added during the pilot study. When individuals would come across a situation that they did not understand enough to explore on their own, they would seek out an example or model, of how it was handled in another related situation. This is external to the individual. In most instances, this model was created by another individual but in some instances it was created by the study participant. This model was then explored and adapted to fit the situation at hand. This was especially true when it came to writing queries. This is a prime example:

*And so what I'll do is I'll save the query. It works. And then, when I want to do it again, I'll go back to that query as an example, so that I can use that same SQL statement again.*

There was a near doubling of frequency counts, users and weighted totals for this strategy over the next weighted strategy, *keeping records*. It was ranked fifth in the most

important ratings. Since many of the participants did not have formal training in some of the more intricate parts of their ERP systems, they would model other's work to help them learn.

#### **4.4.5 Keeping Records - Learner takes written and mental notes through the learning process.**

*[Freq-13; Weight-35.54; Rank-0%]*

Keeping records was reported by eight participants in thirteen separate instances. A typical comment would be:

*I like to use a highlighter and sticky notes like if I'm researching you know reading a book to learn something I'll highlight it and sticky note it. If it is something I think is important.*

These notes were sometimes used but typically they were taken and the participant would not revisit them. Just the act of taking the notes was typically enough if they used the information quickly. Of interest, most of the participants knew exactly where notes were and would point them out to the researcher during the interviews. Many of these notes were years old and materials were out of date or they felt they would never need them, but they did not want to discard them. One example:

*But I've also got, everything in here's probably out of date. It's still pretty similar. <moving around to get book?> Yeah, '97, that's a good one.*

This shows how important the learning was to the participants. The value that the participants put on their learning comes out again in **4.6.5** with the discussion of *accommodation*.

#### **4.4.6 Reviewing Materials - Learner revisits information sources. [Freq-13; Weight-30.92;**

*Rank-0%]*

*Reviewing materials* was reported by seven participants in thirteen separate instances.

*Occasionally I might say I remember you know it might be a month later I remember reading that I just can't remember you know and I've got some sticky notes sticking out so I'll flip through oh yeah here it is. So occasionally I'll go back but...*

Reviewing materials was done when the mental models were not as strong for the individual and they would refresh these models by going back to previous materials from when they were *seeking information or keeping records*.

**4.4.7 Graphical Representation** - *Learner draws pictures, diagrams and graphics to simplify the subject matter. [Freq-7; Weight-18.12; Rank2%]*

*Graphical representation* was reported by four participants at seven separate times. Only one participant felt that this was one of their most important strategies. One example:

*I might flowchart something like the different points, the different decision points like for instance with the online application I kind of drew out you know the decision points and where you know somebody goes in here and what's the next step? The steps. So I do kind of draw. I kind of draw it out to keep everything straight in my head.*

The participants, once they had a mental model would not need to draw it, but would access it. For example, one of the participants was looking for information for the content of all of the tables in one place and to not have to search out things individually, a map of the data:

*There was one site, I can't remember, I think it was Maryland or someplace that actually had, that was it was like finding a gold mine for me. Because everybody kept telling me there was no place that we, I wanted to know what tables the data was stored in.*

This participant was discussing an early stage of becoming a power user for the technology, still building their mental models of the technology.

**4.4.8 Task Division** - *Learner reduces a task to its essential parts and reorganizes them so they are meaningful to the individual. [Freq-6; Weight-17.77; Rank-0%]*

*Task division* was reported by four participants at six separate times. One response was:

*...what I'll do is fist try to tackle okay who's in what, who do I think is in which position, and then, okay, which positions are in which departments, and sometimes if I break it up into, y'know concrete um, uh, dividing way - y'know - divisions I guess, then, sometimes that'll help me solve a problem.*

The researcher felt that this would be much more widely used. The lack of use could be that the participants would enter the learning process when there was a small learning task to be accomplished and would not have to break it up or they broke up the task not as a strategy but the task would be broken up in the process of learning. *Experimentation*, would define what needed to be addressed next and *seeking social assistance* was only used when the participant was “stuck.” The concept of being stuck as they were going through the learning process implies that the individual was stuck on one part of the whole task. The action orientation of the participants which caused them not to heavily use and value the **Forethought phase** may keep them from breaking up the task intentionally. Just as the **Forethought Phase** strategies may be done at a metacognitive level, *task division* may also.

**4.4.9 Triangulation** - *Learner gathers information from different sources to get different perspectives on the subject being learned. [Freq-4; Weight-13.15; Rank-0%]*

*Triangulation* was reported by three participants at four different times. One specific answer:

*So I really have to y’know, dig down deep into - and I’ll look at like ten or twelve different websites because I’ll get a little piece of information y’know from one website and then I’ll go to another website and I’ll get a little bit more and kinda build on my lack of understanding of the whole thing and eventually, you usually get there.*

Since the participants were action-oriented, as soon as they had something to possibly solve the problem at hand, they would try it. Triangulation would then not be needed as it was typically objective type information they were trying to acquire and would not require different “perspectives” but just a concrete answer.

**4.4.10 Socializing** - *Learner discusses subject matter with a peer in a social setting. [Freq-3; Weight-12.81; Rank-0%]*

*Socializing* was reported by three participants one time each. *Socializing* is different from *seeking social information* in that the individual would learn things in a social situation where the focus of the interaction was social in nature and not focused on a problem or business. An example would be:

*And so, yeah, absolutely, y'know, we'll be sitting at dinner, and I'll start chatting about some problem that I had, and still haven't resolved it, or didn't resolve it to my satisfaction, or do you have some insight as to how I could have done better, that kinda thing.*

When participants were still building mental models or needed information about current problem, the opportunity to acquire information to help solve the problem or add to their mental model in a social setting was more likely than later when they had more substantial mental models or no pressing problems. Once a substantial mental model had been established, the likelihood that they would impart information would be higher than acquiring it.

**4.4.11 Imagery** - *Learner produces mental images of successful learning or structures that are to be learned. [Freq-4; Weight-8.88; Rank-0%]*

*Imagery* was reported by two participants at four different times. This strategy was imagining being successful as a way of pulling yourself through the learning process. One answer:

*Yeah, there's a certain sense of accomplishment that you're going for.*

Many answered negatively in this way:

*Oh, no I think I think more about how I'm going to be able to use it in my every day.*

Learning was not an obstacle for most of the participants but a natural part of their everyday jobs. They did not seem to need to pull themselves forward in the learning process but were drawn in by their own need to resolve issues that came up in their work.



#### **4.4.12 Rehearsing and Memorizing - Learner tries to memorize material through practice.**

*[Freq-3; Weight-4.96; Rank-0%]*

*Rehearsing and Memorizing* was reported by one of the participants three separate times.

One of the responses was:

*Um, only trying to memorize I guess you could say memorize the process flow.*

Most of the responses when probed about this strategy were negative. One participant said that memorization was not a strategy employed and:

*...in dealing with what I'm dealing with a computer, it stays in there. So, to commit things in memory I guess all the repetitive motions and the repetitive doing things – it does stick in there.*

The participants were all adult learners that knew that they could go back to specific references. For the most part, they did not feel that they had to memorize things but they would most likely remember them anyway. The first comment shows that the participant was building a mental model. This appears to be the important thing to this participant.

#### **4.4.13 Keeping Records for Others to Learn - Learner takes written and mental notes through the learning process specifically for others to use. [Freq-1; Weight-4.27; Rank-0%]**

*Keeping records for others to learn* is a strategy that was added. This was reported by only one of the participants but it does illustrate that power users share the information that they gather. This is related to *keeping records* but is seen as different because of the intent behind the strategy. The participant would take notes in learning situations specifically for training of others and specifically not for themselves. This illustrates the support from the power user to other users. The respondent was talking generally when the strategy was discussed.

*HRMS [PeopleSoft HRMS] was going to just kind of take that over so you know I created some COBRA process, this is based on \*\*centralized support\*\* but it's been tailored to you know \*\*redacted\*\* so I can figure out how to do it and if I wasn't here, \*\*redacted\*\* could do it.*

The participant was able to create the process and therefore had an understanding of how it worked and was looking to document so that others could follow.

**4.4.14 Self Instruction - Learner “thinks aloud” as they move through a task describing what should happen at each step. [Freq-0; Weight-0; Rank-0%]**

This was not reported in this study.

#### **4.4.15 Performance Phase Summary**

The Performance Phase strategies were the most highly used and highly rated set of strategies. The top three strategies together constituted 65.53% of the count of strategies in the study and were seen as the three most important strategies by the participants. The participants would start many of the critical incidents with a **Performance Phase** strategy. This suggests that the participants were action-oriented. They would use *experimentation* before they would *seek social assistance*. *Experimentation* is much more active than *seeking social assistance* and even though the participants rated *seeking social assistance* more highly, this was used after they had used *experimentation*. The strategies also seemed to be directed at building mental models. Keeping records was used during initial learning of a subject more often and less after they had established a mental model.

The top four strategies in the Performance Phase, *seeking social assistance*, *seeking information*, *experimentation* and *modeling* are also the top four for the study. The next two in this phase, *keeping records* and *reviewing materials*, are close to the rankings for the top strategies in the other phases of the model. The next four, *graphical representation*, *task division*, *triangulation*, and *socializing* showed moderate use. The last four, *imagery*, *rehearsing and memorizing*, *keeping records for others to learn* and *self-instruction* were not heavily used in this study.

## 4.5 Self-Reflection Phase Strategies

The **Self-Reflection Phase** strategies were not widely reported by the participants and none of the participants rated any of the **Self-Reflection Phase** strategies as one of their three most important. One modification was made to one of the definitions to more closely fit the strategies found. Below, in Table 19, are the ratings for the **Self-Reflection Phase** strategies.

Table 19 Strategies in the Self-Reflection Phase

Strategy	Frequency	Weighted Total	Most Important Rank (%)
Self-Evaluation	8	26.31	0%
Causal Attribution	1	4.27	0%
Self Consequences	0	0.00	0%

### 4.5.1 Self-Evaluation- Learner judges the effectiveness of the learning content. [Freq-8; Weight-26.31; Rank-0%]

*Self-Evaluation* was reported to be used by six of the participants in eight instances. This was the most widely used Self-Reflection Phase strategy. A typical response was:

*Oh, yeah, in fact usually what I'll do is uh, I'll do one table join to make sure that's what I've expected, and then I'll start joining more tables, and so I'll evaluate my progress at every table join.*

This evaluation that the participant was doing in this quote was done as they were working through a problem. This is another instance where the participant is focused on the problem and working their way through the learning process, letting the process direct itself. This somewhat iterative process, is evaluating the output of the process and not the process generally. It would seem that the participants may not be able to evaluate the whole process while in the process but would just be able to evaluate the content. The original definition of this strategy was Learner judges the effectiveness of the learning process. Since the

coded strategies for self-evaluation all focused on the output of the process and not the whole process, the definition was modified to more closely match the findings.

**4.5.2 Causal Attribution** - *Learner looks for reasons for success or failure in the learning process. [Freq-1; Weight-4.27; Rank-0%]*

*Causal Attribution* was reported to be used by one of the participants in one instance.

*Um, probably reasons if I failed. I always um I guess one of the greatest teachers is from experience and I'm the type person that if I make the mistake once, I try not to make it a second time so I normally do go back over if something wasn't successful. I normally research it and determine why it wasn't successful and I normally make good notes on it so I don't do it again*

This is in contrast to what was found in the **Performance Phase** strategies. Learners would return to what worked and therefore must, at some level, evaluate why they succeeded or failed using learning strategies. This strategy, as reflected in the quote, is evaluating the process of learning and not the content as was seen in *self-evaluation*. Also, failure of one strategy would lead them to another strategy. They seemed to stay in the learning process until it was complete. It may be that they suspend the learning process to continue it later, thus, they may not see the lack of closure as failure.

**4.5.3 Self-Consequences** - *Learner rewards (or punishes) themselves for progress made (or not) on learning goals. [Freq-0; Weight-0; Rank-0%]*

This was not reported by any of the participants in this study. Most felt that accomplishment was enough of a reward and failure was enough of a punishment.

#### **4.5.4 Self-Reflection Phase Summary**

Self-Reflection was not heavily reported by the participants of this study. None of the strategies were seen as any of the participant's top three strategies. The participants are very action-oriented and may not spend time evaluating. The data seems to suggest that there is

another phase of learning not captured in the model. Two of the strategies, *self-evaluation* and *causal attribution*, referencing the content learned and not the process of learning. Confirmation of the findings here should be verified using another method.

#### 4.6 Appropriation Phase Strategies

The **Appropriation Phase** strategies were the second most reported strategies in this study but still far below those of the **Performance Phase**. There was one strategy added during the study, *testing and verification*. Below, in Table 20, are the ratings for the **Appropriation Phase** strategies.

Table 20 Appropriation Phase Strategies

Strategy	Frequency	Weighted Total	Most Important Rank (%)
Assimilation	15	35.19	6%
Testing and Verification	9	34.50	0%
Linking	15	31.27	2%
Summarizing	9	26.31	0%
Accommodation	8	22.39	0%
Pausing	6	13.85	0%

**4.6.1 Assimilation** - *Learner builds mental models from information gained, either new models or building off of old ones. [Freq-15; Weight-35.19; Rank-6%]*

*Assimilation* was reported to be used by eight of the participants in fifteen instances. *Assimilation* was tied with *linking* in terms of frequency counts and was rated by three participants as one of their top three learning strategies. The value of the mental models built can be seen in this quote:

*Um, if you want to know more than that, if you want to really understand the big picture of what's happening and why and where is it getting the information, where is it putting it, um, so you can use that information to do other things, um, then you have to dig deeper on your own...*

The building of mental models was not always reported by the participants but it can be seen as an underlying strategy to many of the strategies in the **Performance Phase**. These mental models are also of value as pointed out below in the discussion for *accommodation*.

**4.6.2 Testing and Verification** - *Learner will test and verify information prior to acceptance.*

*[Freq-9; Weight-34.50; Rank-0%]*

*Testing and Verification* was reported to be used by eight of the participants in nine instances. This is a strategy that was added during the study. *Testing and Verification* is different from experimentation in that the learner has found the information through some source and believes the source but believes that it must be verified. Since the nature of the strategy is scrutiny prior to full adoption into their mental model, it is seen as part of the **Appropriation Phase**.

*I think, I'm trying to remember there was, there were like two or three parallel payrolls. So **\*\*redacted\*\*** would run it in Legacy and I would run it in PeopleSoft and we would see if we got the same numbers. Um, and then any variances, research them to see what was going on.*

This strategy is utilized after the participant has learned how to do something, testing to see where they might have missed something. The need to not be wrong for some of these participants or pride in their work starts to come out.

**4.6.3 Linking** - *Learners draw linkages to separate mental models and tangential experiences,*

*extending this model and others. [Freq-15; Weight-31.27; Rank-2%]*

*Linking* was reported to be used by seven of the participants in fifteen instances. The mental models of the participants would cover both the subject area and the technology. Many would use the knowledge of one model to further the development of the other. In this quote, the participant speaks of the real world and how it is modeled in the technology and what the limitations and strengths of the bonds between the two:

*And that's a key piece, that's a key piece. Knowing what you do, what if affects at the next stage. And, there's, in PeopleSoft, the three critical components - Budget, HR, Payroll. Budget must have the account number in there, Budget is supposed to attach the person - I'm sorry, the account number - to a position number. HR attaches the person to the position number, payroll pulls all that together and now pays you, then takes it back to the account number. So the number for each component's supposed to do, and the theory behind that is that it takes three of us to commit fraud. Because I can only hire, I can only do those pieces. I can't change account numbers. And I can't pay. So, it would take the three of us to collude together, in order to get a ghost employee on the system. So, the chances of that are much less. And so, in doing that - so, but knowing if something's not flowing, where to go back - the great piece of that is knowing what Budget has to do to make what I do work so I can make what she does work.*

This understanding of the real world, how it is modeled by the technology and the differences between these two models was a common theme for the participants in the interviews but this came up outside of the discussion of the critical incidents. The participants may be *linking* without intent or being cognizant of it.

**4.6.4 Summarizing** - *Learner redraws what was learned to see if they understood material and look for holes in their understanding. [Freq-9; Weight-26.31; Rank-0%]*

*Summarizing* was reported to be used by six of the participants in nine instances. One particular quote:

*So then I went so then I followed the, went back and reviewed the steps for adding a department to the system and when I reviewed the steps, I could see it's not here because this doesn't affect anything. It's not here and I got to the fastview stuff and it was like this has to be it because this is where you're updating the indexing within the database.*

This may not have been used as much by the participants because it causes the learner to stop and they have been shown to favor being active.

**4.6.5 Accommodation** - *When a learner is appropriating information that conflicts with information previously appropriated, learner adapts earlier mental models to accommodate new information or discards new information. [Freq-8; Weight-22.39; Rank-0%]*

*Accommodation* was reported to be used by five of the participants in eight instances.

There is distress about having to leave old learning to accept new understanding evident in this quote:

*Painful because I had to change my way of thinking about something that I had struggled so hard to learn in the first place. And that was the billing rules. Um, initially I really wanted the billing rules to be similar to other institutions in the system which was a very simplistic, not very simplistic, simple outline of tuition and fees, billed this way. This is our in-state. This is our out-of-state. These are our mandatory fees. You know this is great. It's going to be no big deal. We can do it. Well, it turns out every program at \*\*redacted\*\* almost has their own fee. Every program has courses within that program that have their own fee. And in order for those things to be correct, my first attempt at billing rules had to be completely trashed and I had to start over building by program. And it was turned up you know I don't know ten thousand fold in the level of difficulty because it was no longer straightforward. It was no longer simple.*

This also illustrates the value that participants put on their individual learning. When the learner has to give up old models or portions of them to adopt new ones or change the old there is a loss for the learner.

**4.6.6 Pausing** - *Learner intentionally allows time for information to be assimilated. [Freq-6; Weight-13.85; Rank-0%]*

*Pausing* was reported to be used by three of the participants in six instances. One interesting quote:

*Yeah, I'd go get a drink and mull it over. It was not a break in that um you take a break and go do something well it's not break in that um such as doing something to get your mind off of it, it was a break to get away from it so that you could continue to think about it but be in a different setting, a more relaxed setting, I guess, than the stress of being right in front of it.*

The change in setting for this participant may come naturally to others in the course of their jobs. Many of the participants managed others. Fourteen of the seventeen had “Director”, “Manager” or “Controller” as part of their title. *Pausing* may then be significantly under-reported because it is unintentionally used.



#### 4.6.7 Appropriation Phase Summary

The **Appropriation Phase** was the second most frequently used phase and yielded one new strategy: *testing and verification*. From the selected quotes, it is evident that the building and using of mental models is critical. The participants were looking to not only address the issue that brought them into learning, but taking out a confirmed, strengthened or new mental model. The value that the participants put on the learning they have acquired is also evident. Participants found it not only hard to give up notes that they had taken, *keeping records*, old manuals, *seeking information* and *reviewing records*, but previous mental models, *accommodation*. The adding of the **Appropriation Phase** to the Self-Regulated Learner Model (see Figure 2) is strongly supported by these research results..

#### 4.7 Categorization and Description of Triggers of Self-Regulated Learning Strategies

This section addresses the second research question – “What are the key drivers for power users to choose strategies in an IS/IT context?” While sixty-five triggers were coded in the text of the critical incidents between sixteen of the participants, using the critical incident technique did not yield much information. A common trigger would be:

*Um, hopefully, either that they've experienced this problem before and can shed some light on it, or, to inform them that I have a problem and that perhaps they did inadvertently caused the problem.*

Here the participant was expressing a trigger to use *seek social assistance*. This is also another instance in which the learning process guides the process. The triggers are coming from the process itself. Another quote showing much the same thing:

*And so first I tried to delete the two lines and it wouldn't let me*

This was a trigger to use exploration. The process itself dictated the plan and the triggers to use another strategy. This also came out in the discussion of seeking social assistance in 4.4.1 where the participant would only go to someone else if they were “stuck.”

The participants would use the strategy that they felt would yield the best learning for the needs of the situation.

*If I had to have it fast, I may go to him faster.*

This participant was looking to use *seeking social assistance* but only when they needed the information right away. The triggers are brought on by the results from the last learning strategy used, and therefore, the categorization of triggers would not be useful. A quote to illustrate this process:

*That was a lot of trial and error. I've started with \*\*centralized support\*\* and went to documentation and they have a I have to dig it up again. I can never remember where it is. I think it is in her job aids. Um, they have this important table document that doesn't have all the tables of PeopleSoft but it has some of the more important tables that you might hit and might need and I started with that to get the basic paycheck tables and then it was a matter of going in and looking at the tables and looking at the key data that payroll needed and then figuring out how we can join it together and what rows can we exclude, employer deductions we don't need those deduction ideal. And things like that. Um, a lot of trial and error running the query taking look at the results and trying it in PL Sequel until I finally got it to where it needed to be and had a good understanding of the table structures and what data is on each table and what table can we ignore and what data is important to payroll.*

Thus, instead of studying triggers, future research needs to focus on exploring the relationships between strategies to determine how strategies trigger one another.

The last quote above does illustrate an added part to the coding in the area of triggers; the *negative-trigger*. There were eleven *negative-triggers* and they all were associated with why one of the participants would not *seek social assistance*. Many of the participants choose not to use seeking social assistance because:

1. they wanted to make sure the source was not overused.

*I don't want to bother them.*

2. they felt as if they would learn more on their own.

*I tend to retain more if I find it on my own. It sticks up here better.*

3. they did not want to appear to have not looked for the information themselves.

*I don't want to bother them you know for an hour and have them explain this whole process if I can find it online and read the documentation.*

4. there was pride in finding the information they needed on their own.

*I like to get there myself.*

5. They felt it would be quicker to learn on their own.

*Or I get tired of waiting for answers a lot of the times for somebody to come help me. I don't have time to wait for them so I just push through and do it.*

The triggers then are coming from the learning process, dictating what strategies are to be used and negative-triggers which show why a strategy is not used.

#### **4.8 Categorization and Description of Motivations to Learn**

This section addresses the third research question – “What are the key motivators of power users when they are learning in the IS/IT context?” There were sixty-six coded occurrences of motivations to learn in the study occurring in sixteen of the interviews. All but two were motivated by a problem in their job or was a natural part of their job. This again is where the task directs the learning, even to the point of motivation to learn.

*And, so, um, basically, what happened was, is she emailed me with some questions, uh, about her benefits, and when I went in to pull her up I couldn't find her.*

*Probably the, uh, the one - the only one that really sticks out in my mind is um, I needed - I was in charge of the employment office at the time, and I needed to know how much the university spent - paying temp agencies for their assistance.*

In both of the cases, the participants stated why they were going into the learning process and in both cases, they see it as a part of their job. This is consistent with the adult education literature (Hrimech, 1995; Kerlin, 1992; Knowles, 1984), adult learners learn when faced with a problem. The other two codings were where a participant was positioning themselves to obtain a new position in the organization they already were in.

*Um, and the PeopleSoft, I applied for a job that I really wanted and I'd had gotten a little bit of exposure to it through working as a front line helpdesk person, but I really wanted to work with the PeopleSoft team. So, when they had, before they had a opening, I started positioning myself for it by trying to figure out every way possible to answer questions and going out and I used the internet a lot.*

Thus, the best way to represent the data is a two level categorization: *problem-based* or *job-based* and *opportunity-based* motivation types. For the problem-based motivations, the motivation was extrinsic coming from the problem. It was not intrinsic to the individual but came from the technology and the specific application of the technology. Since the original research question was interested in the intrinsic motivators for the individual, further subcategorization was not continued. In addition, after attempting to categorize the problem-based quotes, it was concluded that there was no useful subcategorization structure, and thus, the results were left with these two categories: problem-base vs. opportunity-based.

These two categories do not reveal much information about the intrinsic motivations of the participants and especially what has motivated them to learn to the extent that was required to become a power user. Some intrinsic motivators, indicated in the data, that could have caused them to become a power user were mastery orientation, recognition from their peers, and strong need for learning and growth. For example, a number of comments indicated participants felt recognized and proud when others sought information from them. Intrinsic motivators for power users needs to be addressed in future research.

#### 4.9 Model of Self-Regulated Computer Learner

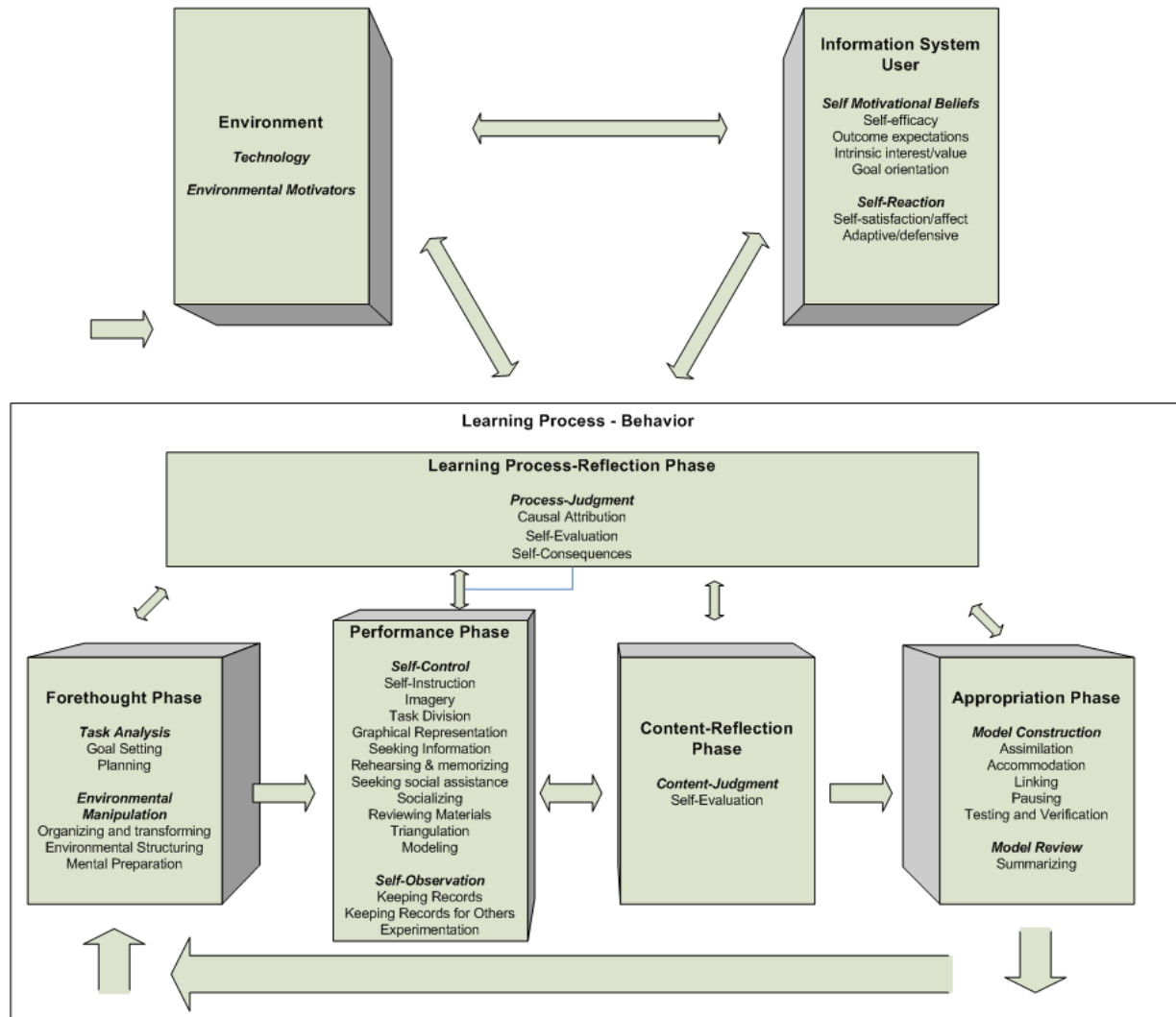
The model of the self-regulated computer learner from chapter 2 was not specifically tested in this study but guided how the study was conducted and is presented here as the Self-Regulated Power User (see figure 4). However, the results clearly support the model. The strategies within each of the phases were used.

Certain strategies in the **Performance Phase** were heavily used. Even though the task or problem primarily set the goals and the plan for learning and much of the environment for the learner was already handled outside of the learning process, the fact that participants rated *mental preparation* so highly shows that the **Forethought Phase** is important. The participants implicitly step into the Forethought Phase although they may not have recognized it themselves. The addition of the **Appropriation Phase** is significant to this model and was the strategies within it were the second most used. The building, modification, and maintenance of mental models are an important part of the learning process of the power user.

**Self-Reflection** strategies were not as heavily used by the power user, and the major one used, *self evaluation*, was reflecting on learning content, not process. The **Self-Reflection** strategies, reflected in the literature and developed in Chapter 2, all are focused on the learning process. Thus, the data analysis turned up evidence to support a revision in the model. The position of the **Self-Reflection Phase** in the original model is primarily where the power-user evaluates the content of their learning. This is shown in Figure 6 by renaming **Self-Reflection Phase** to **Content-Reflection Phase** and would hold the strategy of *self-evaluation* with the addition in the definition of the concept that they are looking at the content. A double-sided arrow was put between **Content-Reflection Phase** to represent the movement from one strategy

to the next based on the previous strategy. This is seen as a very quick *self-evaluation* of the content.

The participants in this study were all able to adjust their learning process when needed. Thus, the participants had to be evaluating the learning process; however, they did not focus on this process evaluation in the incidents as reflected in only one code being found for causal attribution strategy. The interviews suggested that this evaluation could happen throughout the learning process, adjusting strategies used and when the user should move from one phase to the next and when they should move out of the learning process. The evaluation that goes on in the phase sequence is a content evaluation as discussed above. Thus, the **Process-Reflection Phase** **has been moved** outside the main phase sequence to illustrate that it can be invoke from any phase (See Figure 6) and renamed it to be the **Learning Process-Reflection Phase**. **Learning Process-Reflection Phase** could impact and be impacted by all of the phases in the learning process as shown by the double arrows in Figure 6. There would be three strategies in the **Learning Process-Reflection Phase** taken from the original **Self-Evaluation Phase**: *self-consequences*, *causal attribution* and *self-evaluation*. The original definitions, which focused on process evaluation, would be used.



**Figure 6 Revised Self-Regulated Power User**

## **CHAPTER 5**

### **CONCLUSIONS AND IMPLICATIONS**

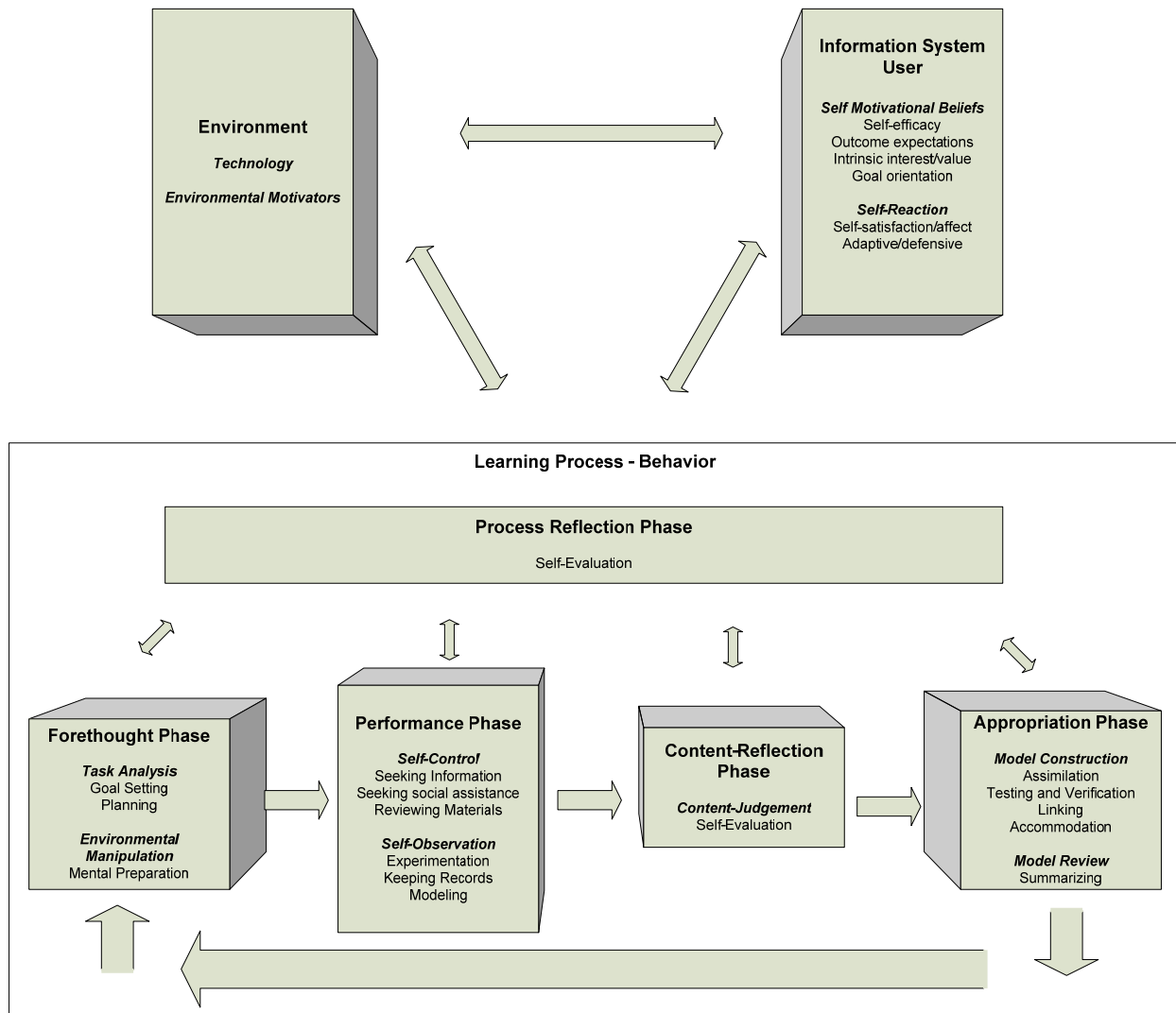
#### **5.1 Summary of Findings**

This section summarizes the results of this study. This research found that the model developed in Chapter 2, with modifications, represents the way that power users learn in an IS/IT context. The section starts out with reviewing the revised model and then summarizes the answers to the three research questions.

#### **5.2 Self-Regulated Computer Learner Model**

The research developed for this study illustrated the learning process of the power user. For each phase, the revised research model shows the key learning strategies and the phases in the learning process for the power user (see Figure 7).





**Figure 7** Revised Self-Regulated Power User

Support for the general model was found. Individuals followed, generally, the structure outlined in the research model but identified some problems with the **Self-Reflection Phase**. The focus of this phase, as documented in the research literature, was to evaluate the learning process. Power users would evaluate the content of the learning while in the process but were evaluating the process outside of the structure captured in the initial research model. Thus, the **Self-Reflection Phase** was then changed to the **Content-Reflection Phase** and a **Learning**

**Process-Reflection Phase** was added that resides outside of the original four phases and interacts with all of them.

Power users would typically enter the learning process in the **Forethought Phase** but could enter at any point. They would set goals for their learning, plan how they were going to learn and prepare themselves mentally. For the power user, much of the **Forethought Phase** is either established by the task/problem or has been established over time. The plan that is established in the **Forethought Phase** leads the learner to the **Performance Phase**.

In the **Performance Phase**, power users start to gain insight into the technology they are learning by using it, talking to others about it and researching it, among other strategies. The learner actively gathers knowledge about the technology. Once they have gathered this knowledge, they would evaluate the knowledge gathered in the **Performance Phase** in the **Content-Reflection Phase**.

During the **Content Reflection Phase**, learners evaluate what they are learning. This evaluation could cause the user to go back to the **Performance Phase** (showed by the double arrow between Performance and Content Reflection phases in Figure 7) or on to the **Appropriation Phase**.

In the **Appropriation Phase**, learners build, modify and adapt mental models of the technology and the technology's domain based on their learning experience. These models assisted the learner to perform their job but the models were also a basis to build off of when they enter a learning process in the future.

Outside of these three phases is where the computer learner would evaluate the learning process, the **Process-Reflection Phase**. This evaluation could happen throughout the learning

process, adjusting strategies used and when the user should move from one phase to the next and when they should move out of the learning process.

### 5.3 Newly Identified Learning Strategies

The study identified four new strategies: *modeling*, *keeping records for others to learn*, *self-evaluation* of content and *testing and verification*. Modeling, a **Performance Phase** strategy, was identified during the pilot study and was the fourth most widely used strategy. The power user uses an example to adapt for their own purposes. This was often used in the case of copying structured query language code, used to gather specific information from a database, from an outside source as a base for a solution they sought.

*Keeping records for others to learn*, another **Performance Phase strategy**, was very similar to *keeping records* in that the power user would take notes but the intent was for others to use these notes. This is in keeping with the definition of power users in that power users help to define how technologies are used in organizations and help to pass this information to others.

*Self-evaluation* is in the new **Content-Reflection Phase**. Codings for *self-evaluation* in the study were all centered around learning content and not process, and therefore, a change was made in the model and consequently the strategy.

*Testing and verification* is the last identified strategy and appeared in the **Assimilation Phase**. Here the power user has accepted learning but feels the need to make sure there are no problems with it prior to them integrating it into their mental models.

**5.4 Research Question 1:** *What are the key self-regulated learning strategies of power users in the IS/IT context?*

The key strategies are the strategies that power users use most frequently. These strategies are shown in Figure 7 for the **Forethought, Performance, Content-Reflection** and **Appropriation Phases**.

To determine what a key strategy was, the natural breaks in the weight statistic for each phase were identified. See Table 21 for detailed data (Table 21 is a copy of Table 15 discussed in Chapter 4).

Table 21 CIT Counts of Self-Regulated Learning Strategies

Strategy	Frequency	Users ( $\alpha$ )	Incidents( $\beta$ )	Weighted Total
<b>Forethought Phase</b>				
Environmental Structuring	1	1	1	4.27
Organizing and Transforming	1	1	1	4.27
Mental Preparation	3	3	3	12.81
Planning	5	4	5	17.42
Goal Setting	7	6	7	25.96
<b>Performance Phase</b>				
Self-Instruction	0	0	0	0.00
Keeping Records for Others to Learn	1	1	1	4.27
Rehearsing and Memorizing	3	1	3	4.96
Imagery	4	2	3	8.88
Socializing	3	3	3	12.81
Triangulation	4	3	4	13.15
Task Division	6	4	6	17.77
Graphical Representation	7	4	7	18.12
Reviewing Materials	13	7	10	30.92
Keeping Records	13	8	12	35.54
Modeling	30	13	24	59.31
Experimentation	99	17	54	85.42
Seeking Information	105	17	57	86.46
Seeking Social Assistance	123	16	70	87.05
<b>Self-Reflection Phase</b>				
Self Consequences	0	0	0	0.00
Causal Attribution	1	1	1	4.27

Self-Evaluation	8	6	8	26.31
<b>Appropriation Phase</b>				
Pausing	6	3	6	13.85
Accommodation	8	5	8	22.39
Summarizing	9	6	8	26.31
Linking	15	7	11	31.27
Testing and Verification	9	8	9	34.50
Assimilation	15	8	11	35.19
<b>Total</b>	<b>499</b>	<b>n/a</b>	<b>n/a</b>	<b>n/a</b>

There was a natural break in the **Forethought Phase** between the weight for *mental preparation* and the weight for *organizing and transforming*, in the **Performance Phase** between *reviewing materials* and *graphical representation*, in the **Appropriation Phase** between *accommodation* and *pausing*. In the **Content-Reflection Phase**, there was only one strategy that was left after the change mentioned above: *self-evaluation*. The data related to **Learning Process-Reflection Phase** was absent in this study.

The key strategies in the **Forethought Phase** were *goal setting*, *planning* and *mental preparation*. The key strategies in the **Performance Phase** were *seeking social assistance*, *seeking information*, *experimentation*, *modeling keeping records*, and *reviewing materials*. The key strategy in the **Content-Reflection Phase** was *self-evaluation*. Lastly, the key strategies in the **Appropriation Phase** were *assimilation*, *testing and verification*, *linking*, *summarizing*, and *accommodation* (see Figure 7).

Strategies that were not viewed as key by the power users were *organizing and transforming* and *environmental structuring* from the **Forethought Phase**, *graphical representation*, *task division*, *triangulation*, *socializing*, *imagery*, *rehearsing and memorizing*, *keeping records for others to learn* and *self-instruction* from the **Performance Phase**, and

pausing from the **Appropriation Phase**. *Self-consequences* and *causal attribution* were moved to the **Learning Process-Reflection Phase** but neither was found to be key strategies.

Self-regulated learning has centered on k-college and other instructor led learning. This research adds to the literature by studying adult learners in a situation where they guide the learning and in the field where the results are more transferable to practice. As discussed in Chapter 2, the one major previous study (Hrimech, 1995) discussed in Chapter 2 that focused on adult learners had added six strategies to the k-college strategies. This study added four more strategies and developed and empirical supported a more comprehensive self-regulated learning model (shown in Figure 7) than current SLR models. It also identified the key learning strategies and those strategies that were not relevant in an important adult learning domain.

It is clear from results of this study that the adult SRL world is different from k-college one. For example, the strategies found in the **Forethought Phase** are stressed in the k-college literature (Montalvo & Torres, 2004; Schmidt & Ford, 2003; Schunk & Ertmer, 2000; Zimmerman, 1996, 1998, 2002; Zimmerman & Schunk, 2001), yet the power users in this research gave the phase little support. *Organization and transforming* and *environmental structuring* are examples of strategies that have been shown to be important to the K-college learner and not in this study.

#### **5.4.1 Forethought Phase Key Strategies**

In the **Forethought Phase**, *goal setting*, *planning*, and *mental preparation* were key strategies. The strategies in the Forethought Phase setup the learning process and were emphasized by education literature (Knowles, 1984; Zimmerman, 2003; Zimmerman & Pons, 1986). This was still an important phase for the IS user but as users move to the point of a power user where their mental models are strong, it was utilized less.

*Goal setting* as a strategy was important for learners where a goal is not already set. For power users, when the learning situation stems from a problem, the goal comes from the problem itself and *goal setting* as a strategy was not necessary.

*Planning* did not get mentioned much in the critical incidents. This was somewhat surprising given all the focus on this in literature. Again, this seems to be the result of the problem-oriented learning of the power-user. Based on the data, it appears that participants have moved in and out of learning so many times that they have established general plans/action templates for specific contexts or problems that are very effective. They would not have to plan as they already had a plan. The participants would learn more about the problem in the **Performance Phase**, letting the problem and parts of the solution found dictate the process. Thus, they had a general plan or template to follow but detail actions steps will emerge from the results of their other learning strategies used in **Performance Phase**. Thus, there is a dynamic planning and adjustment going on as part of the actual performance of learning process. Thus, planning in **Forethought Phase** would be very minimal.

*Mental preparation* was the fourth most highly rated strategy, receiving 14% of the whole, when the participants were asked what their three most important strategies were. This is in contrast to what was found during the critical incident technique where it was moderately used. Power users often move in and out of learning through the course of a day and may be in a state of mental preparation from previous learning situations. However, if they were not in the right mental state, getting into the appropriate state before starting the learning process was important.

### 5.4.2 Performance Phase Key Strategies

In the **Performance Phase**, there were six key strategies. The top four strategies in this phase, *seeking social assistance*, *seeking information*, *experimentation*, and *modeling*, were the top four strategies overall. These four strategies represented 71.54% of the total coded strategies. The power user is very action-oriented and utilizes the **Performance Phase** strategies the most.

Once power users encountered a problem, they would often start the learning process with *experimentation*, exploring the technology and the problem. *Experimentation* would help define the next strategy and the plan for learning. *Experimentation* would also be revisited in the learning process when information learned needed to be tested. *Experimentation* on live systems, while not ideal, is also utilized even though system degradation and other negative consequences might occur.

Once the power user had a plan, often the next thing they would do was utilize *seeking information* from sources to resolve as many of the issues defined by their *experimentation* as they could. Specific sources were not important except to say that they would be seen as useful.

One of the pieces of information that could have been found in *seeking information* would be a model of a solution, such as an example SQL query. Power users often use *modeling* to speed up the learning process especially in areas where their mental models were not well developed.

The next two strategies in the **Performance Phase**, *keeping records* and *reviewing materials*, were especially important when users were building mental models but not as important when they became power users, where mental models were strong.



Learners used *keeping records* to document the information that they had learned and *reviewing materials* to clarify past information learned. Once the material was fully incorporated into a mental model, this information was accessed easily without having to use *reviewing materials*.

#### **5.4.3 Content-Reflection Phase Key Strategies**

The only strategy seen as key in the Content-Reflection Phase was *self-evaluation*. In the original research model, the **Self-Reflection Phase** was believed to be where the individual would evaluate their learning performance. This involved both content and process. During the research, it was apparent that the evaluation of the process of learning was not happening in the process but evaluation of the content was. The *self-evaluation* strategy was refined to reflect this change and there was support for it being a key strategy.

#### **5.4.4 Appropriation Phase Key Strategies**

In the **Appropriation Phase**, power users build, adapt, and maintain mental models. This was the second most heavily used phase in this study, 9.4% of the strategy codings, and had five key learning strategies: *assimilation*, *testing and verification*, *linking*, *summarizing*, and *accommodation*.

Power users built mental models during the *assimilation phase*. This was done over time and parts were added to the mental model through multiple learning episodes. The power user may also have found new parts to a model but may have been unwilling to adopt them until they used *testing and verification*. This would primarily be due to the cost of adopting parts to a mental model that may be incorrect. If the power user acquired learning that conflicted with an already established mental model, the power user would again verify which information was correct and abandoned the incorrect model using the *accommodation* strategy. *Testing and*

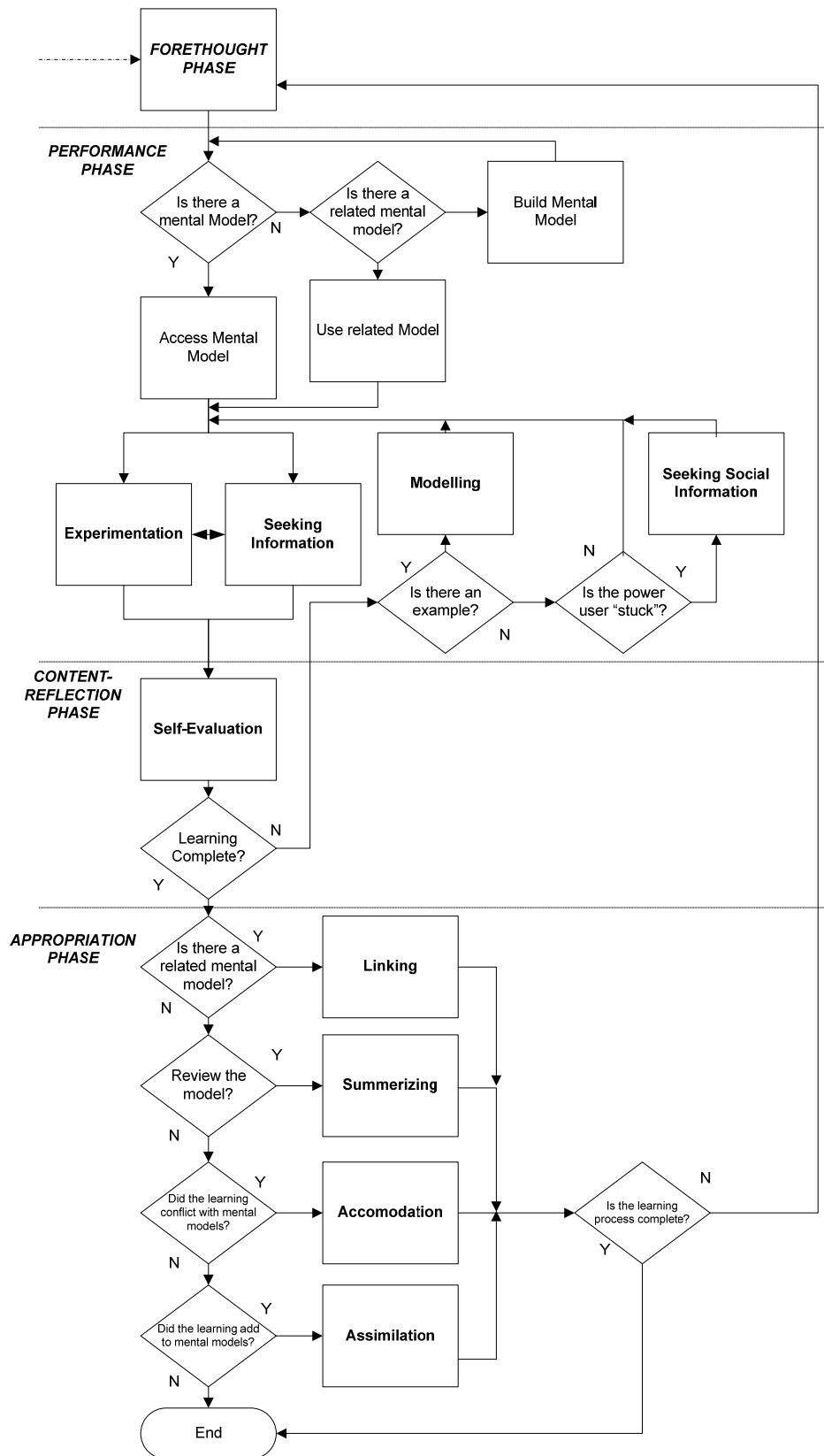
*verification* along with *accommodation* illustrate the value that the power user had for these mental models. The last strategy seen as key in the **Appropriation Phase** was *summarizing*. This was different from the other strategies in that there was no other information for the power user to work with other than the mental model itself. In this strategy, they would explore the model looking for gaps in their understanding as a way of determining what needed to be learned.

#### **5.4.5 Suggested Relationships Between Strategies**

The study design did not allow for direct investigation of the relationships between strategies, but the interviews did shed some light on these relationships. This section will interpret what the data suggests but is preliminary and based on ad-hoc analysis. It is included because the relationships between strategies are seen as a key future research area.

The focus of all power users on a few learning strategies suggests that many power users handle the learning process in very similar ways; they build onto and maintain mental models for the technology and their functional domains. Also, once the power user has established a mental model, their use and maintenance seems to have a standard process (See Figure 8, key learning strategies are bolded). Initially they move into the **Forethought Phase** and define the goal, set the general plan and prepare themselves mentally. As discussed previously, they spend little time in this phase since problem/task usually establishes the goal and general plan.

Power users assess if they have a good enough mental model to guide the learning. If they do, then they use this model to continue. If not, they see if there is a related model, either technological or domain and use this model as their initial mental model. If they have no mental model, they build an initial model. Building an initial model is a different learning process and this study did not reveal anything about this process.



**Figure 8** Accessing Mental Models

Once the learner has a mental model to assist in their learning, they experiment and or seek information. The reliance on *experimentation* and *seeking information* as a cooperative pair came up in every interview and almost all critical incidents. Power users would gather information and immediately try it and see if it could/would apply to the learning situation or they would experiment and then seek information to help understand results and plan next steps.

The power user would then enter the **Content-Reflection Phase** and assess the content of the learning using *self-evaluation*. The resulting learning may or may not be sufficient to accomplish learning goal(s).

If it is not sufficient, they would see if there is a model that could help them. If not, they would declare themselves stuck. If they were stuck, they would seek social information. If they had not been stuck or they were done seeking social information or if they were done modeling, they would go back and either experiment or seek out information about what they had found.

If the power user had assessed that they had accomplished the learning goal(s), they would integrate learning into their mental models. If appropriate, they would build on new models, using portions of other mental models, *linking*. If felt they needed to review the model to find gaps in their understanding they would use *summarizing*. If they found information that conflicted with previous models, they would use *accommodation* to resolve any conflicts. If they had new information they would use it to build on to their mental models with *assimilation*. After they had worked with their mental models, they would again assess if they were through with the learning process. If they were through, they would leave the process and if not, they would go back to the beginning.

**5.5 Research Question 2:** *What are the key drivers for power users to choose strategies in an IS/IT context?*

*Triggers* for power users to choose strategies in a problem-based learning situation come from the problem itself and from the last strategy used. For this reason, the categorization of triggers was explored but not considered relevant. The key drivers for power users to not choose strategies, the *negative-trigger*, were revealed in this study. Interestingly, the most used and most valued strategy, *seeking social assistance*, was used as a last result. There were multiple reasons why power users would not use *seeking social assistance*. It is suggested that future research focused on the relationship between strategies instead of the triggers since usually the previous strategy triggered the use of a strategy. Future research also needs to investigate negative-triggers.

**5.6 Research Question 3:** *What are the key motivators of power users when they are learning in the IS/IT context?*

Motivations for the power user to learn came from opportunities the power user saw and from tasks/problems in their jobs, both extrinsic motivators. This is consistent with adult education literature (Hrimech, 1995; Kerlin, 1992; Knowles, 1984). What is missing is what motivates the power user to learn to the level that makes them a power user. Since the original research question was intended to explore the intrinsic motivators of the power user, further categorization was not continued. Previous research (Gravill, 2004) and the results of this research suggest that mastery orientation, recognition from their peers and a strong need for learning and growth may be important intrinsic motivators but further research is needed.

## **5.7 Discussion of Methodological, Theoretical and Other Findings**

The critical incident technique, used in this study, revealed how the power user learned, i.e., the learning strategies used along with the learning process as a whole. The richness of the information yielded insight that might not have been discovered using another research method. Because learning is an internal process to the individual, sometimes it was difficult for the participants to recall all that happened during an individual learning process. There was a constant struggle during the interview to keep the learner focused on the critical incident. This was also difficult for the researcher because often comments revealed new critical incidents. Overall, however, there was a very good fit between the method, critical incident technique, and self-regulated learning research questions.

Triggers to use specific strategies were found but the major finding was that these triggers came from other strategies or from problems the power users were trying to resolve. The critical incidents technique did not reveal some of the underlying drivers to use specific strategies. However, it did turn up the need to focus on the previous strategy as a trigger and the importance of looking at relationships between strategies in future research.

Motivations of the individual were also not well revealed by the critical incident technique. Two extrinsic motivator types were identified but the motivators for power users to learn to the point where they become power users were not. However, this was primarily a problem of research design and not the technique. With the appropriate framing and question development, critical incidents could be used to identify a complete motivational profile.

## 5.8 Limitations

Many of the limitations of this study center on the choice of methodology. The three key limitations are subjectivity, generalizability, and the interviewee memory.

### 5.8.1 Subjectivity

There is the possibility of bias coming from three primary sources: interviewee, interviewer and the sites chosen. Since the interviews were recollections of the power user about internal process, learning, there is a possibility of bias being introduced into the study (Klein & Myers, 1999). This research relied on interviews coming from power users and did not collect corroborating evidence. Interviewee personal subjectivity could pose a potential limitation (Yin, 2003). This was addressed by having gathering ninety-six critical incidents from seventeen power users. There was no evidence of systemic bias across all power users.

The researcher could also have influenced the study through the coding of critical incidents. A second coder was employed at two different times during the data analysis and intercoder reliability was checked and no bias was found. Further, by collecting an adequate number of critical incidents and from multiple sources helps to reduce the likelihood of influence being introduced by the researcher.

The sites chosen were all from within a large university system in the southern United States and were all supported by a centralized information technology support office.. The commonality of the institutions along with their support structure could have introduced a bias. Since the systems that the power users were using were separate installations and implementations of the technologies, PeopleSoft Financials, PeopleSoft HRMS, and Banner, there is little chance of bias being introduced. Further, the institutions were geographically

separate, had different missions within the university system and the participants in the study were from different areas of their institutions.

### **5.8.2 Generalizability**

Critical incident technique uses intensity sampling not probability sampling. Therefore, the collection of rich data around the self-regulated learning strategies used in an IS/IT context was necessary. The subjects chosen clearly satisfied the criteria for a power-user of a complex technology. The technology that was focused on was ERP systems, which is sufficiently complex to allow for a wide array of learning strategies. While sites chosen were all from academic organizations, the job function of the power users was focused on the business side of these institutions and not academia; accounting, human resources, etc. The choice of technology, subjects and sites yielded a rich data set. This rich data set should then be able to capture a wide array of learning strategies that could be applied to different learning situations especially in situations where information systems are being used or developed. While the sampling strategy and research methodology limit generalizability, there is now a basis to study self-regulated learning strategies in an IS/IT context.

Different areas of technology usage may reveal some different findings related to the learning of technology but this study was designed to be part of the foundation for future research in this area. This study was designed and reported with explicit data collection and data analysis procedures to facilitate replication.

### **5.8.3 Interviewees memory**

There is a recency effect that causes individuals recollection of events to diminish over time (Miller & Campbell, 1959). Since this study utilizes the critical incident technique, only learning episodes that are recalled in detail are included. The details of the events are valid



because they are remembered (Flanagan, 1954). The individuals' memories are also supported since the critical incident technique showed the same strategies being used across participants.

#### **5.8.4 Convenience Sample**

This research is intended to be foundational research and not specifically representative of all populations. The sample of power users was purposefully chosen and not probability based. The convenience sample is then problematic if it does not offer rich data. There were four hundred and ninety-nine coded strategies in ninety-six critical incidents over seventeen interviews which produced four new strategies in the area of self-regulated learning.

### **5.9 Implications for Researchers**

Instruments developed outside of IS/IT for the purpose of studying learning strategies have been applied to IS/IT and found to be inadequate (Chen, 2002). By indentifying key learning strategies, this research sets the groundwork for the development of instruments using strategies identified in this research. The strategies identified in Chapter 2 yield a view of the adult learner and are therefore not limited to use in the IS/IT context. The findings of this research help to extend and refine that set for use in IS/IT. Initial relationships between strategies in the model were also suggested in this research. Future research should be develop the model in and out of IS/IT along with further exploration and refinement of strategies.

The power user was identified and researched in this study. What has motivated them to achieve the level of power user was not determined in this study and should be explored. In Figure 7, the information system user box identifies a number of key individual attributes, such as their motivational beliefs, that can impact the learning process. The motivational beliefs, especially intrinsic motivators, for the power users should be identified so organizations can

motivate their power users and so that these motivations can be used to help select potential power users. In general, research is needed that develops a power user profile of individual attributes. This study developed a profile of key strategies and a power user individual attribute profile would add critical research on another major component of SRL model shown in Figure 7.

This study helped to reveal the strategies employed by power users of technology and which ones of those were key. This research needs to be extended into the area of the beginning user. The key focus in this area should be the development and testing of learning methods to install the key strategies in beginning users to develop their self-regulated learning abilities. Different forms of learning methods should be explored: classroom based, technology-mediated, etc. These developed methods, then, need to be integrated in to academic and organizational training courses.

A profile of the power user was established in this research which can be used to identify power users for future research or organization purposes. Refinement of this profile along with the identified strategies in this study can be used to develop an instrument that could be used to select power users or potential power users for research or organizational purposes.

Power users help define the usage of technology within an organization. They help to define how technologies that are complex, like ERP systems, where there deployment and usage is important to the success of the system, are employed. Power-users should then be a key focus of future research.

### 5.10 Implications for Power Users/Learners

Power users need to understand what their key strategies are and make sure that they have the support structure set up in the organization to utilize them. In addition, if they do not have or they have limited use of a strategy, they need to develop those strategies.

- Goal setting – Power user needs to be cognizant as to what the outcome of learning should be.
- Planning – Power user should approach learning situations with a plan.
- Mental preparation – Power users need to have a mind set to learn at any time.
- Seeking social assistance – Power users need to develop and foster a support network that contains other users and support personnel to help them in times when they feel they are “stuck”.
- Seeking information – Power users should understand what information resources there are for them to draw from and make sure they have a broad set.
- Experimentation – Power users need to make sure they have the realistic facilities in place for them to experiment.
- Modeling – A knowledge base of external examples from which the power user can draw should be established.
- Keeping records – Power users should document procedures so that they can reproduce solutions quickly.
- Reviewing materials – Information that was found when power users were seeking information or output from keeping records should be kept accessible to the power users.

- Self-evaluation – Learners should make sure the strategies that they employ are yielding results that are useful.
- Assimilation, testing and verification, linking, summarizing, and accommodation – Power users should try to understand how the information they gather fits within past information they have gathered about the technologies used, and the domain in which they are used.

Beginning users need to understand what strategies are available and what strategies will be most useful to them as they move towards being a power user. They need to feel comfortable experimenting, they need to identify sources of information that they can reference, especially examples of the technology. Lastly, they need to establish a network of individuals that can assist them in their use of technology.

### 5.11 Implications for Trainers and Organizations

Trainers need to understand how users and power users learn to support their learning. Since most users are not all at the same level, delivery of technical information can miss the target being too technical for some users and not technical enough for others. If they train users to use learning strategies in a specific context, they can assist all users to be self-regulated learners in that context. Trainers can also train users to use self-regulated learning strategies in a general context. This would allow the user to more effectively learn new technologies on their own. The key strategies and learning process to guide these training efforts have been identified in this study.

Organizations need to understand the key learning strategies and make sure they have a support infrastructure in place to support them, especially the **Performance Phase** strategies.

This will help users in an organization get more out of the technologies the organization has deployed.

IS/IT literature describes the importance of the IT power user to the organization and this research highlighted the abilities and knowledge base of the power user. These users define how the technology will be used in the organization and serve as support for the technology, formally and informally, for the organization. Organizations need to understand the value of the power-user and ensure they protect these power users as an asset.

Identification of these assets then becomes important to the organization. Organizations can use the profile outlined earlier in this research and/or can develop an instrument from the identified strategies to help identify power users.

## **5.12 Conclusions**

From the results of this research and from the literature, it appears that self-regulated learning is the primary way that power users learn in an IS/IT context. The enhanced model of Self-Regulated Learning of the Computer User developed through this study describes the learning process in the IS/IT context. Also, this study explored the strategies, triggers to use and not use these strategies, and the motivations of power users to learn.

The study resulted in a research model that can be used to guide future research in self-regulated learning of computer users. Within this model, the study identified four learning strategies not previously identified in the literature and identified the key strategies that IT power users use. These key strategies fell into four phases, Forethought Phase, Performance Phase, Content-Reflection Phase and the Appropriation Phase. An additional phase, Learning Process Reflection Phase, was also suggested and these five phases along with strategies reveal a model

of the self-regulated computer learner. This research was designed to be foundational research in the area of IT power users and self-regulated learning of adults and provides suggested future research directions.

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## **APPENDICIES**

## **Appendix A: Introduction to the Organization and Identification of Supervisors**

Prospective Organization

Address

City, State

Dear Mr. X:

I have been given permission from your organization to contact you directly. I am especially interested in your organization because of your use of Enterprise Resource Planning (ERP) systems. I am researching the learning of software systems by key users in an organization. This will help me in my doctoral dissertation work and may help your organization and the individuals that participate in the study.

### **Introduction:**

We are interested in studying software-related learning by individuals in the business world. Current research in this area is focused on formal training, one of the means to the eventual goal of learning. We believe that by studying how one group, power users of software applications, we will be able to better understand how to learn software applications. While power users may attend outside training, they are managing the learning process, filling in gaps in the training on their own. Even in the absence of formal training, power users still have a significantly better understanding of the software and how it integrates with the tasks in their position than the typical user.

Please help us identify power users in your organization so that we may be interview them about their learning process. These are key individuals inside of an organization. These individuals:

- Typically help support peers with the use of technology. They are they people we ask before we go to technical support.
- Seem to get better than average value from the technology.
- Learn how to use the technology without formal training.
- Often used to test technology.
- Often used to train or setup training for software systems.

You may have already identified these power users, but if not, supervisors or peers are best able to identify these individuals. The primary software application that we are looking at is Enterprise Resource Planning (ERP) systems because of the size and scope of these systems. We are looking for individuals that are power users of your ERP system. While these individuals should be seen as power users of an ERP system, we believe that they will most likely be seen as power users for other software as well.

If you agree to participate in the study, we are requesting that you give us a list of power users or supervisors that we may contact that may be able to identify these users. With the list of these individuals, please include contact information and we will contact to request participation. The interview should last sixty to ninety minutes. We understand that these are key individuals inside of your organization, thus, we will minimize the use of their time.

**Benefits:**

**For the participating individual:** Individuals participating in the study will be able to reflect on and subsequently refine their personal learning strategies. They will also be able to learn what strategies are used by others.

**For your organization:** Organizations will be able to use the results to design better training programs and to develop better self-directed learners.

**For researchers:** This study will help identify the most relevant self-directed learning strategies. These strategies can then be taught to others in conjunction with technology training or separately. We can also start investigating how to design technology and technology-mediated training to include these self-directed learning strategies.

Please contact me via e-mail with the names and contact information at [ckadlec@terry.uga.edu](mailto:ckadlec@terry.uga.edu) or send them to me at:

Chris Kadlec  
487 Arthur Moore Dr.  
Green Cove Springs, FL 32043

Thank you for your help!

Chris Kadlec

## Appendix B: Introduction to the Power User

Power User  
Company X  
City, ST

Mr./Ms. Power User:

My name is Chris Kadlec and I am working on my dissertation research on learning of software applications. You have been identified as a power user of software applications by your organization, specifically with ERP systems. While you may not agree with this designation, this distinction places you in a position that helps to define how software applications are used in your organization. Power users typically find the best way to use software and then pass this information on to their peers. I am looking to explore how you learn to use software. I am asking you to fill out a short online survey and for two hours of your time during which I will ask you about your experience learning software applications.

The software applications we are focusing on are Enterprise Resource Planning (ERP) systems. These systems are large in scope and have many problems in how they are implemented into organizations. There are also significant hurdles in learning these types of systems. While this type of software is important to this study, we do not want to limit the discussion to just this type of system. We are also interested in how you learn other types of software - general office support (word processing, spreadsheet, presentation, etc.) and context specific applications (inventory management systems, accounts payable, CAD/CAM, etc.).

Helping to define the best way to learn ever changing software applications is the motivation for this study. This study will provide feedback to you about your own learning strategies and those of other power users. You will receive a copy of your transcribed interview for review and correction and a copy of the findings report. If you volunteer to take part in this study, you will be asked to do the following five things:

1. Consent to the study and fill out a online survey (<http://mis.terry.uga.edu/survey>).
2. Make yourself available for interview. The primary researcher will contact you to arrange this interview.
3. Be interviewed. The interview will last approximately two hours and will be conducted by phone or face-to-face depending on the researcher's ability to get to the subject's location.
4. Receive and review the transcript of your interview when it arrives within two months after the interview. Upon request, you may also review the recording. If you find any inaccuracies or identifying remarks, you may correct them and return a copy of the changes to the researcher. The researcher will incorporate these corrections.
5. Receive a copy of the findings report if you desire.

No risks are expected in this interview. The information you give will be confidential. The interview will be recorded, and you will have the right to review the recording and transcript. Only the researcher will have access to the recording. It will be stored in an encrypted computer repository and erased after seven years. Its transcript will be stripped of any information that



identifies you and your company. This information may be published or used in further studies but that information will not be attributed to you.

There is a background questionnaire that I would like you to fill out, located at <http://mis.terry.uga.edu>. I will need this information to help interpret all of your data. I will report on the learning of power users but not specific individuals. I will give you a written transcript of the interview which you will have an opportunity to correct if there are any problems. After the study, I will provide you with how your individual learning habits fit with that of other power users. This may provide you insight into how to better improve your own learning habits along with helping to refine your own learning process. In the future, this information could be used to design training programs and learning systems that support the learning strategies of power users and train others to use some of these strategies.

If you fill out the survey, either online or on paper, you are agreeing to participate in the described research project. Your participation is voluntary; and you can stop taking part at any time without giving any reason, and without penalty or loss of benefits. You can ask to have information related to you returned, removed from the research records, or destroyed.

Thank you for your participation. Please keep a copy of this letter for your records.

Chris Kadlec

Feel Free to contact me by phone at (706)340-6184 (work/cell) or by e-mail at [ckadlec@terry.uga.edu](mailto:ckadlec@terry.uga.edu) if you have any questions about the study.

Additional questions or problems regarding your rights as a research participant should be addressed to IRB Chairperson, Human Subjects Office, University of Georgia, 612 Boyd Graduate Studies Research Center, Athens, Georgia 30602-7411; Telephone (706) 542-3199; Email [IRB@uga.edu](mailto:IRB@uga.edu).

## Appendix C: Power User Background

### Background and Computer Usage Survey

This survey is used to describe your use of computers. Please take care in answering all of the questions as fully as you can. The tab key will take you from field (don't hit enter until you want to submit).

Please note that Internet communications are insecure and there is a limit to the confidentiality that can be guaranteed due to the technology itself. However, once we receive the completed surveys, they will be removed from the server and stored in a locked cabinet in my office. Names and contact information will be removed December 2006. If you are not comfortable with the level of confidentiality provided by the Internet, please feel free to print out a copy of the survey, fill it out by hand, and mail it to me at the address found at the bottom of this page. For anonymity, mail it with no return address.

Name:  e-mail:

Mailing address

street:

city:

state:

zip:

What is the best way to contact you?



e-mail   phone   mail

Would you prefer a face-to-face or telephone interview?



face-to-face   telephone

1. Education (check all that apply)

- ☐ High School Diploma
- ☐ Trade School
- ☐ Bachelors
- ☐ Masters
- ☐ Doctorate

☐ Other

2. Age

3. Gender

☐ Male ☐ Female

### Current Usage

4. For what department do you work in your organization?

5. What is your job title?

6. Do others in your organization look to you for guidance on how to use software?

☐ Y ☐ N

a. If so, how many hours do you spend doing this in a typical week?

b. Is this support a formal part of your job?

☐ Y ☐ N

7. Do you believe that you get more value for the organization from software applications than most of your peers in the organization?

☐ Y ☐ N

The following questions will refer to some terms that have many meanings. Please refer to these definitions to help answer the questions:

**Procedural Software:** Software that is used to develop something such as creating documents/slides or writing a program. This software can be used in different ways and is meant to perform general procedures. This category includes the following types of software (with corresponding basic functions):

Type:	Function:	Examples:
· Word Processor/Editor	create/retrieve documents and text	Word, WordPerfect, LaTek, FrontPage, DreamWeaver
· Spreadsheet/Modeling Language	develop spreadsheets for analyzing data or decisions	Lotus 123, Excel
· Programming Language	write a program	Java, C++, Visual Basic

· Database/Retrieval Language	create database, retrieve/update data, produce reports	Access, Oracle, MSSql
· Graphics	produce visual output	PhotoShop, Visio
· Statistics	analyze/graph data	CAD/CAM, SPSS, SAS
· Presentation Software	create slides	PowerPoint
<b>Application Software:</b> Software that is designed to accomplish a specific task such as payroll, budget, or electronic mail. Includes applications that are developed by others using procedural software, but that you use only for entering data, requesting reports or getting a task done. Examples: ERP systems, accounts payable, payroll, budget, project management, browser, games, electronic mail, computer-aided instruction		
<b>Job-Specific Usage:</b> Use of computers is specifically related to your current job.		
<b>Non-Job Usage:</b> Use of computers related to other activities than your current job.		

8. During the past 12 months, on average, I directly used Application or Procedural software as follows:

(Please place one check mark in each column)

	Job-Specific Usage		Non-Job Usage	
	Application	Procedural	Application	Procedural
Not at all	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
0-3 hours a week	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4-6 hours a week	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7-9 hours a week	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10-12 hours a week	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
More than 12 hours a week	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

9. In reference to question 8 above, please allocate your use of **procedural software** as percentage among the listed categories. Make sure that your values total 100. If possible, list the specific software used.

	%	List specific software used
Word Processor/Editor	<input type="text"/> %	<input type="text"/>
Spreadsheet Modeling/Language	<input type="text"/> %	<input type="text"/>
Presentation Software	<input type="text"/> %	<input type="text"/>
Database/Retrieval Language	<input type="text"/> %	<input type="text"/>
Graphics	<input type="text"/> %	<input type="text"/>
Statistics	<input type="text"/> %	<input type="text"/>
Programming Language	<input type="text"/> %	<input type="text"/>
Other	<input type="text"/> %	<input type="text"/>

Total	100%	
-------	------	--

10. How much of what you learned about the software previously covered was given to your through formal training (a CBT, college class, organizational training session, etc.) or without formal training?

Software:	Amount you learned through formal training (%)	Amount you learned without formal training (%)	Total (%)
Word Processor/Editor	<input type="text"/> %	<input type="text"/> %	100%
Spreadsheet Modeling/Language	<input type="text"/> %	<input type="text"/> %	100%
Presentation Software	<input type="text"/> %	<input type="text"/> %	100%
Database/Retrieval Language	<input type="text"/> %	<input type="text"/> %	100%
Statistics	<input type="text"/> %	<input type="text"/> %	100%
Graphics	<input type="text"/> %	<input type="text"/> %	100%
Programming Language	<input type="text"/> %	<input type="text"/> %	100%
Other procedural software	<input type="text"/> %	<input type="text"/> %	100%
Electronic Mail	<input type="text"/> %	<input type="text"/> %	100%
Internet Browser	<input type="text"/> %	<input type="text"/> %	100%
Large, Integrated, Enterprise systems (ERP, CRM, etc.)	<input type="text"/> %	<input type="text"/> %	100%
All other applications of software such as payroll, accts receivables, etc.	<input type="text"/> %	<input type="text"/> %	100%

11. In reference to number 10, if you indicated that you learned something without formal training, what are these other ways?



The things I enjoy the most are the things I do the best.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The opinions others have about how well I can do things are important to me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I like to work on tasks that I have done well on in the past.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

In the last section, you will be asked to complete 12 sentences. These sentences will give us a better understanding of your learning style. Each has four endings. Rank the endings for each sentence according to how well you think each one fits with how you would go about learning something. Try to recall some recent situations where you had to learn something new about software you use in your job. Then, using the spaces provided, rank a "4" for the sentence ending that describes how you learn best, down to a "1" for the sentence ending that seems least like the way you learn in these situations. Be sure to rank all the endings for each sentence unit. Please do not make ties.

Example of completed sentence set:

..

1. When I learn:	<input type="text"/> I am happy	<input type="text"/> I am fast	<input type="text"/> I am logical.	<input type="text"/> I am careful.
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Remember:

- 4 = *most* like you
- 3 = *second* most like you
- 2 = *third* most like you
- 1 = *least* like you

1. When I learn:	<input type="text"/> I like to deal with my feelings.	<input type="text"/> I like to watch and listen.	<input type="text"/> I like to think about ideas.	<input type="text"/> I like to be doing things.
2. I learn best when:	<input type="text"/> I trust my hunches and feelings.	<input type="text"/> I listen and watch carefully.	<input type="text"/> I rely on logical thinking.	<input type="text"/> I work hard to get things

				done.
3. When I am learning:	<input type="text"/> I have strong feelings and reactions.	<input type="text"/> I am quiet and reserved	<input type="text"/> I tend to reason things out.	<input type="text"/> I am responsible about things.
4. I learn by:	<input type="text"/> feeling.	<input type="text"/> watching.	<input type="text"/> thinking.	<input type="text"/> doing.
5. When I learn:	<input type="text"/> I am open to new experiences.	<input type="text"/> I look at all sides of issues.	<input type="text"/> I like to analyze things, break them down into their parts.	<input type="text"/> I like to try things out.
6. When I am learning	<input type="text"/> I am an intuitive person.	<input type="text"/> I am an observing person.	<input type="text"/> I am a logical person.	<input type="text"/> I am an active person.
7. I learn best from:	<input type="text"/> personal relationships.	<input type="text"/> observation.	<input type="text"/> rational theories.	<input type="text"/> a chance to try out and practice
8. When I learn:	<input type="text"/> I feel personally involved in things.	<input type="text"/> I take my time before acting.	<input type="text"/> I like ideas and theories.	<input type="text"/> I like to see results from my work.
9. I learn best when:	<input type="text"/> I rely on my feelings.	<input type="text"/> I rely on my observations.	<input type="text"/> I rely on my ideas.	<input type="text"/> I can try things out for myself.
10. When I am learning:	<input type="text"/> I am an accepting person.	<input type="text"/> I am a reserved person.	<input type="text"/> I am a rational person.	<input type="text"/> I am a responsible person.
11. When I learn:	<input type="text"/> I get involved.	<input type="text"/> I like to observe.	<input type="text"/> I evaluate things.	<input type="text"/> I like to be active.
12. I learn best when:	<input type="text"/> I am receptive and open	<input type="text"/> I am careful.	<input type="text"/> I analyze ideas.	<input type="text"/> I am practical.



	minded.			
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Thank you for your help. If there are any questions, please feel free to contact me.

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## Appendix D: Selection of Power Users

From the current literature, there are three criteria for the power user:

1. Learns technologies on their own (Baskerville et al., 2000; Lee et al., 2003; Massa & Testa, 2005; Watson et al., 2002)
2. Typically supports fellow users (quick questions, informal training and formal training) (Baskerville et al., 2000; Massa & Testa, 2005; Watson et al., 2002)
3. Gets more value from technologies than typical users (Baskerville et al., 2000; Lee et al., 2003; Massa & Testa, 2005)

In this study, there are several checks to ensure that critical incidents are gathered from power users.

1. The first check is the identification of the power user by another user, supervisor or support personnel. These individuals have a perspective of the identified user and other users and how they compare. This starts to satisfy the third criteria.
2. Once an individual has been identified, they fill out an online survey. In question 6, “Do others in your organization look to you for guidance on how to use software?” Identification of the users support role is addressed, addressing the second criteria. If the user supports other users, the amount of formal and informal support is identified. If there is no support to other users, this individual would not be classified as a power user.
3. Question 7 of the survey, “Do you believe that you get more value for the organization from software applications than most of your peers in the organization?”, again, helps to address the third criteria.
4. Question 10 of the survey identifies 12 different categories of software and allows the individual to report how much of these types of software they have learned outside of formal training. Key to this study is the “Large, Integrated, Enterprise systems”. If the individual has learned most of this type of system inside of a formal setting, for the purpose of this study, they would not be classified as a power user.
5. In the interview, they are reminded that they were identified as power users by a third party and reminded of what a power user is. They are then asked as to what software applications they might be identified as a power user of. This is checked against the online survey to ensure that they have learned most of this on their own.

This survey then is used to disqualify individuals as opposed to include them since the set of users was independently identified as power users. If the individual does not learn the technologies primarily on their own, they are disqualified. If the individual does not support other users, formally or informally, they are disqualified. The final criteria, gets more value from the technology than typical users, is much more subjective and while the identification from a third party and the self report in question 7, further exploration needs to be done in the interview. If they do not meet this criteria, they are disqualified.

## **Appendix E: Researcher's Interview Guidelines for Power User as learner of Technology**

- Introduce myself to power user and thank him/her for their willingness to participate in the study.
- Give a timeline for the interview. Make sure that they are OK with the time commitment.
- Remind them of what a power user is and that they were identified as one by people in their organization.
- Ask if they have had time to review the interview package prior to the interview.
- Explain the confidentiality of the interview.
- Ask for permission to record for the purpose of transcription.
- Review the framing of the research.

[FRAME] Think of software that you have mastered or software for which you are considered a power user. One of them should be an ERP system and others might fall into the areas of application (like office applications) or procedural software systems (like payroll, CAD/CAM, account receivable, etc.). What are these software applications?

[Write down Software Application names on Software Application Description Form]

I am interested in times when you learned on your own about these applications. This would be situations where you attempted to learn about the application without formal training. For the purpose of this study, I'll call each time that you tried to learn about the software application a learning episode whether the attempt was successful or not. For each software application, list a couple learning episodes where you succeeded and if there is one, one where you did not learn what you set out to learn.

[Write down learning episodes on Software Application Description Form]

Now I will ask you some questions about the software which will help me fill out a software application context form. We'll then go over the learning episodes related to the learning of the software. I am going to turn on the recorder now if you don't have any questions.

[Turn on the recorder]

[For each application that the individual is considered a power user, fill out a software application description form and then for each incident. Once the power user has listed the critical incidents, have them discuss each of them. Probe for missing strategies after each critical incident by following script in section 3 of Learning Episode Form.]

[Thank them for their time]

## Learning Episode Form

1. Application software context [Remind the interviewee of the context you are covering]  
Technology Context Name \_\_\_\_\_
2. Learning episode [Take from Software Application Description Form] [Remind interviewee what the episode name is]. \_\_\_\_\_. I want you to step back to the beginning of this learning experience. I would like for you to tell me as much as you can remember about this learning episode: what it was you learned, how you learned it, what resources you used, why you learned it, and why you did things in this learning process.
3. I need to follow up on some other things that will help me in my research. This will take a little bit and we may cover some things that you have already told me about. I will try to minimize this but we have covered quite a bit of information. [If there are no outcomes given, prompt for outcomes] What did you learn or what were you trying to learn?
  - a) [If Forethought phase was not covered, prompt for Forethought strategies]  
How did you prepare for this?  
[If the specific Forethought strategy was not covered, prompt to see if it was used]
    - a. Did you set any goals in the learning process?
    - b. Did you make plans as you went through the learning process
    - c. When you had materials to learn from, would you arrange them as you got ready to through them or did you take what ever was closest? [If positive] Was this something that you feel helps and how?
    - d. Did you set up the physical setting to help you learn or do you have a special location that you use to learn?
    - e. Did you have to prepare yourself mentally for the learning process?
  - b) [If Performance phase was not covered, prompt for Performance strategies]  
What were you actually doing when you were learning?  
[If the specific Performance strategy was not covered, prompt to see if it was used]
    - a. Did you imitate a classroom and present the material to yourself as an instructor would?
    - b. Did you imagine successful learning as a way of pulling yourself forward?
    - c. Did you break up the learning task into smaller pieces?
    - d. Did you draw as you were going through the learning process, visually representing the material that you were trying to learn?
    - e. Did you go to people that you viewed as experts to help with the learning process?
      - i. [If positive] Who did you go to?
      - ii. What information were you looking for from them and what did you get?
    - f. Did you go to peers to help with the learning process?
      - i. [If positive] What information were you looking for from them and what did you get?

- g. Did you discuss the technology with peers in a social setting, gathering information?
- h. Did you try to memorize or rehearse things to commit them to memory?
- i. Did you go back over materials that you had already covered?
- j. Did you take mental or written notes as you went through the learning process?
- k. Did you experiment with the software, trying different things to see what would happen?
- l. Did you try to get information from different sources in order to get different perspectives about the software?
- c) [If Reflection phase was not covered, prompt for Reflection strategies] Did you reflect on what you had done?  
[If the specific Reflection strategy was not covered, prompt to see if it was used]
  - a. Did you evaluate your progress in the learning process?
  - b. If you set goals, did you give yourself rewards for achieving them or punishments for failing to meet them?
  - c. Did you look for reasons why you succeeded or failed?
- d) [If Appropriation phase was not covered, prompt for Appropriation strategies] What did you do to make all of that information your own? What if the information did not match with the way you thought the system worked before?  
[If the specific Appropriation strategy was not covered, prompt to see if it was used]
  - a. In the learning process, were you building a mental understanding of how the system worked as opposed to learning “a” leads to “b”, were you building your own mental system representing the software system you were learning?
  - b. If you came across information that seemed to conflict with your understanding of the system, what would you do?
  - c. Did you ever try to work through your understanding of the system to see if you understood the whole system, possibly finding gaps that you would then have to explore?
  - d. When going through the learning process, would you use your understanding of other things, other software or anything else, to help understand how this system worked?
  - e. Would you take breaks from the learning process to allow the information to “sink in”?
- e) [Prompt for motivations] What did the learning or the attempt to learn do for you? What were your learning motivations? [If there is time, prompt for next level of “why”.]
- 4. How long did the learning process take? \_\_\_\_\_
- 5. What resources did you use that we have not already talked about?
- 6. When you look back, was there a better way? Would you have done anything differently?

7. What way in which you learned helped you the most?

**General Learning Form**

Of all of the strategies that you have given me in this interview, what are the three that are the most important to you?

We have covered your learning in the specific areas but I am also interested in your ideas about learning generally. Please tell me your philosophy or your feelings about learning and the way that you approach a learning task, generally.

## Appendix F: Software Application Description Form:

Software application reference name: \_\_\_\_\_

This software is a(n):

- ☐ ERP system – What portion/module? \_\_\_\_\_
- ☐ Application software system
- ☐ Procedural software system

Others consider you a power user for this system. Do you? Y/N

How long do you think you been considered a power user for this software?: \_\_\_\_\_

How long have you used this software? \_\_\_\_\_

Is this software specific to your organization? Y/N

Is this software specific to your industry? Y/N

What are your responsibilities as it relates to this software? \_\_\_\_\_

Were you hired into your present position because of your knowledge of this software? Y/N \_\_\_\_\_

Have you taught others to use or do you answer questions about this software – formally? Y/N

How much time in a typical week do you spend training or supporting others on the use of this software? \_\_\_\_\_

- informally? Y/N How much of your typical week is spent informally training or informally supporting others? \_\_\_\_\_

How would you rate your ability to use this software on a scale from 1 to 10, 10 being the best?

1 2 3 4 5 6 7 8 9 10

How would you rate your understanding of the software on a scale from 1 to 10, 10 being the best? 1 2 3 4 5 6 7 8 9 10

How much do you use this software in a typical day? \_\_\_\_\_

Why did you start learning about this software?

Rate your confidence in your ability to complete the task with the software given the following conditions. Rate your answer from 1 (least confident) to 10 (most confident).

	I could complete an unfamiliar task that requires the use of an unfamiliar capability of the software...	Circle the appropriate number	Cannot answer
1	... if there was no one around to tell me what to do	1 2 3 4 5 6 7 8 9 10	
2	... if I had never used software capability like it before	1 2 3 4 5 6 7 8 9 10	
3	... if I had only the internet for reference	1 2 3 4 5 6 7 8 9 10	
4	... if I had seen someone using it before trying myself	1 2 3 4 5 6 7 8 9 10	
5	... if I could get in touch with someone for help if I got stuck	1 2 3 4 5 6 7 8 9 10	
6	... if someone else helped me get started	1 2 3 4 5 6 7 8 9 10	
7	... if I had a lot of time to complete the job for which I was using the software	1 2 3 4 5 6 7 8 9 10	
8	... if I had just the built-in help facility	1 2 3 4 5 6 7 8 9 10	



	for assistance		
9	... if someone showed me how to do it first	1 2 3 4 5 6 7 8 9 10	
10	... if I had used similar capability like this one before for a different task	1 2 3 4 5 6 7 8 9 10	

Learning Episodes for this software application to become critical incidents:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_

## Appendix G: Initial Coding Agenda

Strategies: actions and processes directed at acquiring information or skill where the individual believes these actions and processes will have a measurable outcome.

Initial strategies and associated definitions:

Strategy	Definition.
Goal Setting	Learner establishes learning objectives.
Planning	Learner formulates a plan to achieve learning goal.
Organizing and Transforming	Learner initiated rearrangement of instructional materials to improve learning.
Environmental Structuring	Arrangement of physical setting by the learner to make learning easier.
Mental Preparation	Learner mentally prepares for the learning process, clearing mental distractions and preparing for frustration during the learning process.
Self-Instruction	Learner “thinks aloud” as they move through a task describing what should happen at each step.
Imagery	Learner produces mental images of successful learning or structures that are to be learned.
Task Division	Learner reduces a task to its essential parts and reorganizes them so they are meaningful to the individual.
Graphical Representation	Learner draws pictures, diagrams and graphics to simplify the subject matter
Seeking Information	Learner seeks out information from a non social source.
Rehearsing and Memorizing	Learner tries to memorize material through practice.
Seeking Social Assistance	Learner seeks out help from another person.
Socializing	Learner discusses subject matter with a peer.
Reviewing Materials	Learner revisits information sources.
Keeping Records	Learner takes written and mental notes through the learning process.
Experimentation	Learner tries out material that was learned and varies the procedures to see the effects.
Triangulation	Learner gathers information from different sources to get different perspectives on the subject being learned.
Self-Evaluation	Learner judges the effectiveness of the learning process.
Self-Consequences	Learner rewards (or punishes) themselves for progress made (or not) on learning goals.
Causal Attribution	Learner looks for reasons for success or failure in the learning process.
Assimilation	Learner builds mental models from information gained, either

	new models of building off of old ones.
Accommodation	When a learner is appropriating information that conflicts with information previously appropriated, learner adapts earlier mental models to accommodate new information or discards new information.
Summarizing	Learner redraws what was learned to see if they understood material and look for holes in their understanding.
Linking	Learners draw linkages to separate mental models and tangential experiences, extending this model and others.
Pausing	Learner intentionally allows time for information to be assimilated

Triggers: Reasons why Power Users choose a learning strategy.

Motivations: Reasons that the Power User entered into the SRL process.

## Appendix H: Coded Critical Incident

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001 RESEARCHER: Okay. Um. One of the, the things I'd  
like to talk to you about is the  
problem you're having this morning,  
so, can you tell me about that?

002  
003 PARTICIPANT: Sure! Um, basically what happened  
was, on June the 28<sup>th</sup> I hired uh, a  
director into the system - she got a  
check, well, certainly in July - but I  
can't see her anymore, and so I can't  
tell exactly when she got a check but I  
know she at least go a check in July.  
And, so, um, basically, what  
happened was, is she emailed me with  
some questions, uh, about her  
benefits, and when I went in to pull  
her up I couldn't find her. Usually,  
what causes that, my experience is,  
what causes that, is that the  
department security tree's gotten out  
of whack. Um, and I know before I  
left for this last conference I went to,

 Motivation~

 Modeling~

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um, I was working on trying to fix so that people's titles made sense instead of just being a plain old director that they were a director of, in this case, um, college relations. And, either something I did to the position or, something I did to the department she was in, or somebody else, because they've been trying to work with the budget, and trying to get the budget cleaned up and the budget runs out of PeopleSoft

004

005 RESEARCHER: Mm-hm.

006

007 PARTICIPANT: HR, and so one of us has done something to this poor woman to where she has disappeared out of our database. And, by the way, the shaking of the building, is, they're doing construction in the back.  
<laugh>

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008

009 RESEARCHER: That's... kinda  
nervewracking... <laughter>

010

011 PARTICIPANT: It - it's very, it's very  
nervewracking. Yeah.

012

013 RESEARCHER: I used to live in a place where  
the ground did move on its own.

014

015 PARTICIPANT: Uh-huh. Yeah. I asked my boss if the  
building was safe and he said yes. He  
said it was worse when they built the  
building that's next door. So - I'm  
like, that's comforting. <laugh>

016

017 RESEARCHER: Um, how are you going to find out, or  
what have you done so far to try and  
find out what's gone on with this.  
And when did - when did you first  
find out about this -

018

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019 PARTICIPANT: Oh, about an hour ago.

020

021 RESEARCHER: - this person missing.

022

023 PARTICIPANT: I found out about an hour ago, and  
what I, the first thing I did was since I  
thought it was a security problem, I  
emailed our security um, I don't know  
what to call them, guru - and I  
emailed the person who's handling  
the budget, in case maybe she had  
done something while I was out. To,  
y'know, mess with the stuff. And, to  
ask if, um, I said, I think I put him in  
thi - her, in this department, I think I  
put her in this position number, this is  
definitely her employee ID, and I  
can't find her. Can you look behind  
the scenes and see if you can figure  
out what happened? And, um, uh, the  
security guy came back to me and  
said, that um, he couldn't find her

 Trigger~ Seeking Social Assistance~

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either, and that the department is in the department security tree. Well, now I've figured out that it looks like the position I initially hired her in is actually director of development, not director of college relations. And, so, then, I started pulling all the different positions that are similar, and all the positions are out of whack. I don't know, maybe I'm trying to do too much at one time, and made a mistake, or, who knows?

 Trigger~

 Seeking Information~

024

025 RESEARCHER: So, this, the - do you think it  
still could be the uh, the budget office?

026

027 PARTICIPANT: Could be.

028

029 RESEARCHER: Okay.

030

031 PARTICIPANT: Could be. Yeah.

032



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033 RESEARCHER: What are you gonna do next? Other  
than, a - after I slow you down for a  
time.

034  
035 PARTICIPANT: Uh, um, I'm going to uh,  
review all the positions that are affected. Um.

Seeking Information~

036  
037 RESEARCHER: How many?

038  
039 PARTICIPANT: Try to backtrack - basically what I've  
done is, I've found so far three  
positions that seem to be, um,  
involved, let's say. Um, where, the  
person that was doing our budged  
before uh, at \*\*REDACTED\*\*, had  
uh, initially assigned a position  
number, changed it, and then the  
domino effect is that it messes  
everybody else up.

040  
041 RESEARCHER: Eh, uh, okay, so, after this  
meeting you're going to start digging more?

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042

043 PARTICIPANT: Yep, yep, continue to dig.

044

045 RESEARCHER: Okay.

046

047 PARTICIPANT: Until I figure it out.

048

049 RESEARCHER: How will you know that - I mean -  
will there just be an aha moment "I  
found it!" ? Or -

050

051 PARTICIPANT: Probably

052

053 RESEARCHER: Okay.

054

055 PARTICIPANT: Yeah, that's typically what  
happens is, y - you just uh, she'll reappear.

056

057 RESEARCHER: Yeah.

058

059 PARTICIPANT: I'll be able to find her again. Um. But,  
I've never encountered one quite like



Interesting Quote

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this. I've never had this many problems. But part of it is because I don't have complete control, y'know, I can't, I can't control everything that happens in the system.

060

061 RESEARCHER: Is that okay?

062

063 PARTICIPANT: Drives me crazy!

064

065 RESEARCHER: Okay for you?

066

067 PARTICIPANT: Absolutely, drives me crazy. Um. But they didn't want to take, uh, the budget manager's access away at \*\*REDACTED\*\*, in case we needed him, and, um, so, I dunno.

068

069 RESEARCHER: Alright, so, y - you get kinda frustrated with not knowing what all's going on.

070

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071 PARTICIPANT: Oh, absolutely.

072

073 RESEARCHER: Okay. Um, the, uh, and, and this may  
sound completely ridiculous, and, and  
there are gonna be some things that  
you think are, are off the wall, some  
things that are right on target as to  
how to learn about this one situation,  
um, do you set any uh, goals in this  
process? Any learning goals?

074

075 PARTICIPANT: Oh, sure. Um, I don't know that I do  
that consciously, y'know certainly I  
want to understand the problem well  
enough that if it ever happens again I  
will instantly know what the problem  
is, so, for instance, um, I would run  
into - often - this type of problem at  
\*\*REDACTED\*\* and, I would, say,  
okay, does this look a little bit like  
y'know, I put somebody in a  
department that doesn't exist? Or, a

Goal Setting~  
Modeling~  
Motivation~

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department that's now inactive? That used to happen quite a bit. And so that's what I initially suspected here, was that, I know they kept changing the name of the department that these people were working in, and thought that maybe somebody at some point took it out of the department security tree, thinking nobody was in that department. But - if that is the problem, we still have other problems too.

076

077 RESEARCHER: Okay. Uh, ah, do you make plans as you're going through the learning process?

078

079 PARTICIPANT: Plans...

080

081 RESEARCHER: Doesn't sound like you -  
sounds like you dig until you -

082

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083 PARTICIPANT: Yeah.

084

085 RESEARCHER: turn over a rock that has  
something under it.

086

087 PARTICIPANT: Yeah.

088

089 RESEARCHER: Um, have you been using any  
materials as you're going through  
this, other than

090

091 PARTICIPANT: Other than hiring forms and  
that kinda thing, no, uh-uh.

092

093 RESEARCHER: Okay. Do you organize them? I see  
you've got them all out to look  
through them. But, do you organize  
them in some way? Or -

094

095 PARTICIPANT: No, not really. Well, other than  
making sure that the form that I really  
need is on the very top, so that I can

Organizing and Transforming~

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quickly find it - the one that has the  
most information that I need.

096

097 RESEARCHER: Okay. Uh, do you have to setup your -  
uh, do you have to set up your  
physical surroundings in a certain  
way when you're gonna go through...

098

099 PARTICIPANT: I dunno, sometimes I like to  
clean my desk off <laughter>

100

101 RESEARCHER: <laughter> Why?

102

103 PARTICIPANT: I - uh - clutter distracts me, I'll  
y'know, I'll be sitting here, I'll be  
trying to solve this problem and then  
I'll see, oh, I need to - y'know - pay  
this bill or, I need to sign these letters,  
or, I really need to figure out who to  
interview for the HR specialist I just  
had posted, and so, if I get these  
things out of the way, and, y'know

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organized such that kinda outta sight  
outta mind, but I won't completely  
forget to do whatever it is I need to do

-

104

105 RESEARCHER: Okay

106

107 PARTICIPANT: Then I'm better off.

108

109 RESEARCHER: Do you have to prepare  
yourself mentally when you -

110

111 PARTICIPANT: Oh yeah, I have to be in the right  
frame of mind to solve some  
problems. And, so, I will often set  
them aside for a day or two and then  
they're usually easier to deal with.

112

113 RESEARCHER: Mm-kay.

114

115 PARTICIPANT: Because I'm in the right frame of  
mind to - somedays I just, um,



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something in my brain - I can't think  
logically that day and so I'll do  
something mindless for a while to get  
back into that.

116

117 RESEARCHER: Okay, uh, once you start learning, do  
you imitate a classroom and present  
material to yourself as an instructor  
would? Like, specifically for this  
situation?

118

119 PARTICIPANT: Sometimes I'll maybe, try to  
document what I've learned so I can  
share it with others, um -

120

121 RESEARCHER: So you take notes, and -

122

123 PARTICIPANT: Mm-hm.

124

125 RESEARCHER: Okay. Um, do you imagine successful  
learning is a way of pulling yourself  
forward?

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126

127 PARTICIPANT: Oh, yeah, absolutely. Absolutley. I don't think I'd be in the position I'm in today if um, I didn't have the information systems knowledge that I have - and, I guess apparently, the reputation in the university system, because, um, I didn't have a very visible position at \*\*REDACTED\*\*, and so, y'know, I had to do what I could to get my name out there and - if that makes sense?

 Interesting Quote

128

129 RESEARCHER: Yeah, i - is -

130

131 PARTICIPANT: The university system's a very close-knit family -

132

133 RESEARCHER: Yes. Yeah. Um, do you feel - is there pride in having your name out there? And being recognized?

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135 PARTICIPANT: Mm-hm. ]

136

137 RESEARCHER: Okay. Is it something you - you, uh,  
nurture or is it just a side, uh, of doing  
your job?

138

139 PARTICIPANT: I'd say it's a side of doing my job.  
Um, I'm, I'm actually kind of an  
introvert, um, and have always tested  
that way on, y'know, Myers-Briggs  
and that kinda thing. And, so, I don't  
really seek, um, acknowledgement or  
anything, but I'm certainly glad when  
I get it.

140

141 RESEARCHER: Okay. Um, do you break up,  
um, tasks like this, into smaller pieces?

142

143 PARTICIPANT: Sometimes, liket his one probably  
what I'll do is fist try to tackle okay  
who's in what, who do I think is in  
which position, and then, okay, which

Task Division~

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positions are in which departments,  
and sometimes if I break it up into,  
y'know concrete um, uh, dividing  
way - y'know - divisions I guess,  
then, sometimes that'll help me solve  
a problem.

144

145 RESEARCHER: Okay. If you find out something  
specific and you know that that's  
holding true -

146

147 PARTICIPANT: Mm-hm.

148

149 RESEARCHER: Okay. Uh, is that because you want to  
eliminate those things? Or, as  
possibilities for problems? Or...

150

151 PARTICIPANT: I also want to make sure that  
I'm not unearthing other problems.

Testing and Verification~

152

153 RESEARCHER: Okay.

154

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155 PARTICIPANT: In a new situation like this, where  
we're setting up a brand new HR  
department, a brand new school, then,  
it's certainly possible that I could  
uncover other um, problems. That are  
completely unrelated. <laugh>

156

157 RESEARCHER: Yes.

158

159 PARTICIPANT: To this problem.

160

161 RESEARCHER: You've been facing a lot of  
problems like this?

162

163 PARTICIPANT: Oh yeah, yeah.

164

165 RESEARCHER: Just another day?

166

167 PARTICIPANT: Yeah, pretty much.

168

169 RESEARCHER: Um, do you draw? And not the note-  
taking, but images, either mental, or

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actually on paper, of how things are  
working? Draw systems, draw  
connections, draw...

170

171 PARTICIPANT: Y'know, I do in other parts of my life,  
but I don't know that I really do here.

172

173 RESEARCHER: Do you draw them mentally?

174

175 PARTICIPANT: Mm.

176

177 RESEARCHER: Do you have mental images of  
the tables?

178

179 PARTICIPANT: Not really, no.

180

181 RESEARCHER: Okay. Um. You said that you went to  
um the security person, you emailed  
also the budget person, uh, is that  
\*\*REDACTED\*\*?

182

183 PARTICIPANT: Mm-hm.

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184

185 RESEARCHER: Okay. And -

186

187 PARTICIPANT: It's not the one that messed  
everything up though. <laugh>

188

189 RESEARCHER: <laughter>

190

191 PARTICIPANT: Just wanted to make sure  
that's clear!

192

193 RESEARCHER: Okay. Uh, and, when you go  
to these people, what are you seeking?

194

195 PARTICIPANT: Um, hopefully, either that they've  
experienced this problem before and  
can shed some light on it, or, to  
inform them that I have a problem  
and that perhaps they did  
inadvertently caused the problem. Uh,  
'cause it's certainly possible  
\*\*REDACTED\*\* has access to um

Trigger~

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y'know switch budgets and stuff and,  
um, \*\*REDACTED\*\* should have  
the experience 'cause he's been at  
\*\*REDACTED\*\* for well, at least  
seven years and supporting  
PeopleSoft from a security standpoint,  
so it - chances are, somebody's  
probably encountered this before.

196

197 RESEARCHER: Okay. Um - you were talking about  
the idea of taking notes, uh, and  
possibly to share them with other  
people, and... do you save them also  
for yourself?

198

199 PARTICIPANT: Y'know, I do, I don't do it as much as  
I used to - and y'know maybe that's a  
problem. Because, um, I used to have,  
uh, I can still picture it, this little pink  
pad of paper, uh, oh, y'know, one of  
the steno pads, and I would keep my  
little notes in there, of everything that



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had ever happened, and I think - I  
wanna say I finally pitched that thing  
when I left \*\*REDACTED\*\* - and  
see, I worked there 22 years, so this  
pad of paper was 22 years old.

200

201 RESEARCHER: &lt;laughter&gt;

202

203 PARTICIPANT: And had all the little notes of - there  
was actually a system before PPS, I  
don't remember what it was called,  
but I remember there were these SO1  
screens and these HO1 screens, and I  
had notes in this note pad of number  
one, how to log on to that system,  
what the screens were and what they  
did, and then never got rid of that,  
until, about six months ago.

204

205 RESEARCHER: Did you - when you came here

-

206

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207 PARTICIPANT: Uh-huh.

208

209 RESEARCHER: Um, how often did you go  
back to that pad? Obviously, it was-

210

211 PARTICIPANT: Early on -

212

213 RESEARCHER: Two revolutions back -

214

215 PARTICIPANT: Yeah, early on, I would go back to it a  
lot. Um, but, lately I hadn't really  
gone back to it much at all, and now,  
um, it's interesting that you bring that  
up because um, I do have more  
trouble remembering things now. I  
dunno, maybe I'm getting older but-

216

217 RESEARCHER: Or maybe there are more  
things to remember -

218

219 PARTICIPANT: And there are more things to  
remember. And you'd - you have to

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choose y'know what are you gonna  
write down, what do you think you  
might have trouble remembering  
later, like a password to some website  
- and - um, and so I often find myself  
going, "Y'know, I remember that, but  
I don't remember all the specifics."

220

221 RESEARCHER: Okay. Uh, You said that you will  
sometimes share these with other  
people - um, how often do you refer  
back to your notes that you take now?

222

223 PARTICIPANT: Uh...

224

225 RESEARCHER: Is it one of those things where you  
take the notes, and then you  
remember it, or is - are you writing  
down things that you know you won't  
remember?

226

227 PARTICIPANT: I'd say about half the time if I - if I

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make a note, that often is enough to help me to remember it, because I can visualize the note and see what's on it. Um, and about half the time, I take the note to share with one of my coworkers, of, y'know, if you ever encounter this problem, this is a way to solve it.

228

229 RESEARCHER: Okay. Um,

230

231 PARTICIPANT: I'd say I refer back to 'em, most of them on a monthly basis. Um, if it's something that I do as infrequently as once a month, that's the only way I can remember exactly how to do it. And now, instead of a note pad, I guess mostly I have file folders.

232

233 RESEARCHER: For specific actions?

234

235 PARTICIPANT: Yeah, yeah.

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236

237 RESEARCHER: Okay. Um, do you experiment with  
the software, trying different things to  
figure out what's going on?

238

239 PARTICIPANT: When I was at \*\*REDACTED\*\* we  
had a, uh, um, a um, I can't remember  
the term, a test database if you will,  
uh, that we could go in and we could  
hire an employee and we could fire  
him and we could make him retired,  
and we could do whatever we wanted  
in that database - um, and, they  
refreshed it at lease once a quarter, so  
that it was fairly accurate data. Here,  
they have one database for all the  
university system schools to do that,  
and so I haven't actually explored  
doing that any of that kind of testing,  
but the - the scope of my job has  
changed, some, I mean, then I was an  
HRIS director, I was in charge of all

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of exactly how the system worked,  
training other people um, working  
with our technical folks to improve  
the system, or solve a problem, or fix  
an error, um, and that's not really my  
role anymore. Now, I'm director of  
Human Resources so I'm over all of  
HR, I have an OIIT department to do  
all that other stuff for me.

240

241 RESEARCHER: Nice to have that?

242

243 PARTICIPANT: It is. It is. Um, there are drawbacks to  
it, because, um, although I can  
certainly make suggestions of things  
that I'd like to see fixed, for the  
future, um, they don't have as much  
time as the programmers at  
\*\*REDACTED\*\* had and so,  
y'know, I'd be dreaming stuff up all  
the time for them but I can't - I have  
to - have to bite my tongue sometimes

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here.

244

245 RESEARCHER: M'kay. Um, when you were looking  
into this problem, uh, do you try to  
get information from different sources  
to get different perspectives on the  
problem? Or the software, or...

246

247 PARTICIPANT: Yeah, that's why I contacted  
\*\*REDACTED\*\* and  
\*\*REDACTED\*\*, and, y'know, if I  
can't figure it out, I might get in touch  
touch with somebody at  
\*\*REDACTED\*\*. Who, uh, I could  
explain the situation to and, y'know,  
maybe they encountered something  
like this.

 Triangulation~

248

249 RESEARCHER: Um, do you evaluate your  
progress as you're going through?

250

251 PARTICIPANT: M- yeah, I - I sit down and I think

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about okay, what have I learned, um,  
what do I think are still the problems,  
um, y'know I try to organize it such  
that I don't get too overwhelmed I  
guess.

252

253 RESEARCHER: K-

254

255 PARTICIPANT: Kinda compartmentalize the  
problem.

256

257 RESEARCHER: Okay. When you - two things there.  
One, the idea of getting overwhelmed  
and one, the idea of - of  
compartmentalizing. Getting  
overwhelmed, is that something you  
have to really manage?

258

259 PARTICIPANT: Mm-hm. Yeah, 'cause I'll shut down  
and stop working on the problem, and  
then, the employee'll start bugging  
me again for - I still don't know -



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"You still haven't answered my question on where, er, my vacation accrual is" and I still don't have an answer for her.

260

261 RESEARCHER: Okay. Um, on the other side, compartmentalizing, we talked about the idea of y'know finding something you knew. Is that part of the idea of compartmentalizing?

262

263 PARTICIPANT: Mm-hm.

264

265 RESEARCHER: Okay. Uh. Do you give yourself awards and punishments?

266

267 PARTICIPANT: <laughter>

268

269 RESEARCHER: For failing to achieve something, or achieving something? Or reverse order?

270

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271 PARTICIPANT: I guess, all I get, really is the  
satisfaction of a job well done,  
y'know, or that I still haven't  
answered a question. Um. No, I don't  
- I wouldn't say I - I give myself  
rewards or anything.

272  
273 RESEARCHER: Okay. Told you some of these  
were gonna seem a little off the wall.

274  
275 PARTICIPANT: <laughter> I'm sure some people do,  
y'know. "Well, I can have that  
donut", y'know.

276  
277 RESEARCHER: <laughter> Uh, do you look  
for reasons why you succeeded or failed?

278  
279 PARTICIPANT: Yeah, I'd say I do, especially if I did  
get some help from somebody else.  
Uh, 'cause I want to try to  
acknowledge that person that's  
having helped me, and to record in

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my mind, that I can go to that person  
next time I have a problem - that they  
might be helpful.

280

281 RESEARCHER: Okay, uh, what did you - after you've  
gone through the learning process,  
after you've kind of evaluated it, you  
talked about the idea of you can go to  
that person in the future. How do you  
make that information that you might  
have gained your own? Like, when  
you find out what's going on here,  
how do you make it part of your own  
information? Does that make sense?

282

283 PARTICIPANT: I guess mostly in - in my head I mean,  
y'know, I just, if it's something that  
where they just pointed out the error  
and it was something that I could  
have solved all along had I had the  
information that I needed - y'know  
that's different from somebody else

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had to solve the problem because  
\*\*PARTICIPANT\*\* doesn't have  
access to that part of the system.

284

285 RESEARCHER: Okay. Um, are you - when you try to  
learn something or if you try to figure  
out how to do something, do you try  
to get a mental understanding of the  
whole system, or what went wrong in  
it, or do you try to memorize y'know  
A leads to B, B leads to C.

286

287 PARTICIPANT: Well, let's think about Excel for a  
minute. Um, 'cause, a lot of times I  
need to, one of the ways that  
PeopleSoft downloads data is through  
Excel, but it - I can't always get the  
data in the manner that I want it out of  
PeopleSoft, so I often use Excel to  
y'know um, massage the data in a  
different manner, like converting a  
date to an age is a good example.

 Assimilation~

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And, for whatever reason, I can never remember how to convert a date to an age. And I always have to play with it until I get it right. Um, so, in in that respect, I'd say, I try to look at the whole picture of, okay, if I wanted to know somebody's age on a calculator, how would I do it, and then how can I convert that into something that Excel understands?

288

289 RESEARCHER:

Okay, that makes sense. Um, if you come across information that seems to conflict with your understanding of the system, what do you do? Do you believe the new information? Do you take what you have and kind of throw out the new information -

290

291 PARTICIPANT:

I test it first.

292

293 RESEARCHER:

Or do -

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294

295 PARTICIPANT: And probably run it by somebody else  
that would have knowledge of that,  
before I take it that something has  
changed. Um, because, typically, stuff  
doesn't change without somebody  
letting me know.

296

297 RESEARCHER: Okay.

298

299 PARTICIPANT: Communication's pretty good.

300

301 RESEARCHER: Um, do you try to work through your  
understanding of the system to see if  
you understood the whole system,  
possibly finding gaps that you would  
then have to explore?

302

303 PARTICIPANT: Can you say that again?

304

305 RESEARCHER: Do you ever try to work through your  
understanding of the system to see if

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you understand the whole system,  
possibly finding gaps that you would  
then have to explore? Do you think  
through PeopleSoft, kind of  
imagining the whole system, and  
then...

306

307 PARTICIPANT:

Yeah, yeah, oh, especially when I'm  
trying to build a query. I try to think  
about how does - okay, I know the  
data resides here but how does it  
relate to other tables in the database?  
Because, typically, you can't run any  
query out of just one record, you  
usually have to have five or six of  
them all joined together to get what  
you want. And so, okay, how does -  
how do the premiums on this benefit  
relate back to the rate table, relate  
back to the table where you enroll the  
employee - relate back to the  
employee itself. What are the keys

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that make all those things join?

308

309 RESEARCHER: Okay, um, I wrote this and I

310

311 PARTICIPANT: Don't even know what it  
means?

312

313 RESEARCHER: I - I've read it three times now. When  
you go through the learning process,  
would you use your understanding of  
other things, okay, other software or  
anything else to help you understand  
how this system works?

314

315 PARTICIPANT: Sure, um, because typically systems  
are very similar in their, either their  
table structure or the way their data  
relate to each other, and so, like I said  
earlier, I think that um, it's a building  
process, of, an evolve - evolution of  
your understanding of of any sort of  
database. And, so, once you



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understand even how something as  
simple as Access works, that helps  
you to understand how any relational  
database works.

316

317 RESEARCHER: Uh, And, uh, you already answered  
this, would you take breaks from the  
learning process to allow information  
to sink in, also to keep from  
frustrating you?

318

319 PARTICIPANT: Yeah, yeah, I often postpone  
something for a day to give myself  
time to sleep on it, essentially.

320

321 RESEARCHER: Um, you said you'd been  
working on this for about an hour this morning.

322

323 PARTICIPANT: Mm-hm.

324

325 RESEARCHER: Um, any other resource other than  
those two contacts and the paper files

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here, whatever you found on your  
screen - have you got any help files or  
anything like that?

326

327 PARTICIPANT: Y'know, PeopleSoft's help is terrible,  
so I'd be unlikely to go to um,  
PeopleBooks - I do often go to  
PeopleBooks, but for this particular  
problem I don't think it would be very  
helpful. Um, yes, freaky isn't it? It  
reminds me of being on a cruise ship.

328