AN INVESTIGATION OF A WEB-BASED

SELF-REGULATED LEARNING SUPPORT TOOL:

A CASE STUDY IN GRADUATE EDUCATION

by

HYUNGKOOK PARK

(Under the Direction of Janette R. Hill)

ABSTRACT

This study was designed to explore the use of a Web-based Self-Regulated Learning Support tool (SRLS tool) in a student-centered postsecondary educational software development course in order to design a better learner support system to help students experience successful learning. This study followed an embedded single-case designed study approach that employed multiple methods (questionnaire, interviews and artifacts) to answer the research questions focused on how the participants in the course used the SRLS tool, how they perceived the instrumentality of the tool, and how they benefited from the use of the tool.

Results indicated that the students in the course used the tool for basic activities like goal setting, planning, monitoring, and reflection with the help of the email triggers and guiding questions in the update templates. They did not use the more advanced functions like shared learning, request feedback, and GuideMe® to as great an extent.

The participants' perceived instrumentality (or utility value) on the use of the SRLS tool varied according to several factors. Students had 1) higher utility value for the use of the tool in the beginning of the semester than the end; 2) higher utility value for the difficult, big, and team-

based tasks than the easy, small, and individual-based tasks; 3) higher utility value for inexperienced students than experienced students; and 4) higher utility value when their design and reflection style matched up with the tool's structure.

It appears the tool benefited some students in getting started with their projects, and to keep moving ahead toward completion by reinforcing self-efficacy, ownership, and a clearer structure over the tasks, many of which were completed in complex settings. In addition, the communication functions of the Web enabled direct and indirect interactions between the students and the instructor. The guiding questions in the tool also facilitated the students' ability to actively look for resources such as books, Web sites, and human sources of information.

INDEX WORDS: Self-regulated learning, Student-centered learning, Constructivism, Project-based learning, Cognitive tools, Motivation, Self-efficacy, Scaffolding, Technology-mediated learning support, Metacognition, Reflection

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by

HYUNGKOOK PARK

B. A. Hanyang University, Republic of Korea, 1994

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by

HYUNGKOOK PARK

Major Professor:	Janette R. Hill
Committee:	Martha M. Carr Thomas C. Reeves Lloyd P. Rieber Paul A. Schutz

Electronic Version Approved:

Maureen Grasso
Dean of the Graduate School
The University of Georgia
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DEDICATION

To My Parents,

My Wife, Sunjoo Hong, and Our Baby, Younwoo (Alison).

For their Endless Love, Support, and Trust.

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CHAPTER I.

INTRODUCTION

Efforts to apply a paradigm change from the objectivist view of learning to the constructivist view of learning has led to a change in what to teach as well as in the instructors' and learners' roles. This transition has been accelerated by technological developments. Information and communication technologies enable transformed approaches to learning and teaching as well as opportunities for enhanced and more flexible access to information (Lajoie, 2000a). The technologies also provide new ways of interaction, especially time independent and place independent ways of communication, thus allowing learning to be more flexible for the student and instructor (Khan, 1997). As students gain increased opportunities to learn at their own time and own pace, more attention has been focused on identifying and developing the methods to use the information and communication technologies to support and facilitate learning in these more learner-centered environments. Recent studies have helped to extend our understanding of how technologies could support learning in these environments (e.g., McLoughlin, Winnips, & Oliver, 2000; Scardamalia & Bereiter, 1994; Slotta & Linn, 2000). Yet more research is needed, particularly in contexts in which learners are expected to direct much of their learning. This study focused on how to support learners in constructivist learning environments by using Web technology as a cognitive tool.

Background

As we move further into the knowledge era, what to teach in school has continued to evolve. Unlike the industrial era when skills needed in their jobs or what to teach in school were relatively standardized, today's employers have growing demands for continually customizing

skills. People must be able to seek out, analyze, and use information by themselves to adapt themselves to the ever-changing role of their jobs as the amount of information continues to grow at an exponential rate. The goal of education may, therefore, be focused more than ever on the acquisition of the necessary skills so that workers can renew their knowledge by themselves. To meet the needs of this fast changing society, learning should stretch out across a lifetime beyond the formal education system (Fisher, in press). People should, therefore, be lifelong learners. Universities, as a part of the changing world, are being called to play a critical role in helping students to become lifelong learners.

How to meet the needs of the lifelong learner is an area in need of further exploration. However, some research has been undertaken that gives insight into what is needed for lifelong learners. One of the most important abilities of lifelong learners is self-regulated learning ability. Pintrich (1995) argued that lifelong learners, whether inside or outside of the classroom, should self-regulate their own learning. Self-regulated learning is known to contribute to learning achievement and, at the same time, it can be the outcome of the learning (Pintrich, 1995). In addition, he argued "it is not a characteristic that is genetically based or formed early in life" (p. 5). That means self-regulated learning can be improved through the intentionally designed learning experience. Therefore, self-regulated learning has gained a great deal of interest among academic researchers and practicing educators because it appears to be a worthy objective for students of all ages in all disciplines (Paris & Paris, 2001).

Parallel with this societal change that emphasizes lifelong learning, the paradigm shift from an objective view of learning to a constructivist view of learning accelerates the change in what and how to teach in school and also impacts the learners' role. Constructivist learning environments put learners in the center of learning and emphasize the active role of learners in

the learning process (Driscoll, 2000; Duffy & Cunningham, 1996; Land & Hannafin, 2000). To be more successful learners in constructivist learning environments, students should have more expertise as self-regulated learners. Further discussion about constructivist learning environments and the role of learners within that context follows in the next section.

Constructivist Learning Environments and the Role of Learners

According to Mayer (1999), three views of learning have emerged during the past 100 years of research on learning: learning as response strengthening, learning as knowledge acquisition, and learning as knowledge construction. From the view of learning as response strengthening, learning occurs when a learner strengthens or weakens an association between a stimulus and a response (Mayer, 1999). The educational community in the United States was largely affected by this view in the first half of the 20th century. Research findings from this view were based on the study of animal learning in artificial laboratory settings. The learners in this view of learning are assumed to passively receive rewards and punishments.

The view of learning as knowledge acquisition, which developed in the 1950s, 1960s, and 1970s, assumes that learning occurs when a learner places new information in long-term memory (Mayer, 1999). Research findings from this view were largely based on the study of human learning in artificial laboratory settings. The learners in this view of learning are assumed to passively acquire information, and the knowledge is transmitted from teacher to learner.

The view of learning as knowledge construction, which emerged in the 1980s and 1990s, assumes that learning occurs when a learner actively constructs a knowledge representation in working memory (Mayer, 1999). Research based on this view has been conducted on human learning in increasingly realistic settings. The learners in this view, contrary to the previous two views, were assumed to play an active role in their knowledge construction.

Similarly, Jonassen (1999) distinguished objectivist conceptions of learning and constructivist conceptions of learning. According to Jonassen, "objective conceptions of learning assume that knowledge can be transferred from teachers or transmitted by technologies and acquired by learners" (p. 217). The objective conceptions of learning include Mayer's (1999) first two views, learning as response strengthening and learning as knowledge acquisition. On the other hand, "constructivist conceptions of learning assume that knowledge is individually constructed and socially coconstructed by learners based on their interpretations of experiences in the world" (Jonassen, 1999, p. 217). The reconceptualization shifts the learning from teacher-centered to learner-centered.

A myriad of learning theories based on the constructivist view of learning have emerged in recent years, including open learning environments (Hannafin, Land, & Oliver, 1999), problem-based learning (Hmelo, 1999), anchored instruction (Cognition & Technology Group at Vanderbilt, 1992), cognitive apprenticeships (Collins, Brown, & Newman, 1989), reciprocal teaching (Palinscar & Brown, 1984), and goal-based scenarios (Schank, Berman, & Macpherson, 1999). Although somewhat varied in their scope, and methods, these approaches share similar key epistemological foundations and assumptions about the nature of learning. These similarities are described in the following paragraphs.

Several changes occur in constructivist learning environments. The roles of both students and teachers change differently from those in objectivist learning environments: students move toward more self-reliance and peer coaching and teachers function more as facilitators than as lecturers (Duffy & Cunningham, 1996). Constructivists emphasize the process-oriented learning environments rather than content-oriented learning environments (Bannan-Ritland, Dabbagh, & Murphy, 2000). In process oriented learning environments, learners are usually required "to

examine thinking and learning processes; collect, record and analyze data; formulate and test hypothesis; reflect on previous understandings; and construct their own meaning" (Crotty, 1994, cited in Bannan-Ritland et al., 2000, p. 28) in a variety of content areas. Indeed, many of the skills described as needed in constructivist learning environments are closely related with self-regulated learning.

To be more successful learners in the constructivist learning environments, students should be more expert self-regulated learners. However, students, especially less expert learners, are likely to be using passive learning strategies and they are not likely to adopt more active learning strategies (Land & Hannafin, 2000). Less active learning strategies appear to be remarkably persistent and enduring. This may be attributable to a lifetime of experience in passive learning environments. Some learners do heavily rely on knowledge being delivered to them in terms of lectures and presentations and are not able to learn from new situations without someone to package the new knowledge for them.

More expert learners, on the other hand, use a variety of cognitive strategies and self-regulation procedures to plan and pursue goals, integrate new knowledge with existing knowledge, formulate questions and inferences, and continually review and reorganize their thinking (Bereiter & Scardamalia, 1989; Scardamalia, Bereiter, McLean, Swallow, & Woodruff, 1989). Given that not all students are expert learners, it is important to assist learners with the strategies and procedures that can assist with the learning process. Supporting and facilitating learning in these more learner-centered learning environments may lead to more satisfactory and rewarding learning experiences. How this might occur within a higher education setting is explored in the next section.

Higher Education and Self-Regulated Learning

Research and development efforts related to self-regulated learning have focused primarily on K-12 students. However the need for self-regulated learning with adult learners has gained an increased focus. College students need self-regulated learning because they have more freedom than secondary students (Paris & Paris, 2001). Research has indicated that new higher education students in particular experience difficulty in balancing the social demands versus the educational demands of the higher education experience (Zimmerman, Greenberg, & Weinstein, 1994). Burd (1996) estimated that one third of the students who enter colleges and universities will be under-prepared or lack the skills needed to be successful learners (Ley & Young, 1998). "About three fourths of the higher education institutions that enrolled freshmen offered at least one remedial reading, writing, or mathematics course in Fall 1995" (U.S. Department of Education, 1996. p. 1). Ley and Young (1998) argued that the issue is not a question of whether or not to accept under-prepared college applicants any more, but how to identify those students who need additional support and assist them.

One way to help less expert learners in universities is to offer a "how to learn" course or a learning strategies course (Hofer, Yu, & Pintrich, 1998). Weinstein, Husman, and Dierking (2000) suggested that an adjunct course approach is necessary, especially at the college level, where it is very unlikely that college faculty will be able to teach general learning and self-regulatory strategies in their discipline-specific courses. This implies that it is hard to implement a course at the college level where instruction in learning strategies is embedded in the context of a regular disciplinary course (e.g., chemistry, history, sociology). Although it may be easier to implement an adjunct course than integrate the skills in a regular course, one of the main drawbacks to an adjunct course relates to the transfer of learning (Hofer et al., 1998).

Researchers emphasize the importance of applying the strategies learned in the adjunct course into other courses. An integrated approach at the college level faces a similar problem of transfer: applying strategies learned in one context (e.g., a chemistry course) to other disciplinary courses (Simpson, Hynd, Nist, & Burrell, 1997). How to support the less expert learners at the college level in various courses still needs to be investigated.

Another population that could benefit from self-regulated learning skills are graduate students. With the needs of renewing and deepening their knowledge and skills, many adults return to school to take graduate courses. Given the relative recent acceptance of constructivist, active learning approaches in higher education, these students are even more likely to be accustomed to a passive learning model. In addition, these graduate students are likely to have many demands in their time, making an adjunct course a difficult option. Finding a way to support such learners is a challenge.

New approaches are being tried in an effort to provide practical solutions. One possible approach to this issue is to provide learners with cognitive tools that are designed to support the process of self-regulated learning within a specific context. A discussion about cognitive tools follows in the next section.

Computers as Cognitive Tools

Jonassen and Reeves (1996) offered the following definition of cognitive tools: "Cognitive tools refer to technologies, tangible or intangible, that enhance the cognitive powers of human beings during thinking, problem solving, and learning. Written language, mathematical notation, and most recently, the universal computer are examples of cognitive tools" (p. 693). One of the rationales for using cognitive tools is that a portion of the cognitive power used by an individual resides in other people, artifacts, or tools created by the larger society (Pea, 1993;

Salomon, 1993a). Cognitive tools enable the cognitive power to be shared across and between several individuals.

Several computer cognitive tools have been developed starting with Taylor's (1980) conception of computers in education as "Tutors, Tools, and Tutees," to more sophisticated cognitive tools as described by Lajoie (2000b). With the recent technological developments, such as multimedia and the Internet, various Web-based cognitive tools have been created. Even many successful non-Web based systems are going "online," making other cognitive tools and resources accessible via the Web (Sugrue, 2000). The Web itself has great potential as a cognitive tool with its inherent characteristics: easy access to the vast amount of information distributed throughout the Internet and asynchronous and synchronous communication tools that can enhance communication between learners and learners, learners and teachers, and teachers and teachers.

One of the roles that can be supported by computers as cognitive tools is similar to the roles played by peers, mentors, experts or teachers in more traditional teaching-learning environments. For example, a cognitive tool can be developed to provide guidance and hints that provide just enough support for a learner to move from one stage of a learning task to another. With this point, computers as cognitive tools can support self-regulated learning. Schunk and Zimmerman (1996) emphasized the importance of the social source to support self-regulated learning. Learners can acquire self-regulatory knowledge and skill from this social source through modeling, verbal instruction, physical guidance, corrective feedback, social structuring, supervision and monitoring, peer teaching, cooperative learning, and reciprocal teaching. The promise of cognitive tools is compelling. Yet how the tools can be used to best support learners in learner-centered environments is not fully understood. More research is needed to explore

how Web-based cognitive tools can support self-regulated learning in constructivist learner-centered contexts.

Statement of the Problem

As indicated so far, computers as cognitive tools have a potential to support self-regulated learning within the context of higher education. The implications of using computer technologies to support self-regulated learning, however, are just beginning to be identified. One of the computer tools found through the related articles is STUDY (Winne & Stockley, 1998). The STUDY software is based on the Winne and Hadwin's (1997) 3 + 1 phase model of self-regulated learning. The 3 + 1 phase model illustrates self-regulated learning as an event involving three necessary phases and an optional fourth phase: perceiving the task, setting goals, enacting tactics, and adapting tactics for self-regulated learning. However, this tool is not completely developed and tested yet.

Project Based Learning Supporting System (PBLSS: Laffey, Tupper, Musser, & Wedman, 1998) is designed to support collaborative project-based learning of K-12 through postsecondary students. Though it is not explicitly mentioned as a tool to support self-regulated learning, PBLSS is a related tool given that it provides supports for students to manage collaborative learning projects. PBLSS has relevant functions that are considered to support self-regulated learning. However, because the main purpose of the tool is to support project-based learning, the researchers did not investigate how the tool supports self-regulated learning.

Research is needed to identify and describe how students use this kind of self-regulated learning support tool, and are influenced by its use. Jonassen and Reeves (1996) pointed out, "...researchers should seek to reveal the nature of interactions and collaborations between the learner and the computer" (Jonassen & Reeves, 1996, p. 697). Depending on how the theories

are integrated, as well as the implementation of the tool, cognitive tools offer much promise in supporting learning. However, the effectiveness of cognitive tools is also linked to various factors such as individual differences and the characteristics of learning tasks. It is also important to investigate the nature of interactions between the learners and cognitive tools. Finally, once we have a better understanding of self-regulation from research, development of the self-regulated learning support tool based on the theories and research on self-regulated learning is needed. Research needs to extend to examine multiple factors associated with the use of cognitive tools.

Purpose of the Study

This study focused on how to facilitate and support self-regulated learning within higher education by using Web-based technology as a cognitive tool. For this purpose, the study examined students' use of a Self-Regulated Learning Support (SRLS) tool in a post secondary course. Particular interest was given to how the use of a SRLS tool influenced learning, and the factors that influenced the students' use of a SRLS tool. The study was guided by the following questions:

1. How do students describe their perceived instrumentality (or utility value) on the use of a SRLS tool?
2. How do students engage in self-regulated learning activities provided by a SRLS tool (e.g., goal setting, planning, monitoring, evaluating, resources use)?
3. What factors appear to impact, and in what ways do they impact, the students' use of the SRLS tool (including the level of motivation and metacognitive learning strategies)?

Significance of the Study

This study has implications for different groups. First, students who have trouble in more student-centered learning environments might benefit from the tool if the tool is effective and efficient in helping their learning. Given that not all students are expert learners, it is important to support and facilitate self-regulated learning in those learning environments. To provide students with cognitive tools that are designed to support the process of self-regulated learning is one possible approach to this issue.

Second, practitioners and educators interested in facilitating their students' self-regulated learning might benefit from the results of this study. Identifying interactions between the use of a Web-based learning support tool and the students' self-regulated learning will inform them about strengths, potential risks, and concerns associated with the use of the Web-based learning support tool. Such information will be useful in planning their courses when they try to use this kind of learning support tool. The research results might also be helpful for designers and developers of student-centered learning environments to adapt and introduce more efficient scaffolding by using the Web technologies for self-regulated learning in such environments.

Apart from practical implications, this study will contribute to the literature on computers as cognitive tools to support self-regulated learning. There have been very few studies that involve the use of computer-based cognitive tools that integrate self-regulated learning theories to support learning in more student-centered learning environments, especially in the context of higher education. Finally, this study may suggest additional studies for other researchers who are interested in further exploring the use of Web-based technologies as cognitive tools. As the use of computers and the Internet continues to expand within our society, studies of the mutual influences between users and those computer technologies are of increasing importance.

Outline of the Document

The purpose of this study was to investigate how to facilitate self-regulated learning in less expert learners within higher education by using the Web technology as a cognitive tool. Chapter One discussed the challenges associated with self-regulation, stated the purpose of the research and presented three major research questions that were explored in the study. Chapter Two reports the review of relevant research and theoretical literature. It provides the various views of self-regulated learning, the principles that can support self-regulated learning, and the theory and research about cognitive tools. Chapter Three discusses the research questions, research design, sample selection, and the methods of data collection and analysis with the issues of reliability, validity, and limitations. Chapter Four presents the analysis of the data, findings of investigation answering each research question. Finally, Chapter Five provides the discussion of the findings, implications of the study, and suggestions for further study.

CHAPTER II.

REVIEW OF THE LITERATURE

Overview

As established in Chapter One, this research is focused on how to support and facilitate self-regulated learning in less expert learners at the post secondary level by using Web technology as a cognitive tool. The study investigated the use of a Self-Regulated Learning Support Tool (SRLS tool) designed to facilitate students' self-regulated learning with particular interest in how the SRLS tool influences their self-regulated learning, and the way they used the SRLS tool depending on their level of motivation, metacognitive learning strategies, and other factors. In this second chapter, the review of relevant research and theoretical literature are reported.

This literature review consists of three sections. The first section begins with the various perspectives on self-regulated learning, and provides the principles of self-regulated learning based on literature that can be embedded in a Web-based self-regulated learning support tool. The second section is a review of the theory and research about the cognitive tools. The third section presents design guidelines for embedding those principles in the self-regulated learning support tool.

The literature used in this study was located by using the GALILEO database system at the University of Georgia. The primary databases include ERIC, EBSCOhost, Current Contents, PsycINFO, and Dissertation Abstracts. The search terms such as "cognitive tools," "mind tools," "scaffolding," "self-regulated learning," "self-regulation," "metacognition," "learner-centered

learning," "constructivism," "constructivist learning," "learning strategies," "cognitive strategies," and "metacognitive strategies" were used for this literature review.

Concepts of Self-Regulated Learning and Principles to Support It

In an effort to provide an informed view of self-regulated learning, this section of the literature review begins with a brief synopsis of various perspectives of self-regulated learning. Next, a definition of self-regulated learning used to guide the study is provided. Finally, based on the related literature, the principles of self-regulated learning that can be integrated in a Web-based self-regulated learning support tool are discussed.

Seven Views of Self-Regulated Learning

This section provides the seven prominent theoretical perspectives on self-regulated learning: operant, phenomenological, information processing, social cognitive, volitional, Vygotskian, and cognitive constructivist approaches. The selection of these seven views is based on the book, "Self-regulated Learning and Academic Achievement: Theoretical Perspectives" edited by Zimmerman and Schunk (2001a). The book is the second edition and has added 'information processing views of self-regulated learning' to the first edition (Zimmerman and Schunk, 1989). Each theory is discussed in terms of motivation to self-regulate, the major process mentioned in each view, and major instruction methods or principles to enhance self-regulated learning (see Table 2.1 for a summary).

Table 2.1. Seven Perspectives of Self-Regulated Learning

Perspectives	Motivation to self-regulate	Major processes	How to enhance SRL
Operant View	Reinforcing stimuli	Self-monitoring, self-instruction, self-evaluation, and self-reinforcement	Presence of effective models of and external reinforcements for self-regulative responses
Phenomenological View	Need to reduce the gap between their perceptions of actual and ideal selves	Self-system structures and processes	Learner-centered interventions and providing self-assessment tools
Information Processing View	Motivation was not explicit, historically	Self-evaluative standards, self-monitoring, adjustments or adaptations	Efficient use of the working memory, reducing demands of the task, schematizing and automating information, and off-loading information from memory to the environment
Social Cognitive View	Outcome and self-efficacy expectations and goals	Self-observation, self-judgment, and self-reaction	Academic competence develops initially from social sources, and feedback and subsequently shifts to self-resource
Volitional View	Value and expectancy for achieving a particular goal, perceptions of impediments to the learning goals as distractions or competing-action tendencies	Control of cognition, emotion, and motivation, control of task situation and others like peers and teachers in the task setting	Naturalistic guidance, or participant modeling instruction
Vygotskian View	Motivation was not explicit, historically. Self-involved inner speech and task-involved inner speech	Egocentric speech, inner speech	Social interaction with more capable peers or adults
Cognitive Constructivist View	Cognitive conflicts or disequilibria between an old mental model and current experience, students' theory of agency and control	Constructing personal theories of self-competence, agency and control, schooling and academic tasks, and strategies	Multiple opportunities to succeed, scaffolded interpretations of their performance, culturally meaningful and challenging tasks, and encouragement to pursue positive possible selves

Operant View

The operant view is mainly based on the environmentalist principles of B. F. Skinner and his behavioral technology for personal use (Zimmerman, 2001). A basic assumption of Skinner's theory is that changes in behavior depend on the environmental consequences that the behavior produces (Mace, Belfiore, & Hutchinson, 2001). That is, if a particular Stimulus-

Response pattern is reinforced, the individual is conditioned to have the same response given the same stimulus.

According to Mace, Belfiore, and Hutchinson (2001), a behavior becomes more likely to occur through positive reinforcement or negative reinforcement. A teacher giving a token to a student when the student has finished a difficult task is an example of positive reinforcement. Giving a token increases the probability of the student finishing the difficult task. In contrast, a teacher staring at a student who engages in disruptive behavior instead of doing in-seat assignment is an example of negative reinforcement. If the negative reinforcement is successful, the student discontinues the disruptive behavior and resumes the in-seat assignment to avoid the teacher's stare. In this situation, staring at the student increases the likelihood of the student doing seatwork.

The source of motivation to self-regulate during learning is the reinforcing stimuli from the operant view (Zimmerman, 2001). The decision to self-regulate depends on the amount of the immediate and delayed reinforcements and the time interval between them (Mace, Belfiore, & Hutchinson, 2001). When students self-regulate, they postpone immediate rewards in favor of alternative or greater rewards at a later point in time. An example might include a student who studies for the history exam rather than go to the movies with friends. In this example, the student postpones going to the movies (immediate reward) and chooses to study in hope of getting a good grade on the exam (perceived greater reward).

Mace and his colleagues (2001) described four major processes in self-regulation according to the operant view: self-monitoring, self-instruction, self-evaluation, and self-reinforcement. Self-monitoring (also called self-recording) is a process involving observation and recording of one's own behavior. To self-monitor, first, an individual discriminates the

occurrence of the target response that is to be controlled and the individual records some dimension of the target response (e.g., frequency, duration, or latency). Self-instruction provides discriminative stimuli that bring about specific behaviors or behavioral sequences that will lead to reinforcement. From the operant perspective, teaching self-instructions and accompanying nonverbal actions is an effective way of improving functioning in a wide variety of academic areas.

Self-evaluation refers to individuals' comparing some dimension of their behavior to that of a standard. In an operant view, self-evaluation is dependent on student discrimination as determined by the self-monitoring and may result in modifying the previous response based on the results. Self-reinforcement often requires a person to come in contact with a stimulus following the occurrence of a response. The stimulus, in keeping with an operant view, often occurs after satisfying a performance standard or criteria. The stimulus/response combination results in an increase in the chance of the occurrence of the response subject to the performance standard.

To operant theorists, the main instructional methods to develop self-regulation are modeling, verbal tuition, and reinforcement (Zimmerman, 2001). The key factors leading to a capacity to regulate one's own learning are the presence of effective models of and external reinforcements for self-regulative responses. Verbal tuition is also useful in that it can provide explicit explanation about the ways to self-monitor, self-instruct, self-evaluate, and self-reinforce.

Phenomenological View

A phenomenological perspective of self-regulated learning is "one that accepts the primacy of self-phenomena in directing learning behaviors; it favors a person-referenced over a

performance-referenced account of SRL processes and activities" (McCombs, 2001, p. 68). Self-perceptions of human psychological functioning have been important to phenomenologists because these perceptions were assumed to be organized into a distinctive identity or self-concept that influenced all aspects of behavioral functioning including academic learning and achievement (Zimmerman, 2001). For example, one would interpret academic errors as hopeful signs of progress if one's academic self-concept were positive, whereas the same errors could be regarded as signs of failure if one's self-image were negative.

From the phenomenological view, individuals' motivation to self-regulate emotions, cognitions, and actions is based on a need to reduce the gap between their perceptions of actual and ideal selves (McCombs, 2001). In addition, affective reactions to self-evaluation that yield discrepancies between what we are and want to be play a key role in motivation to achieve our self-goals (McCombs, 2001). According to phenomenologist, if self-perceptions are unfavorable, motivation decreases and negative affect like anxiety results. In contrast, if self-perceptions are favorable, students' confidence level increases, so does intrinsic motivation.

McCombs (2001) explained the key processes of self-regulation from a phenomenological perspective with self-system structures and processes. Self-system structures represent individuals' personalized and self-defined conceptualizations of self-attributes such as self-worth and self-identity. Self-concepts, or self-system structures, are typically organized as a global and as domain-specific conceptualization. Global self-concept is "the individuals' beliefs and perceptions of their ability to direct and control their cognition, affect, motivation, and behavior in learning situation in general" (p 86). Domain-specific self-concept is an "individuals' beliefs and percepts of their ability to direct and control their cognition, affect, motivation, and behavior in a particular type of learning situation or context" (p. 87). For

example, to know one's learning style in general is a global self-concept while for an individual to know his or her capability to solve a problem in geometry is a domain specific self-concept. It is important to understand self-system structures as they affect self-processes that consist of a variety of metacognitive or higher order processes, including self-awareness, self-evaluation, and self-reflection.

The main focus to develop self-regulation from the phenomenological view is development of a self-system (McCombs, 2001). Instructional methods targeted on the development of a self-system emphasize learner-centered interventions through which students can practice to execute each step of self-regulated learning. In addition, McCombs suggested providing self-assessment and other measurement tools that can help identify self-beliefs, self-perceptions, and self-processes.

Information Processing View

From the information processing view, learning is a cognitive process or a set of cognitive processes by which humans acquire information (Winne, 2001). Research conducted by scholars in this area has focused on how information can be sensed and processed to be stored in memory and how this information can be retrieved. When we learn, information is sensed through sensory organs like ears, eyes, nose, and skin. The information is then rehearsed, elaborated, or organized in the working memory and encoded in long-term memory. All the information stored in long-term memory has a pattern of which an image is a network, consisting of nodes of information and links between these nodes. The links allow us to retrieve specific information that has been stored in long-term memory.

The source of motivation to self-regulate during learning from the information processing view was not explicitly stated. Historically, information processing scholars paid little attention

to the role of motivation to self-regulate during learning because the main focuses of the theory is on knowledge states or methods of reasoning (Zimmerman, 2001). This shortcoming, however, has led some information processing theorists to add motivational components to their models. For example, Winne (2001) included four motivational variables to expand the list of personal beliefs in his model: outcome expectations, judgments of self-efficacy, attributions, and incentives or values. These motivational elements are envisioned as affectively laden information. Winne emphasized that this information is used for students to know their affective status related to the tasks.

Information processing theorists of self-regulated learning envisioned self-regulation in terms of self-evaluative standards, self-monitoring of performance outcomes comparative to those standards, and adjustments or adaptations designed to rectify that performance (Zimmerman & Schunk, 2001b). For example, Winne (2001) formulated a four-stage model of self-regulated learning. This model illustrates self-regulated learning as an event involving three necessary phases and an optional fourth phase: defining the task, selecting goals and planning, enacting tactics, and adapting metacognition. In the phase of defining the task, learners process information that defines a task in terms of conditions that characterize the task. In the phase of selecting goals and planning, learners set goals, and plan tactics and strategies to achieve the goals. Goals are used as standards against which products can be monitored throughout the task. In the enacting tactics phase, tactics and strategies are applied to achieve the goals set in the second phase. In the optional phase of adapting metacognition, learners make major adaptations to schemas that structure how self-regulating is carried out.

In Winne's (2001) model, metacognitive monitoring plays a key role in self-regulating one's learning. He described monitoring processes in terms of recursive feedback loops. When

there is a negative discrepancy between feedback and self-evaluative standards (goals), learners continue their efforts until the discrepancy is resolved. Once the discrepancy is resolved, the goals are achieved. Through monitoring, for example, students are able to update task conditions, students' cognitive conditions about the task, the standards (goals), and the tactics or strategies.

As ways to help learners to self-regulate, information-processing theories emphasize the efficient use of the working memory. Because the capacity of the working memory is very limited and like other information processes, self-regulation also requires the use of working memory, it is important to use the working memory efficiently. Winne (2001) suggested reducing demands of the task, schematizing and automating information, and off-loading information from memory to the environment as ways of using working memory efficiently. In addition, Winne and Stockley (1998) and Winne (2001) recommended using a computer-assisted learning system (e.g., STUDY) to help learners to increase their level of self-regulation and to reduce their cognitive overload during learning.

Social Cognitive View

Social cognitive views of self-regulated learning emphasize both social-contextual and personal factors as reciprocally interacting with each other to determine human learning (Bandura, 1986). Bandura stated, "In the social cognitive view, people are neither driven by inner forces nor automatically shaped and controlled by external stimuli. Rather, human functioning is explained in terms of model of triadic reciprocality in which behavior, cognitive and other personal factors, and environmental events all operate as interacting determinants of each other" (p. 18). Self-efficacy, a major construct in Bandura's theory, influences behaviors such as choice of tasks, persistence, effort, and achievement (Schunk, 2001). In turn, students'

behaviors affect their efficacy. For example, if students perceive positive progress when they work on tasks, the perceived progress enhances the students' self-efficacy on the tasks, in turn impacting their behavior.

Personal factors and environmental factors also influence each other. Individuals such as teachers and other students in an individual student's social environments may react to the student based on attributes typically associated with the student rather than based on what the student actually does (Schunk, 2001). In turn, teachers can affect students' self-efficacy with the feedback based on those perceived attributes. The interaction between students' behaviors and classroom environments can also be found. If students give incorrect answers, the teacher in the environment may teach some points related to the question again. Conversely, if the teacher's lecture is not prepared well, students may not pay attention to the lecture. This shows how three kinds of factors affect each and explains reciprocal determinism.

From the social cognitive view, the sources of motivation to self-regulate during learning are outcome and self-efficacy expectations and goals (Zimmerman, 2001). People are motivated by the consequences that they expect to receive for behaving (i.e., outcome expectation), rather than by the actual rewards themselves (Bandura 1971, cited in Zimmerman, 2001). This view essentially differs from the operant view, which treats actual environmental reinforcements as main sources of motivation. Another construct, self-efficacy, an individual's personal conception about one's ability to accomplish a certain task, is also related to the individual's choice of tasks, persistence, effort expenditure, and skill acquisition (Zimmerman, 2001). These outcome and self-efficacy expectations help learners set goals for themselves and these goals serve as standards against which future performance is evaluated (Zimmerman, 2001).

Bandura (1986) identified self-observation, self-judgment, and self-reaction as three sub-processes of self-regulation. In the processes involved in self-observation, students monitor their own performance to get information about progress towards goals. Self-judgment involves comparing performance with various standards such as goals. As self-reaction to the result of these comparisons, students reinforce themselves either positively or negatively in the process of self-judgment.

The interactive nature of self-regulatory process can be described with Zimmerman's (2000) three-phase cyclical model of self-regulated learning process. In this model, self-regulatory processes and accompanying beliefs fall into three cyclical phases: 1) forethought, 2) performance or volitional control, and 3) self-reflection processes (Zimmerman, 2000). The forethought phase precedes actual performance and refers to processes that set the stage for action. This phase involves task analysis including goal setting and strategic planning and self-motivation beliefs activation such as self-efficacy, outcome expectations, intrinsic interest, and goal orientation. The performance (volitional) control phase refers to self-regulatory processes that occur during learning that affect learners' attention and action. In this phase, students are doing self-control such as self-instruction, imagery, attention focusing, and task strategies, and self-observation through self-recording and self-experimentation. The self-reflection phase occurs after performance when learners judge their efforts by self-evaluation and casual attribution and react to the results.

To social cognitive theorists, self-regulation does not develop automatically as people get older, nor is it passively acquired during environmental interactions (Schunk, 2001). Zimmerman and his colleagues have described a social cognitive model of the development of self-regulatory competency which consists of four levels: observational, emulative, self-

controlled, and self-regulated (Schunk & Zimmerman, 1997; Zimmerman, 2000). According to this model, academic competence develops initially from social sources such as models, verbal description, social guidance, and feedback and subsequently shifts to self-resources such as self-regulatory processes (e.g., self-observation, self-judgment, and self-reaction), and self-efficacy beliefs on a series of levels (Schunk, 2001).

Volitional Views

A volitional view of self-regulated learning is one that emphasizes the role of volition or will in self-regulation and tries to explain how learners become more able to maintain their motivation and resist the distractions after undertaking a learning task. The researchers clearly distinguish volition or will from motivation. According to Corno (2001), "motivation processes promote an intention to learn or to carry out a task, mediating the formation of decisions about work. Volitional processes protect the intention to learn from competing action tendencies and other processes, such as task appraisals made in relation to performance, contribute to self-regulation in learning" (p. 194). One of the reasons that the researchers focused on the role of volition is that learners often fail to resist distraction temptations even though they may be initially motivated to study a subject.

Motivation to self-regulate can be explained in two ways from a volitional view. At first, based on their value and expectancy for achieving a particular goal, learners' motivation to self-regulate is decided (Kuhl, 1984, cited in Corno, 2001), whereas learners' decision to use volitional control strategies are prompted by their perceptions of impediments to the learning goals as distractions or competing-action tendencies (Zimmerman, 2001).

Corno (2001) suggested two volitional processes of self-regulated learning – covert processes and overt processes of self-control, and their sub-processes. Covert processes include

control of cognition, emotion control, and motivation control. Controlling attention to information and encoding which has been a focus of information processing theories is an example of covert process. Controlling emotion and thinking ahead to positive or negative outcomes are also examples of covert process. Overt processes involve the control of a task situation, and control of others like peers and teachers in the task setting. The overt process reflects efforts to control the self by controlling one's environment. For example, people who can modify poorly designed tasks into easier tasks by rearranging the sub-goals might control themselves to maintain their motivation to do the tasks longer than those who cannot.

Corno (2001) argued that volitional strategies are trainable. As ways to train the volitional strategies, she recommended naturalistic guidance, or participant modeling instruction because she believes that the developmental process of volition was heavily influenced by socialization practices in the home and elsewhere.

Vygotskian View

The theorists of the Vygotskian view of self-regulated learning classified the role of language into two areas: external speech and inner speech. External speech is to turn thought into words, whereas inner speech is to turn words into thought (Vygotsky, 1962, cited in McCaslin & Hickey, 2001). External speech plays a role of interactive dialogue between adults and children as a vehicle for conveying and internalizing linguistic skills. Inner speech is a source of knowledge and self-control. To Vygotskian theorists, learning seems to be a process in which children internalize the social-instructional environment (SIE) in a type of language through the interactive dialogues with more capable of peers or adults in their culture. Therefore, learning cannot be separated from its social context.

Although motivation to self-regulate is not traditionally emphasized by Vygotsky, we can extrapolate based on what is known about his theory. In a Vygotskian view, self-involved inner speech and task-involved inner speech can influence motivation (Zimmerman, 2001). Self-involved inner speech refers to motivation and affective statements that are used to improve self-control. Task-involved inner speech refers to problem-solving strategic statements that are used to increase task control (Zimmerman, 2001).

Egocentric speech, which was believed to be a transition from external to inner speech control (Vygotsky, 1962), is a key process in developing self-regulation. The structural and functional qualities of egocentric speech develop and evolve into inner speech that is different from external, social speech. When children internalize the speech that the more capable persons have used to regulate them, they can exercise self-regulation at an intrapersonal level.

Children can acquire inner use of speech through social interaction with other more capable peers or adults. This idea is well described in Zone of Proximal Development (Vygotsky, 1978), which is "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (p. 86). From this perspective, various teaching and learning methods such as self-instruction, ideational scaffolding, and reciprocal teaching, can be provided to develop self-regulation processes.

Cognitive Constructivist View

One of the origins of cognitive constructivism is based on Piaget (1926, 1952)'s theory on schema construction. Piaget proposed a more specific explanation about the adaptation of an organism to the environment, as well as the equilibrium between the organism and the environment, by using assimilation and accommodation. Assimilation refers to the process in

which people fit the new information into their existing mental structure (schemas). For example, when a child sees a cat and only has a schema for a dog, the child will likely try to interpret the cat as a dog. This process is a process of assimilation. In contrast, accommodation refers to the process in which people rearrange or change their existing schemas to accept the new external information. Extending the example used before, when the parents of the child let the child know that it is a cat (instead of a dog), the child will create a new schema about a cat to provide consistency with external reality. This is the process of accommodation. These two processes occur to maintain equilibrium.

From the cognitive constructivist view, the principal source of students' self-regulation to construct a more developmentally advanced mental model are cognitive conflicts or disequilibria between an old mental model and current experience. Recently, Paris, Byrnes, and Paris (2001), however, included students' theory of agency and control in their theory in order to give more comprehensive explanation about motivation to self-regulate in naturalistic contexts. The concept of personal agency is that "people take responsibility for their action and ascribe success and failure to the goals they choose, the resources they mobilize, and the effort they expend" (Paris, Byrnes, & Paris, 2001, p. 267). Students' positive theory about their agency and control is developed as they accumulate evidence about the success of their attempts to control academic situations.

Paris and his colleagues (2001) provided four major components of students' self-regulated learning: self-competence, agency and control, schooling and academic tasks, and strategies. Students' theory of self-competence involves personal perceptions of personal academic ability. Students' theory of agency and control deals with their interpretation of success and failure as well as their intentions and actions. The theory of schooling and academic

tasks involves the students' concepts about the nature of schooling such as methods of evaluation, and the nature of tasks such as how long it will take. Students' theory of strategies involves the students' knowledge about strategies that can be used in their learning. Students are assumed to construct these personal theories about the major components through various learning experience. Based on these personal theories or schemas about the major components, individual students regulate their learning.

In this view of self-regulation, individuals are assumed to be naturally inclined to construct their own theories or explanatory frameworks and to make sense of their educational experiences (Paris, Byrnes, & Paris, 2001). This implies that to help students construct personal theories that foster the acquisition and use of self-regulated learning, the important roles of the teacher are to provide students with: multiple opportunities to succeed, scaffolded interpretations of their performance, culturally meaningful and challenging tasks, and encouragement to pursue positive possible selves.

Definition of Self-Regulated Learning

The key issue defining self-regulated learning is not whether learning occurs as a socially isolated event, but rather whether the learner exhibits personal initiative, perseverance, and adaptive skill in pursuing it (Zimmerman, 2001). This means that self-regulated learning does not have to be limited to the application to the solo cognition (Anderson, Reder, & Simon, 1996, 1997). Self-regulated learning can be applied to the learning based on the situated learning theories that emphasize the social nature of cognition and meaning (Greeno, 1998; Resnick, 1987). This view is also supported by the Vygotskian view (McCaslin & Hickey, 2001), social cognitive view (Schunk, 2001), and constructivist view (Paris, Byrnes, & Paris, 2001) of self-regulated learning.

Self-regulated learning is a form of learning that places great emphasis on learners' active role and control of their own learning. Self-regulated learning involves the conscious awareness and modification of cognitive as well as affective processes that are required for success in an educational environment (Corno and Mandinach, 1983). It can be contrasted with passive learning, a form of learning whereby learners are assumed to absorb information presented to them by a lecturer or some form of media such as a film.

Proponents of self-regulated learning espouse that it is more effective than passive learning. They also believe that it is more important because learners who only know how to receive information passively from others won't be successful as lifelong learners in real world situations where the knowledge to be gained is not neatly packaged for them.

Although each theory in the literature about self-regulated learning (e.g., operant, phenomenological, information processing, social cognitive, volitional, Vygotskian, and constructivist views) has a different view to explain learning itself, most of them share some aspects in explaining about self-regulated learning. Pintrich (2000) proposed four assumptions about self-regulated learning that can be found throughout the theories. Pintrich's assumptions on self-regulated learning include: (a) that is an active, constructive process, (b) that learners have potential for control, (c) that learners establish goal, criterion, or standard, and (d) that mediators (e.g., teachers, computer based tools) play an important role. From these common assumptions, Pintrich (2000) defined self-regulated learning as "an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behavior, guided and constrained by their goals and the contextual features in the environment" (p. 453). This definition does not explicitly tell about planning, through which learners select and manipulate the strategies necessary to achieve the

goals and come up with the paths to follow. However, various models of self-regulated learning (e.g., Winne & Stockley, 1998; Zimmerman, 1998) have planning in their models and describe it explicitly. If a planning is added to this definition, in the simplest sense, self-regulated learning is an active, constructive process whereby learners set goals for their learning, plan how to achieve the goals, and then attempt to monitor, regulate, and control their cognition, motivation, and behavior, guided and constrained by their goals and the contextual features in the environment.

According to this more elaborated definition, a process of self-regulated learning can be described as following. Self-regulated learners know when to engage in learning, set goals for learning, plan to achieve the goal through which learners select the strategies to use and decide orders to follow. As they move toward the goals, learners monitor their progress, cognition and motivation. If they find their progress toward their goals does not follow their plans or encounter obstacles, learners try to modify the plans or even give up the initial goals, to manage motivation and adjust their strategies for making progress.

Principles to Support Self-Regulated Learning

Self-regulated learners keep setting goals, planning, monitoring, and evaluating cyclically when they engage in learning. While doing these, they use various cognitive strategies and try to sustain their motivation. The purpose of this section is to suggest principles to be integrated into a Web-based self-regulated learning support tool to facilitate the process of self-regulated learning in less expert self-regulated learners. The principles are based on research literature that describes self-regulated learning, prescribes the ways to support it, and identifies self-regulated learning components that may be deficient in some learners. The principles this study proposes are as follows:

1. Support students to set goals to guide their learning
2. Support students' metacognitive activities including planning, monitoring, and evaluating
3. Help students to sustain their motivation by enhancing self-efficacy
4. Provide students with resources and help seeking

A description of each principle, with the description about the relevant concepts and related research studies, follows. See Table 2.2 for an overall summary.

Table 2.2. Principles with Relevant Concepts and Supporting Researchers

Principles	Specific constructs	Researchers
Support students to set goals to guide their learning	Goal setting	Pintrich, 2000
	Learning goal vs. performance goal	Dweck, 1986, 1992; Meece, Blumenfeld, & Hoyle, 1988; Pintrich & De Groot, 1990
	Short-term goals involving specific performance standards	Bandura, 1986; Schunk, 1990; Morrone & Schutz, 2000; Alderman, 1999
Support students' metacognitive activities including planning, monitoring, and evaluating	Metacognition	Flavell, 1976; Lin, 1994; Ertmer & Newby, 1996
	Planning	Derry and Murphy, 1986 Davidson & Sternberg, 1998
	Monitoring	Zimmerman & Kitsantas, 1997; Kitsantas & Baylor, 2001; Lan 1998
	Evaluating	Zimmerman & Kitsantas, 1997, 1999; Orange, 1999
Help students to sustain their motivation by enhancing self-efficacy	Self-efficacy	Bandura, 1986; Pajares, 1996; Morrone & Schutz, 2000; Dai, Moon, & Feldhusen, 1998 Schunk & Zimmerman, 1994; Schunk & Ertmer, 2000
Provide students with resources and help seeking	Resources	Hill & Hannafin, 2001
	Help seeking	Zimmerman, 1998; Newman, 1998; 2000; Greer, et al., 2000

Principle 1: Support Students to Set Goals to Guide their Learning

Goal setting is a critical part of the initial or forethought phase of self-regulation (Schunk, 2001, Winne, 2001; Zimmerman, 2000). A goal is a representation of what one would like to happen or what one would like to achieve in the future that often directs one's behavior (Pintrich & Schunk, 1996). All models of self-regulation assume that there is some type of goal, standard, criterion, or reference value against which comparisons are made in order to assess whether the current mental processes one is using should continue as is or if some type of change is necessary (Pintrich, 2000).

According to the social cognitive theorists (Schunk, 2001; Zimmerman, 2000) of self-regulated learning, if learners set their own goals for academic tasks to be learned and improved, then as they monitor their performance and attempt to control and regulate it, these goals should guide them toward the use of more self-regulatory processes. Participating in setting goals can lead to building personal commitment to meaningful goals and improve learners' sense of regulating their own learning (Schunk, 2001). It is also reasonable to assume that if one does not have personally meaningful goals, then it will be unlikely that one will engage in effective metacognitive strategies.

There are two types of task-related goals that students choose between or balance in some measure: learning goals and performance goals (Dweck, 1986, 1992). Learners who adopt learning goals seek expertise in the task's subject matter domain and place high value on the development of skill, the recognition of effort, and the inclusion of all participants for the good of a team. They tend to choose challenging tasks that foster learning regardless of ability and are willing to risk display of ignorance in order to acquire skills and knowledge.

In contrast, students who adopt performance goals strive to enhance their own and other's perceptions of their competence in the task and place high value on individual ability relative to the ability of others. They tend to choose personally easy tasks on which success is insured or excessively difficult tasks in which failure does not signify low ability. This goal promotes defensive strategies that interfere with challenge seeking. In general, students who emphasize learning goals over performance goals study more strategically (Meece, Blumenfeld, & Hoyle, 1988; Pintrich & De Groot, 1990).

Long-term goals keep people directed toward their ultimate target while short-term goals, also known as proximal goals or sub goals, are the stepping-stones to the long-term goal (Alderman, 1999). Long-term goals help students keep the large picture in focus. However, if students have only long-term goals, they can easily give up or fail to achieve the long-term goals or lose their motivation to continue their work for the goals because the students may think the goals look beyond their ability and may have difficulty to monitor and evaluate their progress. Bandura (1986) and Schunk (1990) emphasized that the setting of short-term goals involving specific performance standards is likely to lead to successful performance, and so to enhance self-efficacy and positive self-reinforcement. Morrone and Schutz (2000) suggested three guidelines for promoting self-regulated learning skills in the classroom. One of them is to teach students to set short-term goals and help them monitor their progress toward those goals.

To summarize, a goal is one of the most important constructs in self-regulated learning. It is recommended to guide students to set learning goals, and short-term and specific goals to achieve long-term goals to promote their self-regulated learning.

Principle 2: Support Students' Metacognitive Activities Including Planning, Monitoring, and Evaluating

Metacognition refers to individuals' cognition and control of their own process of cognition (Flavell, 1976). Activities such as planning how to approach a given learning task, monitoring comprehension, and evaluating progress toward the completion of a task are metacognitive in nature. Hacker (1998) summarized key factors associated with metacognition:

> Although not all researchers will agree on some of the fuzzier aspects of metacognition, there does seem to be general consensus that a definition of metacognition should include at least these notions: knowledge of one's knowledge, processes, and cognitive and affective states; and the ability to consciously and deliberately monitor and regulate one's knowledge, processes, and cognitive and affective states (p. 11).

Ertmer and Newby (1996) described metacognition by using two notions when students are conducting a task. One is metacognitive knowledge, which includes awareness of task requirements and one's current knowledge, and cognitive, motivational, and environmental strategies. This is a type of declarative knowledge. The second is metacognitive control, that is, the ability to consciously and deliberately plan, monitor, evaluate, and reflect the process of learning. This is a type of procedural knowledge.

The metacognitive processes can also be found in Bandura's (1986) social cognitive theory. He mentioned three sub processes of self-regulation: self-observation (self-monitoring), self-judgment (referential comparison), and self-reaction (self-reinforcement). In the processes involved in self-observation, students monitor their own performance to get information about progress towards goals. Self-judgment involves comparing performance with various standards such as goals. Based on a result of these comparisons, students will reinforce themselves either positively or negatively in the process of self-reaction.

Individuals with higher metacognitive ability can plan cognitive activities in advance (e.g., decide to read an assignment text twice, once quickly and again more carefully), realize their own ability (e.g., accept the knowledge that they must devote more time to studying than another person), monitor their cognitive processes (e.g., question themselves concerning the degree to which they really understand something), reflect on the mental processes in which they are engaged (e.g., analyze their conceptualization of complex phenomena and seek clarification or enrichment when it is needed), and regulate these cognition-related processes by themselves (e.g., invest more mental effort when they are puzzled about something) better than those with lower metacognitive ability.

Even though researchers on metacognition have some different subcategories, this study focuses on three metacognitive activities based on Ertmer and Newby's (1996) metacognitive control. Ertmer and Newby described the metacognitive control with planning, monitoring, and evaluating.

Planning is deciding the overall approach to achieve the learning goals or to solve a problem (Lin, 1994). More specifically, planning is a process that involves setting learning goals, selecting and ordering strategies for achieving the goals, identifying potential obstacles, and preparing to tackle those obstacles (Ertmer & Newby, 1996). According to Derry and Murphy's (1986) study, students who have a chance to analyze goals and make a plan are more successful than others who do not.

In problem solving, if a problem is identified or encoded, an expert solver uses metacognition (planning) to decide how to go about solving the problem (Davidson & Sternberg, 1998). According to Holyoak (1995), reviewing and choosing plans helps the solver to anticipate the consequences of possible procedures, can save the solver from making expensive

mistakes, and provides information about what to expect from certain outcomes. Further, in problem solving, planning tends to be relatively flexible rather than fixed and complete. While working on a problem, people need to update their plans based on metacognitive monitoring of how well the plans are working and on what opportunities for modifications are available (Davidson & Sternberg, 1998)

Monitoring refers to ongoing tracking or recording one's performance. As a crucial metacognitive strategy, this process can occur through: an awareness of what one is doing; an understanding of where it fits into the established sequence of steps; and an anticipation and planning for what-ought to be done next (Ertmer & Newby, 1996). During monitoring, students need to ensure that they are making progress toward accomplishing their learning goals.

Research indicates the value of monitoring. Girls who monitored their progress by recording while learning to throw darts showed better performance enhancement than those who did not monitor (Zimmerman & Kitsantas, 1997). Zimmerman and Kitsantas (1999) also found that in acquiring writing revision skill, the girl students who recorded the numbers of the strategy steps they had done correctly at the end of each practice on the practice form outperformed those who didn't. According to the study of Kitsantas and Baylor (2001), among college students who enrolled in an introductory educational technology course, the students who monitored their instructional planning process by using the Instructional Planning Self-Reflective Tool (IPSRT) demonstrated greater skill acquisition than those who did not use the IPSRT (IPSRT is a tool designed to facilitate monitoring and self-evaluation during instructional planning). In Lan's (1998) study of comparing self-monitoring, instructor-monitoring, and control group in an introductory statistics course for graduate students, the self-monitoring group outperformed its counterparts on the course examinations. The self-monitoring group also used other strategies

like self-evaluation, environmental structuring, rehearsal and memorization, more frequently than did other groups.

Evaluating involves the assessment on both the process employed and the product achieved after completing the entire task (Ertmer & Newby, 1996), while monitoring is limited to tracking and recording one's performance without comparing effort to outcomes. Students should evaluate whether strategies or steps selected in the phase of planning are appropriate and decide whether moving to the next stage is effective based on their comprehension level. Evaluation cannot be done without monitoring because monitoring provides the current status which evaluation should compare with the standards or goals. During evaluating, students assess the reasonableness and accuracy of any learning product to determine the extent to which the goal was achieved, the effectiveness of overall process and its supporting steps, their preparedness for obstacles, and the effectiveness and efficiency of their plan.

Girl students who self-monitor, and consequently self-evaluate their progress during the writing revision course, show higher skill acquisition and more satisfaction, show more intrinsic interest in the task, and report higher self-efficacy perceptions than those who do not (Zimmerman & Kitsantas, 1999). In addition, Orange (1999) examined the effect of a peer modeling video on the self-regulated learning of college students and reported that self-evaluation (assessing behaviors, attitudes, and actions in terms of personal standards) contributed to self-regulated learning second most among seven first order factors in the confirmatory factor analysis.

To summarize, planning, monitoring, and evaluating are the commonly used metacognitive activities involved in self-regulated learning. To provide students with

opportunities to plan, monitor, and evaluate their learning and to guide them to do these metacognitive activities can support their self-regulated learning.

Principle 3: Help Students to Sustain their Motivation by Enhancing Self-Efficacy

Although metacognition plays an important role in self-regulated learning, it is a necessary, but not sufficient, condition for higher self-regulation. Self-regulation also depends on self-beliefs and affective reactions, such as confidence, doubts, and fears, within the context of specific performance (Zimmerman, 2000). Motivation is another requirement throughout the various theories of self-regulated learning described by Zimmerman and Schunk (1989, 2001a). There are a number of motivational beliefs and constructs that can be adaptive. This section, however, will focus on self-efficacy construct of motivation to investigate what conditions help with self-regulated learning.

Self-efficacy refers to an individual's personal conception about one's ability to accomplish a certain task (Bandura, 1986). Self-efficacy is one of the main themes in current research, primarily because of its predictive power and application for practically any behavioral task (Graham & Weiner, 1996). Self-efficacy is related to motivation that leads to successful self-regulated learning. As Bandura observed: "People regulate their level and distribution of effort in accordance with the effects they expect their actions to have. As a result, their behavior is better predicted from their beliefs than from the actual consequences of their actions" (1986, p. 129).

Self-efficacy is situational and task-specific (Pajares, 1996). For example, learners with a high self-efficacy in math can have a low self-efficacy in science. Learners are likely to make more effort in domains in which they have high self-efficacy and show relatively little effort and persistence in those in which they have low self-efficacy (Morrone & Schutz, 2000; Dai, Moon,

& Feldhusen, 1998). Learners who lack self-efficacy in a certain domain tend to be more anxious about learning in the domain (Meece, Wigfield, & Eccles, 1990). When learners have high self-efficacy for certain activities and tasks, they tend to work longer and harder on those activities and tasks despite the difficulties they face.

Setting short-term and specific goals can enhance students' self-efficacy because short-term goals look more manageable to students and specific goals provide a clear and specific guide for the type and amount of effort needed to accomplish the goals (Bandura, 1986). Completing a series of short-term goals often requires fewer steps, and results in fewer errors, than trying to devise and implement a global plan for reaching the long-term goal.

Another way to enhance students' self-efficacy is to provide a model that students can observe (Schunk & Zimmerman, 1994). Students obtain efficacy information by socially comparing their performances with those of others. The more similar others provide the more valid basis for comparison. Observing similar peers perform a task successfully may raise observers' efficacy.

Persuasive information suggesting that the students are able to perform a task successfully like "You can do it" from teachers, parents, and others, may also enhance the students' self-efficacy (Schunk & Ertmer, 2000). But if the students subsequently fail to perform, such information may be negated because it is important for them to experience their success. Therefore, it is important to help them success to perform by providing other strategies like mentioned above in addition to giving persuasive information.

To summarize, motivation is another requirement in self-regulated learning. Self-efficacy is one of the important constructs of motivation. To help students enhance self-efficacy can improve students' self-regulated learning.

Principle 4: Provide Students with Resources and Help Seeking

"Resources are media, people or ideas that have potential to support learning" (Hill & Hannafin, 2001, p. 38). According to this definition, resources can include information that is used as content to be learned, information about strategies that can be used to learn the content, or any persons who are available to assist with the learning process. In this study, human resources related to help seeking are dealt with as resources to support learning.

Humans are dynamic resources that have characteristics of frequent, sometimes continual, change rather than static resources that have stable content like print-based textbooks and newspaper articles (Hill & Hannafin, 2001). The human resource may be an expert or a peer who is more knowledgeable in a particular subject area. The human resources may be very powerful resources to help learning in that they can give adaptable help to the students depending on their specific needs and situations.

Human resources are definitely necessary for help seeking. Help seeking is one of the important characteristics of good self-regulated learners (Zimmerman, 1998). Until recently, help seeking was assumed as an indicator of students' incompetence, dependence on others, and immaturity. Help seeking is now often viewed as necessary or instrumental for learning (Newman, 2000). "It has been demonstrated that when children monitor their academic performance, show awareness of difficulty they cannot overcome independently, and exhibit the wherewithal and self-determination to remedy that difficulty by requesting assistance from another individual, they are exhibiting mature, strategic behavior" (Newman, 2000, p. 351). When students face academic difficulties that cannot be overcome on their own, seeking help from teachers and more knowledgeable peers plays a critical role in successful learning by

maintaining tasks, averting possible failure, and optimizing students' chances for mastery and autonomy (Newman, 1998; 2000).

Peer help has many advantages for learning as well as expert or teacher help especially in learning that emphasizes the role of learners. Greer, McCalla, Cooke, Collins, Kumar, Bishop, and Vassileva (2000) pointed out the four benefits of peer help:

> First, it is deeply situated in a shared context and can therefore provide a stronger learning experience for the person who is seeking help. Second, it promotes processes of self-explanation (Chi, de Leeuw, Chu, & La Vancher, 1994) and reflection in the helper, and in this way reciprocal learning takes place (Nicoles, 1993). Third, it is cost effective, since it uses the learners themselves as a teaching resource. Fourth, it facilitates social interaction in a group of learners and helps to create knowledge-anchored personal relationships among them (p. 69).

It is important, however, for students to be able to identify who is available to help them. "If they did not know a potential helper, they would not know whether the helper was currently available, which could mean a loss of time and a loss of immediate context in which the problem had arisen" (Greer, et al., 2000, p. 70). To provide the information about available human resources may promote help seeking and reduce the time to search for the more knowledgeable others.

To summarize, help seeking is an important activity of good self-regulated learners when students face the difficulties that they cannot tackle by themselves. To facilitate help seeking by giving information about the available personal resources can support self-regulated learning.

Computers as Cognitive Tools

In this section, the definition of the cognitive tools and rationales for using the cognitive tools are presented. Then, the potential of the Web as cognitive tool is discussed. Finally, previously developed computer tools that support self-regulated learning are reviewed.

The Definition and Theoretical Foundations of Cognitive Tools

"Cognitive tools refer to technologies, tangible or intangible, that enhance the cognitive powers of human beings during thinking, problem solving, and learning" (Jonassen & Reeves, 1996, p. 693). Salomon (1993b) characterized the computer as a cognitive tool by suggesting how the computer can become a partner with the novice learner by providing guidance or a scaffold as the novice undertakes a complex task. For example, a computer can emulate the typical cognitive processes and behaviors of an expert, and be programmed to intervene whenever a non-expert learner falters during an attempt to do something difficult and complex.

The role of the computer as a cognitive tool reflects the social help described in Vygotsky's (1978) "zone of proximal development." The concept of the zone of proximal development assumes that there exist two developmental levels: one level that is the actual development level already achieved by a learner and another level that is the potential level of development that can be achieved by a learner with help. Cognitive tools can play roles similar to those of social sources – parents, teachers, siblings, friends, and classmates.

Rationales for using cognitive tools in teaching and learning environments vary according to the purposes of their uses. Among them, the following rationales are thought to be especially important for using technology, especially computers and related technologies, to support self-regulated learning: learning "from" and "with" technology, distributed cognition, and effects "of" and "with" computers. Each rationale is described in the following sections.

Learning "From" and "With" Technology

Reeves (1996) argued that the failure of technology to become an integral component of educational practice stems primarily from misunderstandings about appropriate roles for technology. According to Reeves, technology in education can be used in two ways.

Technology can be used as something that people learn “from,” and the other way is as something that people learn “with.”

In terms of the “from” technology perspective, learners can be facilitated in their learning by having content explicitly taught by a software package. In this case, technology is regarded as forms of instructional media that communicate information, transmit knowledge, or tutor students (Reeves, 1996). Content to be learned are incorporated into the software itself. Skills are often acquired through activities embedded in the software environment which explicitly requires the practice of those skills, as is common in CAI and drill and practice software. When a learner learns from technology, the content and skills to be learned are already prescribed and delivered by the software. That fact means that the software itself is doing the teaching.

This perspective of using technology (i.e., learning from) is related to the general disappointing results of educational technology since it was first introduced early in the 20th Century (Cuban, 1986). Research generally indicates that the ability that is acquired and enhanced through using technology in the “from” perspective can be just as easily acquired in traditional teaching and learning environments such as the classroom. Most of the research literature indicates no significant differences between technology-based instruction and classroom-based instruction (Clark, 1994). Although at first this may seem surprising, it really is not once one considers that the “from” approach engages the same passive cognitive processes regardless of whether they occur within a classroom or on a computer screen. For technology to be more effective, it must engage new and more powerful cognitive processes.

In contrast, the “with” technology perspective in education largely involves the application of technologies as cognitive tools. This view is related to the power of technology to enhance an individual's capability and efficiency when working on other materials and tasks.

When computer programs are used in terms of the "with" technology perspective or as cognitive tools, learners use software to analyze problems or tasks, organize knowledge representations, and share what they have learned with others (Reeves, 1999). In this sense, technology includes the range of supportive devices and programs from word processing to statistical packages to multimedia authoring systems. These different support tools can provide learners with different options of how they engage in their work. The perspective of technologies as cognitive tools can be used to help learners take more responsibility for their learning and to help them focus their cognition on higher order thinking processes such as problem-solving. Cognitive tools are especially important in constructivist learning environments in which learners actively construct and change their own mental model through interactions with authentic problems or complex real world tasks.

Distributed Cognition

The concept of distributed cognition, or distributed intelligence, is important to cognitive tools in two points. First, it emphasizes the release of human cognition from a vast amount of memorization work that has been thought to be a main part of learning for many centuries. It gives legitimacy in using computers as cognitive tools. Another point is that the concept is well matched with social constructivism, which emphasizes knowledge construction through interaction with social environments.

Distribution of cognition involves off-loading cognitive processes onto others or onto technical implements (Salomon, 1993a). When a person performs a task or solves a problem, it is often done with the aid of other resources. These other resources can be (1) books; (2) the World Wide Web; (3) other people such as peers, subject matter experts or teachers; (4) simulation and modeling computer programs; (5) communication modes such as telephones,

emails, and bulletin boards; (6) reporting vehicles such as print, PowerPoint, and Web-authoring tools; and (7) electronic performance support systems. The knowledge brought to bear on the task can be said to be distributed among the individual and these other resources – reference materials, computers, other people, and so forth.

The concept of distributed intelligence is related to the concept of distributed cognition (Pea, 1993). The idea of distributed intelligence is to think of people (and the machines they create) as acting intelligently, rather than possessing intelligence (Pea, 1993). According to this theory, before doing some authentic task, people cannot be said to have intelligence, nor can their intelligence be measured. Being able to do a task is different from actually doing the task. There are many tasks that people cannot do without resources or technology, such as write a literature review. However, with the proper resources (e.g., a library and a professor) and technology (e.g., a computer with word-processing and Internet access), this complex task can be accomplished. That is, a person can do this intelligent task because distributed intelligence enables activity. Distributed intelligence means that the resources that shape and enable cognitive activity are distributed across people, the environment, and the learning situation itself.

When learners use computers as intellectual partners that share the cognitive burden, they off-load some of the unproductive memorizing tasks and the time consuming calculations to the computers. Although some might worry that this partnership makes learners too dependent on the technology to perform without it, many contemporary performances are meaningless without the technologies that enable them (Jonassen & Reeves, 1996).

Effects With and Of Computers

According to Salomon (1992), there are two different kinds of effects that humans can get through interaction with computer-based learning environments. He labeled these effects as "with" and "of" working with computers, respectively.

Effects "with" computers refer to those changes in performance that become possible during intellectual partnership with computers (Salomon, 1992). A computer tool may well increase the chances that learners engage in higher order thinking, when it affords, for example, complex modeling for global climate (see Spitulnik, Krajcik, & Soloway, 1999), that could not possibly have been done without the computerized model-building tool (e.g., Model It). This activity becomes possible when the computer tool shares with learners some of their cognitive load through a process such as complex modeling. These are amplifications of learner's cognitive powers that are attained with the computer and during activity with it.

Effects "of" computers refers to the changes that pertains to the cognitive residue that the partnership with the computer tool might leave behind in the form of improved mastery of skill or strategy or a better developed ability (Salomon, 1992). Learners may come to be better able to think systemically like the expert climate scientists after they experienced the climate modeling activities by using a computer-modeling tool even though they still cannot build or run the climate model without a modeling tool. The idea of effects "of" is in parallel with the argument of Perkins (1993). He argued that higher order knowledge should be acquired after learning in the environments based in distributed cognition.

If the effect of learning "with" technology were the goal, then a designer would design systems that are as clever as he or she could make them such that the joint performance of person

and computer is maximally intelligent. If the effect "of computers" is the goal, then a designer would want to design systems that make the human partner more intelligent, not a joint system.

Web as a Cognitive Tool

Since the publication of "The Computer in the School" (Taylor, 1980), several changes have been made in the uses of computer technology for educational purposes. In the late 1970's, when the tutor, tool, tutee framework was suggested by Taylor, intelligent tutoring systems (Tutor mode) and computer programming (Tutee mode) were relatively dominant. Taylor's view focused on computers as a productive tool. On the other hand, today, due to the easy accessibility to the personal computers equipped with multimedia and Internet access, the more various types of computer technologies show their potential as powerful cognitive tools.

One example is the advent of the World Wide Web, which combines the wide distribution capabilities of the Internet with hypermedia. The Web also integrates many of the communication technologies such as email, and synchronous and asynchronous conferencing. Many successful non-Web based systems are also going "online," making their tools and resources accessible via the Web (Sugrue, 2000). The Web has become "a universal metaenvironemnt for learning" (Sugrue, 2000, p. 133), and can be used as a cognitive tool in a variety of ways. Its most frequent instructional use is an information base. Another prominent educational use of the Web is to increase and broaden communication between learners and learners, learners and teachers, and teachers and teachers. Several of these strategies for using the Web as a cognitive tool are described in the following sections.

Information Base

The Web provides learners with relatively easier and faster access to a vast amount of information resources than any other tool. This is the most general use for learning and

instruction as an online library of unlimited hyper-linked information that learners can access from any computer or even a PDA with an Internet connection and a browser such as Explorer or Navigator. Further more, the Web has not only static information such as simple text and pictures but also dynamic information such as simulation and animation because almost all kinds of computer programs that have been developed can be adapted to the Web.

The information on the Web is provided in hypermedia format. Hypermedia consists of information nodes of multimedia - texts, graphics, sounds, video clips, etc. In many hypermedia systems, users navigate through the knowledge base by selecting nodes linked within the system, and they can even modify nodes themselves (Jonassen & Carr, 2000). In a traditional classroom, instructors represent ideas in a linear narrative form, which reveals the underlying structure of their ideas. This narrative basically comes from their personal understanding of the concepts. However, hypermedia technology like the Web can present ideas in almost any mediated form (Harper, Hedberg, Corderoy, & Wright, 2000). Therefore, students can capitalize on information that is best matched with their cognitive and personal learning styles. Students may be able to create their own meanings and understandings of the phenomena they encounter while roaming through the multimedia resources of the Web.

Information resources take two predominant forms: static and dynamic (Hannafin, Hill, & McCarthy, 2000; Hill & Hannafin, 2001). Static resources are fixed and immutable recordings of ideas, facts, and beliefs at a specific point in time. For example, printed textbooks, magazines, and encyclopedias are the static resources. Though static resources are useful for standardized information, “the data presented in static resources can quickly become obsolete or inaccurate, particularly in rapidly changing fields” (Hill & Hannafin, 2001, p. 42). Dynamic resources, on the other hand, are changeable and mutable. Many Web-based resources are

dynamic. This abundance of dynamic resources has come from the relative ease with which materials can be developed and updated. Even students, alone or collaboratively, can present their ideas in text or multimedia form more easily on the web than with any other self-publishing technique in the past (Berge, 1999). This feature of the Web enables the information continuously updated from hourly (e.g., weather information on the Web), to several time a day (e.g., newspapers on the Web) (Hill & Hannafin, 2001). The legitimacy and accuracy of such dynamic sources must be examined closely.

Communication

The use of the Web made one widely recognizable shift in how students learn using computers in education. On the Web, students can collaborate on tasks more easily with the communication technologies than ever before. E-mail, online chat groups, electronic discussion groups, and bulletin boards are common examples that can be used as communication tools in the Web. The value of using these communication technologies for educational purpose is widely cited (Bonk & Reynolds, 1997; Dede, Whitehouse, & Brown L'Bahy, 2002; Harasim, Hiltz, Teles, & Turoff, 1995).

The communication technologies of the Internet enhance socially shared cognition through synchronous and asynchronous conversation between learners and learners, and learners and teachers. The interactions of learners can lead to a number of collaborative behaviors, many of which have the prospect of influencing learning outcomes (Oliver, Omari, & Herrington, 1998). General collaborative learning methods are amenable to the Web. A common structure for collaborative learning in a typical classroom is that students share their ideas with a partner or small group. This method can be easily applied to a Web-based environment. Students might have partners to exchange their thoughts and ideas, by email, regarding questions raised from an

instructor or their peers. In addition, the team might share their ideas by doing small group chatting and then post their ideas on the bulletin board for the entire class to review (Bonk & Reynolds, 1997).

More recently, Web-based communication tools have begun to focus on supporting collaborative activities among students, teachers, and even experts in a wider academic community. Some examples of these tools include TAPPED-IN, KIE, and CSILE. TAPPED-IN is designed for teachers to share ideas and resources at a distance (Derry, Gance, Gance, & Schlager, 2000). KIE (Knowledge Integration Environment) of which the current version is WISE (Web-based Inquiry Science Environment), is designed to support lifelong science learning (Linn, 2000). CSILE (Computer Supported International Learning Environments), of which the Web-based current version is Knowledge Forum, is designed for students and teachers to create a communal database for shared knowledge building (Scardamalia & Bereiter, 1994). Each of these environments enables the dynamic sharing of information amongst and between individual participants and teams.

Computer Tools to Support Self-regulated Learning

This section provides the review of the previously developed computer tools that support self-regulated learning to draw implications for the design and implementation of a Self-Regulated Learning Support tool (SRLS tool). Tools or systems reviewed through the related articles are STUDY (Field & Winne, 1997), and Project Based Learning Supporting System (Laffey, Tupper, Musser, & Wedman, 1998). It should be noted that research on cognitive tools or computer programs to support the self-regulated learning, however, is very limited, especially in the case of the research that says explicitly the purpose of the research related tools is to

support self-regulated learning. The points of focus in this review are functions or structures that the tools have in order to support self-regulated learning and the weak points of the tools.

STUDY

One example of a computer program designed to support self-regulated learning is Field and Winne's (1997) STUDY. Winne and Stockely (1998) describe the software, although this program is not yet completely developed and tested. The STUDY software is based on the Winne and Hadwin's (1997) 3 + 1 phase model of self-regulated learning. The 3 + 1 phase model illustrates self-regulated learning as an event involving three necessary phases and an optional fourth phase: perceiving the task, setting goals, enacting tactics, and adapting tactics for self-regulated learning. They discuss how computing technologies might support students within each phase in the 3 + 1 phase model of self-regulated learning. This tool targets various school levels and subjects. By using problem solving approaches, it tries to help students accomplish various tasks such as writing an essay.

STUDY has three main windows that students can use to easily manage their learning. STUDY provides the notebook window that has four regions or fields labeled "Key Terms," "Source," "URL," and "Analysis." The fields are used for summarizing and making notes on reading materials. This notebook window also helps students to find and manage information for their goals. Another window, the goal setting window, has five columns labeled "Conditions," "Operation," "Products," "Evaluation," and "Standards." Students put their own terms in each column and use these terms to state their goals. This goal setting window supports students to set a specific goal with templates.

The third window, the "SOLVER" window, has three panels named "Tasks," "Methods," (tactics), and "Ratings." In the panel of "Tasks" are the tasks such as essays, experiments, and

drawing data. Depending on the task selected, the "Method" panel lists tactics that the students use to do the task. The students can make their own tactics and put them in the panel. And they also copied the tactics of peers and the teacher.

Perceiving task and setting goal, the first two phases of STUDY, help students set their goals based on task analysis. The enacting tactics phase emphasizes the importance of students' planning on how to achieve their goals using learning strategies. Finally, adapting tactics phase leads students to reflect on their progress and to check the appropriateness of the tactics they employed to achieve the goals and decide whether to keep their strategies or adapt their strategies.

STUDY supports goal setting, note-taking, and planning. It also provides a strategies database to which students can refer and save their own strategies that can be shared with peers. In terms of its interface design, it uses templates with labels that give structure for activities to guide students to successfully engage in self-regulatory activities.

Project-Based Learning Support System (PBLSS)

Laffey et al. (1998) developed a computer-mediated support system as a suite of integrated, Internet-based client-server tools: Project-Based Learning Support System (PBLSS). PBLSS is designed to support the collaborative project-based learning of K-12 through postsecondary students. The authors did not explicitly mention that the system supports self-regulated learning, but, because it provides supports for students to regulate the project by themselves, it is valuable to review the tool. The tool is designed to provide both the intelligent support for the processes of doing a project and a shared dynamic knowledge base for working and learning in a community-supporting project-based learning.

The interface of PBLSS is designed to broadly scaffold students to follow the steps of a project such as setting goals, breaking complex goals down into achievable objectives, planning for these objectives by allocating time, and planning for the resources that must be available for the objectives. The system provides topic-based discussion groups based on the assumption that social discourse can provide ongoing stimulus for intellectual growth, challenge students to think about what they are doing, and spark reflection and restructuring of previous knowledge (Laffey et al, 1998).

PBLSS leads students to engage in setting a long-term goal, breaking it into short-term goals that are more achievable, and planning. It also supports reflection by allowing students to see every revision of their own documents (goals, plans, and other project documents) and revise them as well as by providing topic based discussion boards in which students can compare their idea and knowledge to those of others. From the interface design, the importance of template with labels mentioned in STUDY tool is emphasized again.

Strengths and Weakness of STUDY and PBLSS for Supporting Self-Regulated Learning

One of the strengths of STUDY is that it is based on a specific self-regulated learning model, Winne and Hadwin's (1997) 3 + 1 phase model. It tries to support various self-regulatory activities described in the model. It also has a note taking function which supports reading and writing as the model is based on an information processing view of self-regulated learning.

PBLSS has a strong point in that it is specifically designed to help students manage their project while STUDY is designed to be used with various learning tasks in various subjects. Another strength of PBLSS is that it is Web-based. It can be accessed from any computer which has an Internet access and a Web-browser.

Both of these two tools have also some weak points. In the case of STUDY, to support many activities described in the model, it opens many windows on a screen. While the windows contain important information, too many buttons, labels, and windows on a screen may cause cognitive overload, which can be contrary to the purpose of the tool. For example, in Grabinger's (1993) study, he asked students to rate 20 different computer screens. He found that a screen that has many buttons on it produces cognitive overload from the students' responses. Another weakness is that STUDY is developed as a specific computer software application, which means that students need to have the specific application on their computers to use the tool. Using the Web as a platform can allow easy access from anywhere (school or home) as long as the students have Internet access.

PBLSS is designed based on a specific task-based approach to guide project-based learning process. Because the main purpose of the tool is to support project-based learning, even if the tool has relevant functions that are considered to support self-regulated learning, the researchers did not investigate how the tool supports self-regulated learning.

Another point to be considered with these two tools is that learner-support tools like these two tools may not always provide obvious advantages to students who need specific help for a particular task. This implies that the tool should be tightly woven into the curriculum (Laffey et al, 1998). For example, IPSRT (Instructional Planning Self-Reflective Tool) (Kitsantas & Baylor, 2001) supports task-specific monitoring and evaluating in that the tool provides a specific checklist for the planning stage of instructional design.

Summary

Self-regulated learners can be defined as learners who can set personal goals for learning, make plans to achieve the goals through which learners select the strategies to use, and make

decisions about the order to implement the strategies. As learners move toward their goals, they monitor their progress, cognition and motivation. If they find their progress toward their goals does not follow their plans or they encounter obstacles, they can try to modify the plans or even give up the initial goals, to manage motivation, seek help, and adjust their strategies for making progress. To support this process, this review proposed four principles based on the related literature. Two SRLS tools were also discussed in order to examine how computers can be used to help learning as cognitive tools and what efforts of using computers have been done to support self-regulated learning.

CHAPTER III.

METHODS

Overview

This study was designed to understand the use of a Self-Regulated Learning Support tool (SRLS tool) in a postsecondary educational software development course which was student-centered, in order to design a better learner support system to help students to experience successful learning. For this purpose, the study was guided by the following questions throughout data collection and analysis.

1. How do students describe their perceived instrumentality (or utility value) on the use of a SRLS tool?
2. How do students engage in self-regulated learning activities provided by a SRLS tool (e.g., goal setting, planning, monitoring, evaluating, resources use)?
3. What factors appear to impact, and in what ways do they impact, the students' use of the SRLS tool (including the level of motivation and metacognitive learning strategies)?

The research questions of this study involved the impact of a SRLS tool on their learning. Thus, data collection and analysis concentrated on participants' interactions with the tool and the impact on their project process.

This chapter delineates the methodology for the study, clarifies the rationale behind the research decisions, and addresses inherent limitations and assumptions. This chapter starts with the description of a pilot study and a SRLS tool followed by the research design. After an overview of research design, specific research decisions concerning data sources, data collection

and analysis procedures are described. Finally, researcher's perspectives, general issues of credibility, and study limitations are addressed.

Pilot Study

A pilot study was conducted to determine the feasibility of implementing a SRLS tool within the context of a course and to identify any problems with software and hardware. The Web-based SRLS tool used in the pilot study was developed by the researcher and had limited features. The main features of the tool included the goal setting and planning, and the monitoring and reflection.

The pilot study employed a case study approach. The case was the course that provides the introduction to computer to pre-service teachers in spring, 2002. The students used the SRLS tool for their final project which was to create a Web-quest for their future students. The students spent approximately 3 weeks finishing the projects. The students were required to set goals for the projects 4 times and to reflect on the goal achievement 4 times through the SRLS tool. At the end of the course, participant opinions regarding the tool use were gathered through an open-ended questionnaire. It asked the participants such things as what they did and did not like about the elements of the tool, what helped them, what did not help them, whether they felt that the SRLS tool-related activities that were required of them were appropriate for their needs, what changes they would make if they could, and whether they felt they attained the objectives.

Results from the pilot study indicated that the SRLS tool played the intended role for supporting the learning despite some negative opinions from some of the students. One of the positive remarks about the tool was that it helped motivate the students to get the task done. The tool informed them of their accomplishment through monitoring and evaluating activities and it helped them continue to complete their tasks. This finding is in parallel with the literature on

self-efficacy. The experience of successful performance enhances self-efficacy and it helps the students maintain motivation for the task (Schunk & Ertmer, 2000). It is also important to notice that the short-term goals helped students because completing a series of short-term goals often requires fewer steps, and results in fewer errors.

Another positive remark related to the SRLS tool is that it assisted with time management. Students indicated that continuous planning and monitoring helped keep them on track. It helped the students organize thinking into priorities by facilitating the division of one big thing (long-term goal) into small parts (short-term goals), and to order the small parts to achieve the big thing. The tool also helped the students' reflection on the project process. Through the reflection, some of the students reported they tried to figure out why they did not do good work this time and how to improve next time.

Two important factors that are regarded to affect the students' perception about the effectiveness and efficiency of the SRLS tool are the characteristics of the task and the individuals' motivation level. Some of the students among those who indicated the tool was not necessary reported that the project was too easy for them and three weeks were short enough not to use the tool. This implies that using the tool may be bothersome to the students if the task is too easy or needs a short period to finish it. Another negative remark was from those who felt that they were well motivated. They mentioned that they were motivated enough to complete the projects themselves without using the tool.

Although the tool used in the pilot study did not have all the functions that the researcher planned to include in the tool, the findings from the pilot test led to the major changes for the final study. First, the results of the pilot study influenced the sampling for the case in the main study. As indicated by participants in the pilot study, the case used for the final study should

have a long-term project that facilitates a need to use the SRLS tool. Results also indicated the necessity to investigate the interaction between the individual differences, the tool, and other factors like task characteristics.

Finally, after the pilot study, the researcher found a tool which was already developed that had many of the functions that the researcher planned to add to the SRLS tool used in the pilot study. Rather than spending additional time in development, the decision was made to use the already developed SRLS tool, Friday5s®. A detailed description of the tool is presented in the following section.

Description of Friday5s®

Friday5s® (http://www.friday5.com) was selected as a SRLS tool for the study. The Friday5s® tool was originally designed to support "follow through," the transfer of the learning from the training into real job situations in the corporate training field. Friday5s® provides functions to prompt employees to put learning into action and to let managers monitor progress and provide coaching. However, Friday5s® has potential to be used in various learning situations in which students have more control, flexibility, and responsibility for their learning. The course instructor and the researcher worked with the developers of the tool to adapt it for use in a higher education setting.

Friday5s® has several template forms which students use to do goal setting, planning to achieve the goals, and monitoring and reflection on the progress. Friday5s® uses various methods to help students to do those activities including e-mail reminders or prompts, shared reflections, coaching through peers and experts, and an embedded expert system called GuideMe®. The template forms, the frequency and the content of the email reminders, and the content of GuideMe® can be modified to meet the specific course needs by the instructor or

designer. Student access to each function is also controlled by the instructor or designer. Several key features of Frdiay5s are described below. Sample screens from Friday5s® are located in Appendix A.

Email Reminders. At selected intervals, Friday5s® automatically sends reminder email messages to individual participants, reminding them of their goals and providing a link to their group's private site where they can reflect on their goals and progress, and plan for the next steps. The instructor determines when the reminder email messages are sent to students.

Current Progress (Reflection). The Current Progress page is where students are guided to set or update goals, monitor and evaluate the progress toward the goals, and plan for next steps. Users can revise, complete, or add new goals at any time. The Current Progress page of Friday5s® has built-in scaffolds in the form of a template with guiding questions to help students with self-regulatory activities. Duffy and Cunningham (1996) defined scaffolding as any type of support for learning. This includes not only the support of other individuals but also "any artifacts in the environment that afford support" (p. 183). The functions of the Current Progress page help to create scaffolding for the students.

The template with guiding questions provide the structure and play a role of prompts that facilitate students to engage in the targeted activities such as goal setting, planning, monitoring, evaluating, and reflecting. The template also supports the function that Lajoie (1993) described as sharing "the cognitive load by providing support for lower level cognitive skills so that (cognitive) resources are left over for higher order thinking skills" (p. 261).

Metacognitive processes can be supported when the students can have a chance to recap their problem-solving steps by reviewing the artifacts they created as a representation of their internal thoughts. And when such physical representation provides opportunities for the learners

to inspect and reflect on their solution strategies, generalized metacognitive awareness is prompted (Lajoie, 1993). The Friday5s® tool can help students to engage in these processes by storing their artifacts such as the goals, plans, and reflections from the beginning.

These goal setting and planning activities are also expected to improve students' self-efficacy. Setting short-term goals involving specific performance standards is likely to lead to successful performance, and so to enhance self-efficacy and positive self-reinforcement because short-term goals look more manageable to students and specific goals provide a clear and specific guide for the type and amount of effort needed to accomplish the goals (Bandura, 1986; Schunk, 1990). Further completing a series of short-term goals often requires fewer steps and can result in fewer errors, whereas trying to devise and implement a broader global plan for reaching a long-term goal can be daunting and overwhelming.

GuideMe®. GuideMe® is an embedded expert system. In Friday5s®, GuideMe® helps convert learning into action by suggesting practical actions the user can take to make progress. Suggestions are tailored to the course content and user's objectives. The "Tell Me More" button on GuideMe® links the students to additional rationale, tips, and details that reinforce course concepts.

Coaching or Mentoring. Friday5s® facilitates getting and giving feedback. Each time a user completes an update, she or he can solicit feedback from a coach, mentor or instructor. The system sends an email to the coach or instructor with a link to the update and a built-in feedback form.

Shared Reflection. Friday5s® helps create a community of learners to continue the process of shared learning started in the formal course or meeting. Each person's updates are visible to all the others in the group, fostering group accountability and shared learning. Users

can quickly review all the goals in the system to find other people with similar objectives. By scanning others' updates and answers, users can discover the best practices of those making the most progress.

Research Design

This study followed an embedded single-case designed study approach that employed multiple methods (a quantitative questionnaire, interviews and artifacts) to answer the research questions. Case studies can be classified as 'single-case designs' or 'multiple-case designs', depending on whether it has only one case to be studied or more than one. Case studies can also be classified as "designed cases or naturalistic cases, depending on whether the situation under investigation is manipulated in any way by the researcher" (Reigeluth & Frick, 1999, p. 637). The case in this study is a designed case because a case (in this study, a class) was selected and provided with the SRLS tool.

Given that the goal of this study was to investigate the use of a purposely designed learning support tool in a real-life context and to understand the manner in which students interact with it in a real context, a case study is appropriate. Yin (1994) suggested the scope of a case study compared to three other research strategies: experiment, history, and surveys. A case study is an empirical inquiry that investigates a contemporary phenomenon within its "real-life context" while an experiment deliberately divorces a phenomenon from its context, so that attention can be focused on only a few variables. In a history research study, even though it investigates both the phenomenon and their context, it usually deals with non-contemporary events. Survey research, although it tries to deal with phenomenon and context, struggles to limit the number of variables to get a sufficient number of respondents. Case study is used to

explain the casual links in real-life interventions that are too complex for the survey or experimental strategies (Yin, 1994).

The case study approach used in this research is based on Yin's (1994) concept of case study. According to Yin (1994), "case study as a research strategy comprises an all-encompassing method – with the logic of design incorporating specific approaches to data collection and to data analysis. In this sense, the case study is not either a data collection tactic or merely a design feature alone (Stoecker, 1991) but a comprehensive research strategy" (p. 13).

In selecting research methods, Punch (1998) argued that "the matching, or fit between the research questions and research methods should be as close as possible, and that the best general way to do that is for methods to follow from the questions" (p. 19). Similarly, Howe and Eisenhart (1990) also contended that the method employed should be judged in terms of its success "in investigating educational problems deemed important" (p. 2). In other words, the methods we are trying to use should be based on what we are trying to find out through the research (Punch, 1998).

An embedded single-case design was used in this study. Yin (1994) distinguished case studies as "holistic" or "embedded," depending on whether it has a unitary unit of analyses or multiple units of analysis. If the purpose of a study is to examine the global nature of a program, it would be a holistic, whereas if it is to examine each of individual projects within the program and examine them in the case context, it would be an embedded (Yin, 1994). In this situation, even though a case study might be about a single class, the analysis included outcomes from individual participants within the class. The researcher conducted individual case analysis of all nine students in the case for in-depth analysis.

In this study, both qualitative and quantitative data collection methods were used to answer the research questions with the primary focus on qualitative methods. Far from being mutually exclusive, qualitative and quantitative mixed methods can increase the strength of the findings by adding complementarities to each method (Patton, 2002; Schutz, Chambless, & DeCuir, 2004; Yin, 1994). The benefits of using the multiple methods are various: corroboration in the results from different methods, complementarity in which focus is on studying different aspects of a phenomenon, advancing a study or program of research by using the result from one method to help guide the development of the next phase of research, opportunity to use the results for expansion, and opportunity to investigate potential paradoxes and contradictions that emerges from data (Schutz, Chambless, & DeCuir, 2004).

The main reason for employing mixed methods in this study was to look for complementarity by using a quantitative dimension mainly to define the characteristics of the participants based on which the participants' use of the SRLS tool was investigated. For example, this study used the MSLQ pretest to examine the level of self-regulated learning focused on motivation and metacognitive learning strategies. The data resulting from the questionnaire were used to find any relationship with the use of the SRLS tool of the participants. The research questions and the data sources are outlined in Table 3.1.

Table 3.1. Research Questions and Data Sources

Research Questions	Data Sources
1. How do students describe their perceived instrumentality (or utility value) on the use of a SRLS tool?	Interviews
2. How do students engage in self-regulated learning activities provided by a SRLS tool (e.g., goal setting, planning, monitoring, evaluating, resources use)?	Interviews, Artifacts
3. What factors appear to impact, and in what ways do they impact, the students' use of the SRLS tool (including the level of motivation and metacognitive learning strategies)?	Interviews, Artifacts, MSLQ (Complementary data)

Case Selection and Tool Customization

Purposeful sampling was used for this study to select a case within which a SRLS tool was implemented. As Merriam (1998) noted, purposeful sampling is based on the assumption that "the investigator wants to discover, understand, and gain insight and therefore must select a sample from which the most can be learned" (p. 61). For the purposeful sampling, the researcher was advised to establish the criteria to guide a sampling process (Goetz & LeComte, 1984). Based on the purpose of the study and the results from the pilot study, the following five criteria were set up and used to choose the case.

1. The course should have at least one personal or group assignment that should be conducted by the students themselves because this study seeks to find out how students use a SRLS tool in the learning environments that requires students manage and regulate their learning
2. Students in the course should be able to access the Web with ease because the SRLS tool is a Web-based tool. Access to the tool should not be another burden for their learning.
3. The course should make the use of the SRLS tool, especially the journaling part of the tool, required by the students. Unless the tool is required, the students might hardly use the tool because it will be additional work for the course. Data from another pilot study, which was conducted with EDIT6190 in spring 2002, indicated that if the tool use is optional, students tend not to use it.
4. The course should be offered at the postsecondary level. This is because the purpose of the study is to investigate the postsecondary students' use of a SRLS tool. Mentioned in the Chapter One, postsecondary students need self-regulated learning because they have relatively more freedom than secondary students in scheduling their learning.

5. The instructor should be the one who the researcher can collaborate with easily. As a designed case study, this study should integrate the use of a SRLS tool in a course. During the process of integration, collaboration between the researcher and the course instructor is critical.

The course in which the tool was used is EDIT6200, Learning Environment Design I. EDIT6200 is one of three courses in the Studio in the Instructional Technology Department (for more details see the course website: http://it.coe.uga.edu/studio). The main goal of this course is to apply the tools mastered in the EDIT6190 (Design and Development Tools) course and the instructional design principles learned in EDIT6170 (Instruction Design) by designing an individual project that leads to a motivational interactive learning experience for an intended audience (Rieber, Orey, & King, 2002). Students in EDIT6200 work independently with a client to develop the multimedia products. While there are weekly activities in the Studio and five mandatory class meetings throughout the semester, participants in EDIT6200 spend a considerable amount of time working on their own to complete the project.

Several requirements for EDIT6200 are currently in place to assist students with the completion of their projects. First, several deadlines have been established so that students turn in components of their projects throughout the semester. Second, EDIT6200 students are required to write weekly "15/5" project reports. Given its name because it should take no longer than 15 minutes to write and 5 minutes to read, this weekly "15/5" project report is meant to summarize the weekly progress of the student's client-based project. The report addresses five questions: "1. What are my overall goals?", "2. What did I accomplish this week?", "3. What are my short term goals for this week?", "4. What do I need to do to reach my goals for this week?",

and "5. What resources/assistance do I need to help me reach my goals?" Finally, EDIT6200 participants are encouraged to attend bi-weekly "On the Boards" meetings. These sessions are designed to be a forum where students can share their successes, challenges, and specific components of their projects for comments and feedback.

The current scaffolding activities embedded in EDIT6200 have been beneficial in helping facilitate students' self-regulation of a complex open ended task. However, the activities have not been as successful as anticipated. One reason may be that many EDIT6200 students are not located near the campus, making it a challenge to come to sessions like "On the Boards" – particularly since they are optional. Another reason may be that, although 15/5s and deadlines are in places as requirements, students work independently and somewhat in isolation to meet these requirements. There is no weekly meeting to help motivate and remind students to take action (Hill, personal communication, 2002).

The Friday5s® tool holds considerable promise for helping to overcome the challenges associated with working in the EDIT6200 environments. The Friday5s® tool also instantiates the four principles needed to support self-regulated learning described in Chapter Two (see Table 3.2 for an overview).

Table 3.2. Principles and Elements of Friday5s®

Principles	**Elements of Friday5s®**
Support students to set goals to guide their learning	Template with guiding question in Current Progress, Coaching, GuideMe®, Shared Reflection
Support students' metacognitive activities including planning, monitoring, and evaluating	Template with guiding question in Current Progress, Trigger Email, Coaching, GuideMe, Shared Reflection
Help students to sustain their motivation by enhancing self-efficacy	Short-term and specific goal setting, Coaching, Shared Reflection
Provide students with resources and help seeking	Links to Resources, Shared Reflection, Coaching

The Friday5s® tool was customized to meet the specific needs of the course. The first customization included setting a specific implementation plan. After a discussion with the course instructor and an analysis of the learning tasks, the Friday5s® reports were required weekly as the course required the weekly 15/5 reports. Because self-regulated learning requires continuous monitoring of progress toward goals and revising students' plans based on the monitoring and evaluation (Pintrich, 2000), the interval to do these self-regulatory activities should be short enough to manage their learning. This also parallels the reason of setting short-term goals to achieve the long-term goal.

The second major customization took place with the guiding questions in the Current Progress page that can help students with self-regulatory activities. Even though Friday5s® has "Current Progress" page where students are guided to set goals and plan to achieve the goals through the guiding questions, the guiding questions should be prepared to be used in the specific context. The instructor and the researcher prepared the questions to meet the needs of the course. The followings are the questions that were provided in the "Current Progress" page according to the learners' progress towards each goal they set up:

- What have you done to make progress on this goal?
- What do you need to do to reach your goal for the coming week?
- What has been your most significant accomplishment on this project?
- How much progress have you made on this goal?
- What has proven most valuable to you from this experience?
- What was your most important lesson learned?
- What resources / assistance do you need to help you reach your goals for the coming week?

- What do you consider your greatest accomplishment in completing this goal?

The third major customization occurred with the GuideMe® function. The content of GuideMe® were prepared by the instructor and the researcher to specifically meet the needs of the learning tasks for the course. The main content in the tool was information related to the design and development of educational software based on a model proposed by Alessi and Trollip (2001). The main components of this model include: planning, design, and development. Content for evaluation was also provided by specifying the development of the model.

Finally, the current course Web site was linked in Friday5s®. The current Web site has various menus such as the course calendar with specific requirements and events, the resource page that has a directory of human resources available and a list of online tutorial for the various tools such as Director, Flash, DreamWeaver, etc. The instructor and researcher felt it was important to provide easy access to this information.

Data Collection

To identify and describe how a Self-Regulated Learning Support (SRLS) tool was used to facilitate and support students in an educational software development course, several different sources of data were gathered: student general information questionnaire, artifacts, open-ended questionnaire, and interviews. In addition, the Motivated Strategies for Learning Questionnaire (MSLQ) by Pintrich, Smith, Garcia, and McKeachie (1991) was used for measuring students' motivation and metacognitive learning strategies.

A flowchart of the data collection is displayed in Figure 3.1, followed by a detailed description of data collection procedures.

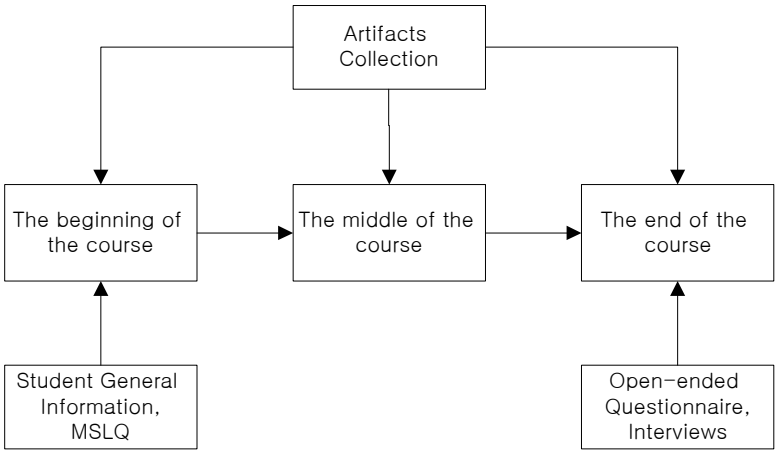

Figure 3.1. A flowchart of data collection

Week 1: An introduction to the SRLS tool was given to the EDIT 6200 students. PowerPoint Slides and the Friday5s® Web site were used during the session. This introduction included what Friday5s® is, an explanation of the features, and an overview of how to use it. An introduction to the research study was also given to the 9 students. The session took about 30 minutes.

Week 2: 8 students were told about the Friday5s® tool again, and had a question and answer session about the Friday5s® tool with the instructor. Although the SRLS tool itself was designed to help students to set short-term and specific goals, the students were encouraged to set short-term goals during this session, too. The students were informed of the research again. The consent form (see Appendix B) and the modified MSLQ were distributed to the 8 students. All 8 students attending the session volunteered to participant in the research and allowed the researcher to use the data collected from the study. The consent form and the modified MSLQ were collected. It took approximately 15 minutes for students to review the consent form and answer the questionnaire.

Week 3: The researcher met with a student who did not attend the last week session and explained the research briefly. He also agreed to volunteer to participate in the research. He returned the signed consent form with the answered and modified MSLQ. The student general information questionnaire was sent to each participant and collected by email.

Week 13 through 15: The open-ended questionnaire was distributed and collected. Interviews with individuals were conducted.

Week 1 through 15: All the journal entries (artifacts) created by the students and the log data in the SRLS tool were collected.

MSLQ

The modified Motivated Strategies for Learning Questionnaire (MSLQ) was administered to measure students' motivation and learning strategies in the early stage of the semester (see Appendix C for a sample). The original MSLQ was developed by Pintrich, Smith, Garcia, and McKeachie (1991). The MSLQ is a self-report instrument designed to assess college students' motivational orientations and their use of different learning strategies for a college course. There are 3 sections in the MSLQ. Part A consists of 31 items that deal with students' motivation. Part B includes 31 items regarding students' use of different cognitive and metacognitive learning strategies. Part C includes 19 items concerning resources management learning strategies. Each section has various sub-scales. For example, Part A includes intrinsic goal orientation, extrinsic goal orientation, task value, self-efficacy, and so forth. Students rate themselves on a 7-point Likert scale (1=not true of me, to 7- very true of me).

Students can be asked to do any one, two or all three parts of the MSLQ depending on the purpose of using the instrument. Additionally, the fifteen different sub-scales on the MSLQ can be used together or separately. The total fifteen sub-scales, the number of items for each scale,

and alphas are shown in Table 3.3. The alpha is Cronbach alpha score. This alpha ranges in value from 0 to 1 and is used to describe the reliability of factors extracted from dichotomous and/or multi-point formatted questionnaires or scales (e.g., rating scale: 1 = poor, 7 = excellent). The higher the score, the more reliable the generated scale is.

Table 3.3. The Scales of the Original MSLQ (Pintrich, 1991)

Scale	Number of Items of Original MSLQ	Alpha of Original MSLQ
Intrinsic goal orientation	4	.74
Extrinsic goal orientation	4	.62
Task value	6	.90
Control of learning beliefs	4	.68
Self-efficacy for learning and performance	8	.93
Test Anxiety	5	.80
Rehearsal	4	.69
Elaboration	6	.76
Organization	4	.64
Critical thinking	5	.80
Metacognitive self-regulation	12	.79
Time and study environment	8	.76
Effort regulation	4	.69
Peer learning	3	.76
Help seeking	4	.52

Because the original MSLQ was developed more than 10 years ago and the items appeared too general to measure the students' motivation, metacognitive strategies, and resource managements in a specific context, the original MSLQ was modified by the researcher along with two other experts. First, 9 subscales that were relevant to the research were selected among the 15 ones. The 9 subscales selected included: Intrinsic Goal Orientation, Extrinsic Goal

Orientation, Task Value, Control of Learning Belief, Self-Efficacy for Learning and Performance, Metacognitive Self-Regulation, Time and Study Environment Management, Effort Regulation, and Help Seeking. The subscales for cognitive learning strategies were excluded because the purpose of the course was not focused on factual knowledge acquisition. The Test Anxiety subscale was also excluded because the course did not have a test. Finally, the Peer Learning subscale was omitted for two reasons: (1) to reduce the total number of items, and (2) because it was very related to the help seeking sub-scale, which was more suited to the research.

In the case of motivation subscales, it was decided to use Peng's (1999) modified items. Peng administered the motivation subscales of original MSLQ for pretest and posttest in his research. To test the validity of the original MSLQ in his particular contest, Peng modified the items by rephrasing the items to fit into the context of multimedia design and implemented the modified ones between pre-test and post-test of the original MSLQ (5 weeks after the pretest and 2 weeks before the posttest). Based on the correlation coefficients between the both the results of pretest and posttest of the original MSLQ and the results of the modified MSLQ, the modified questionnaire was correlated to original one in a positive manner.

In the case of other subscales, the researcher modified items by rephrasing the items as Peng's (1999) changed the item "In a course like this, I prefer course material that really challenge me so I can learn new things." to "I like the challenge of creating multimedia because I can learn new things." The number of the items for each scale was changed. The modified questionnaire was checked with other two experts. The layout and format of the modified questionnaire were the same as in the original MSLQ. The total nine sub-scales and the number of items for each scale of the modified MSLQ are shown in Table 3.4.

Table 3.4. The Modified MSLQ

Section	Scale	Number of Items
Motivation	Intrinsic Goal Orientation	3
	Extrinsic Goal Orientation	3
	Task Value	3
	Control of Learning Beliefs	3
	Self-Efficacy for Learning and Performance	3
Metacognitive Strategies and Resource Management	Metacognitive Self-regulation	6
	Time and Study Environment	6
	Effort Regulation	3
	Help Seeking	4
Total	9 scales	34

Student General Information Questionnaire

An information questionnaire was used to collect basic information about the students for the study (see Appendix D). In addition to the personal demographic information (e.g., name, major, age, and native language), students described their learning style and teaching experiences (if they had any). The student general information questionnaire was the major source of demographic information about the participants and their individual differences in how they believe they learn.

Artifacts

Merriam (1998) stated that the artifacts are a ready-made source of data easily accessible to the researcher. Artifacts are valuable not only because of what can be learned directly from them but also as stimulus for paths of inquiry that can be pursued only through direct observation and interviewing (Patton, 2002). In this study, the artifacts included the process artifacts that were created from the students' journaling activities that were guided by the SRLS tool, the product artifacts that students created as course assignments, and miscellaneous artifacts

including other documents related to the course and its assignments that the instructor provided to the students. Each artifact is described below.

Process Artifacts

The process artifacts were used to see how students engaged in self-regulated learning activities provided by the SRLS tool, such as goal setting, and metacognitive activities. More specifically, the process artifacts helped answer the following research questions: "How do students engage in self-regulated learning activities provided by a SRLS tool (e.g., goal setting, planning, monitoring, evaluating, resources use)?" and "What factors appear to impact, and in what ways do they impact, the students' use of the SRLS tool (including the level of motivation and metacognitive learning strategies)?"

The process artifacts are a kind of researcher-generated artifact (Yin, 1994) because the artifacts were created during using the SRLS tool that was selected and modified by the researcher. All 9 participants' artifacts, created by using the tool, were collected. In addition, because of the SRLS tool's management function, the researcher collected the students' log which included when they used the tool and what pages of the SRLS tool they visited (see Appendix E for examples). The completion of the updates in the SRLS tool accounted for 10% of the final grade for each student.

Product Artifacts

The product artifacts were collected to see if there were any relationships between the use of the SRLS tool and the quality of the final products. In addition to the final multimedia products, other design and development related artifacts were collected. These included the analysis and design documentation, flowchart, and initial screen designs (prototypes) (see Appendix F for examples). These artifacts were provided in the form of Web-based products

(e.g., Web pages, Flash files) linked to Web sites by the students. The researcher downloaded all the files for each participant on a personal computer for future use. The product artifacts accounted for 40% of the participants' final grade.

Miscellaneous Artifacts

Various documentation materials were used as rich information about the context in which the tool was integrated and the self-regulated learning related activities engaged (e.g., help seeking and providing assistance). The documents included the course syllabus and electronic mail communications through the course listserv. The instructor's evaluation and feedback on all of the students' assignments was also analyzed, which included feedback on reading assignments, service hours, desk critics, participation in the Special Interest Group (SIG) sessions and the Interactive Museum (IM) sessions, 6210 team, WWild Team contribution, On-the-Board meetings, and the reflections on their project. Among these artifacts, the documentation Web pages created by the participants were downloaded onto the researcher's personal computer and stored for future use.

Open-Ended Survey

A set of pre-defined open-ended questions was administered at the end of the semester after the implementation of the tool (see Appendix G). The survey asked the participants such things as what they did and did not like about elements of the tool, what helped them, what did not help them, whether they felt that the SRLS tool-related activities that were required of them were appropriate for their needs, what changes they would make if they could, and whether they felt they attained the objectives. The table 3.5 shows the questions with rationale for the open-ended survey.

Table 3.5. Open-Ended Survey

Questions	Type of question and purpose
Do you think the self-regulated learning support tool helped you manage your learning? Why or why not?	Opinion question to obtain information on whether the tool helped the respondent manage learning.
What activities of the tool do you think helped your learning most and why?	Presupposition question to obtain information on what elements of the tool were most effective to help learning.
What changes would you like to make in the self-regulated learning tool if you could?	Opinion question which seeks recommendations for change or improvements to the tool.
Would you recommend others using this tool for their learning? Why or why not?	Projective question which asks the respondent to take on the role of 'expert'.
Did you have any problems using the self-regulated learning support tool? If so, what were they?	Experience question which seeks any technical or usability problems using the tool as formative data.
If you had problems, did this have any influence on your thoughts about the tool?	Experience question to check if technical or usability problems affected the opinion about the tool.
How helpful do you think the tool-related activities such as goal setting, self-evaluating, and reflections are for managing your learning?	Presupposition question to obtain information on whether students get help for planning as they used the tool.

Interviews

At the end of the course, students' opinions regarding the research questions were elicited through interviews (see Appendix H for the interview protocol). For this study, eight students who were involved in the class were interviewed because Danica did not participant in the interview. Each interview took around 30 minutes. Six interviews were conducted face-to-face, while two of them were conducted through telephone. All interviews were recorded and transcribed by the researcher. To improve the accuracy of the transcriptions, one native English speaker checked the errors and fixed them.

The interview protocol was designed for the researcher to probe the reactions and thinking of the participants about using the tool. More specifically, the interviews were used to

answer the research question “How do students describe their learning experiences with using the SRLS tool in terms of its instrumentality and self-efficacy?”, “How do students engage in self-regulated learning activities provided by the SRLS tool?”, and “What other factors appear to impact, and in what ways do they impact, the students’ use of the SRLS tool?” The interviews also provided complementary information to the data from alternate sources like artifacts to answer the research questions.

Patton (2002) emphasized the usefulness of the interview in that through the interview the research can find out information that may be difficult to determine in any other way. Interviews have been broadly categorized into several kinds by researchers in several ways. Patton (2002) distinguished that there are four approaches to qualitative interviewing: (1) an informal conversational interview; (2) an interview guide approach; (3) a standardized open-ended interview; and (4) a closed, fixed-response interview. The differences in these approaches are the degree to which the questions are predetermined before interviewing occurs. Minichiello, Aroni, Timewell, and Alexander (1990) provide three types of interviews: (1) structured interviews; (2) semi-structured interviews; and (3) unstructured interviews, based on the degree of structure involved.

Patton (2002) pointed out that these contrasting strategies are not mutually exclusive, and that in practice, any one interview may employ several of the interviewing strategies together. The interviewing technique that will be used in this study most closely resembles the elements of both the standardized open-ended interview and the informal conversational interview of Patton’s (2002) categorization and falls into a semi-structured interview category of Minichiello et al. (1990). For the standardized open-ended interview, the exact wording and sentence of questions are determined in advance; all interviewees are asked the same basic questions in the

same order; and questions are worded in a completely open-ended format. For the informal conversational interview, questions emerge from the immediate context and are asked in the natural course of things and there is no predetermination of question topics or wording.

In this study, a semi-structured interview technique was used to focus on the points of interest but there can still be a degree of flexibility to allow the interviewer to expand on answers. This approach was chosen because a framework of topics was required to ensure that certain areas were not inadvertently missed if they did not arise naturally during the interview. Another reason was that if the interviews were not focused, too much superfluous information could be collected which might cause "compromise the efficiency and power of the analysis" (Miles & Huberman, 1994, p. 35). However, as only a single researcher was working with the data, some flexibility was also allowed in probing and determining when it was appropriate to explore certain subjects in greater depth, or even to pose questions about new areas of inquiry that were not originally anticipated. For this purpose, this study used a standardized interview format in the early part of an interview and then allowed pursuing any subjects of interest during the latter parts of the interview. Table 3.6 shows the interview protocol with questions and rationale.

Table 3.6. The Interview Protocol

Question	Type of question and purpose
Background and SRLS tool experience	
The purpose of this interview is to get some information that will help designers of self-regulated learning support tool to design the tool more effectively. As someone who has experienced the self-regulated learning support tool in your course, you are in a good position to describe your experience and how you found it. *Explain right to withdraw and that the interview will be taped.*	Explanatory and introductory comments.

Question	Type of question and purpose
Ask name, age and year of course	Brief demographic information.
What do you think of a self-regulated learning support tool?	Open-ended question to encourage the respondent to speak descriptively rather than forming the habit of providing short answer and routine responses (Patton, 2002).
Have you ever used a tool similar to the self-regulated learning support tool before? If so, when and how?	Background questions to find out any experience with a tool similar to self-regulated learning support tool.
Have you used any similar activities like journaling to your students? If so, what is your experience?	
Effectiveness of the SRLS tool and pattern of use In general	
When you were working with the self-regulated learning support tool, what elements of the tool did you use?	Experience questions to encourage the respondent to review their use of the tool before offering more detailed opinion.
What were the strengths of the SRLS tool? *What were the weaknesses of the SRLS tool?*	Presupposition questions (i.e. the questions assume the tool has strengths and weaknesses, and can thus elicit useful information) (Patton, 2002)
How confident have you been about the goal accomplishment when you set the short-term goals every week? And why do you think like that?	Open-ended, experience question on student's self-efficacy on their learning or doing a project.
What were your projects? Can you describe about it?	Open-ended, experience question on the students' projects.
How effective do you think the SRLS tool helping your learning (projects)?	Opinion question which seeks summary comments and reinforcement of previous answers.
What are some of the things you really liked about the SRLS tool? *What are some of the things you disliked about the SRLS tool?*	Feeling questions which are aimed at finding out the respondent's emotional response to the tool.
If you had the power to change the SRLS tool, what would you make different?	Opinion question which seeks recommendations for change or improvements to the tool.
If a friend of yours is about to use the self-regulated learning support tool for the first time, what advice would you give?	Projective question which asks the respondent to take on the role of 'expert'.

Question	Type of question and purpose
Effect of critical elements of SRLS tool	
We've been talking about your experiences with the self-regulated learning support tool in general. I'd like now to ask your opinion on some of the specific features of the self-regulated learning support tool.	Transition statement to move onto the discussion of each of the critical elements of the self-regulated learning support tool.
How did the self-regulated learning support tool enable you to set goals and plan on your learning as you went on the course?	Presupposition question to obtain information on whether students get help for planning as they used the tool.
How do you think specifying your goal help your learning?	
How do you think the short-term goals help your learning?	
How did the self-regulated learning support tool help you to reflect on your learning?	Presupposition question to obtain information on whether students get help for reflection on their learning.
What did you find when you evaluate on previous works?	Experience question, which is aimed at finding out the respondent's evaluation on their progress.
There is a strategies database. How did you use it?	Experience question to find out how the respondent use the strategies database.
There is a help-seeking page. How did you use it? How did you like Q&A bulletin board?	Experience question to find out how the respondent use the help-seeking page and Q&A bulletin board.
How did you feel motivated throughout the course?	Feeling question to ascertain the respondent's motivation level.
When did you feel your motivation declining? And why?	Feeling question to ascertain the respondent's motivational change.
How did you maintain your motivation at that time?	Experience question to find out how the respondent maintain motivation.
What other assistances do you think you need as you worked on?	Opinion question to find out what the students need more for the course.
Closing comments	
You've been very helpful. Do you have any other thoughts or feelings on using the assessment strategies interactive multimedia package? *Thank you.*	Final open-ended question to obtain any further comment. Closing remarks and thanks.

Data Analysis

This case study is an embedded case study. A single course in which a SRLS tool was used is the case. However, within this single case, this research conducted case studies of several participants. In this approach, the analysis began with the individual embedded cases, and then the cross-case pattern analysis of the individual cases was conducted so that these data could be used as a part of the data for the entire case study. Although this study dealt with both qualitative and quantitative data, the main data were qualitative. The basic process of qualitative data analysis is to form categories of information, which represent concepts indicated by the data (Merriam, 1998). In the case of quantitative data, this study used simple descriptive statistics to calculate mean or standard deviation of the data.

Major data analyzed included MSLQ, process artifacts, open-ended questionnaire, interviews, product artifacts, and miscellaneous documents such as syllabus, electronic mail communications through the course listserv, and any others that emerged and were regarded valuable and helpful for the purpose of the research when the study was being conducted. Methods that were used to analyze each kind of the data are as follows.

MSLQ

Modified MSLQ measurement scores were analyzed using the MSLQ Manual (Pintrich et al., 1991) and descriptive statistics. The MSLQ sub-scale scores for each participant are constructed by taking the mean of the items that make up that scale (Pintrich et al., 1991). For example, intrinsic goal orientation in the modified MSLQ had three items. An individual's score for intrinsic goal orientation was computed by summing the three items and taking the average. There were some negatively worded items and the ratings were reversed before an individual's score was computed. A higher score of 4, 5, 6, or 7 indicated a positive response to the items.

Open-Ended Questionnaires, Interviews, and Artifacts

The transcripts of the student information questionnaire, the open-ended Web surveys, the interviews, the miscellaneous artifacts, and the process artifacts that the students created when they used the SRLS tool in this study were analyzed using content analysis. Given that "No precise or agreed-on terms describe varieties and processes of qualitative analysis" (Patton, 2002, p. 453), it is important to operationally define the term "content analysis" used in this study.

Content analysis usually refers to analyzing text (interview transcripts, diaries, or documents) rather than observation-based field notes although sometimes it refers to searching text for recurring words or themes (Patton, 2002). More generally, the term, content analysis is also used to refer to "any qualitative data reduction and sense-making effort that takes a volume of qualitative material and attempts to identify core consistencies and meanings" (Patton, 2002, p. 453). In this study, more general definitions with the focus on the text data were used to guide the analysis.

Data analysis involved three activities that included data reduction, data display, and conclusion drawing (Miles & Huberman, 1994). Typically, qualitative data analysis is using inductive way in the early stages to figure out possible categories, patterns, and themes indicated by the data (Patton, 2002). This process of developing categories or patterns of information is called "data reduction" (Miles & Huberman, 1994) or "open coding" (Strauss & Corbin, 1998). The patterns or themes can be seen as trends in the data and are used to help explain a phenomenon and generate theory about the phenomenon. The basic strategy of the method is to constantly compare a particular incident from data with another incident in the same set or another set of data. These constant comparisons lead to creating categories that capture a

recurring pattern that cuts across the data (Merriam, 1998). Therefore, one of the most important processes that the researcher should conduct for analyzing the data in the early stage (i.e., stage one) is to construct categories that capture a recurring pattern that cuts across the data when the multiple sources of data are used.

As a second stage of the data analysis, themes or patterns were displayed in matrices, graphs, charts, networks or any other forms in order to show what those data imply and to lead conclusion drawing and action (Miles & Huberman, 1994). During the stage three of analysis, conclusion drawing, and verification involved the decisions about the meaning of data and testing validity of findings (Miles & Huberman, 1994). For testing the validity, the member check and peer reviews were conducted. The important point is that these three streams are "interwoven before, during, and after data collection in parallel form, to make up the general domain called analysis" (Miles & Huberman, 1994, p. 12). Therefore, these three types of analysis activities and the data collection were conducted interdependently and cyclically as shown in the Figure 3.2.

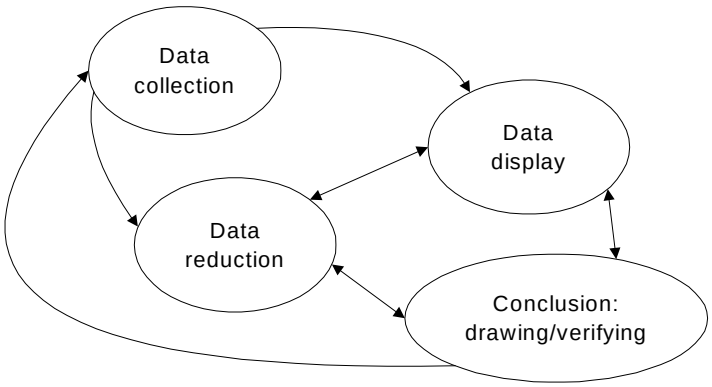

Figure 3.2. Components of data analysis: Interactive Model (Miles & Huberman, 1994, p. 12)

Validity and Reliability

Internal Validity

Validity of the data is enhanced through triangulation, and clarification of researcher's assumptions, biases, and theoretical orientation (Merriam, 1998). First, triangulation entails using a variety of data sources and using a variety of data collection and analysis techniques to examine the same phenomena. In this study, the multiple data sources included: the MSLQ survey, student artifacts, a pre-defined open-ended questionnaire, and an interview. To enhance the internal validity over the open-ended questionnaire and interview data analysis, a peer reviewer confirmed the concept and categories with the researcher. For the member checks, each case report based on the analysis of process artifacts, miscellaneous artifacts, open-ended questionnaire, and interviews, was taken back to each participant (see Appendix I for an example). Through further dialogue with the interviewees or through their feedback from them, errors or misinterpretations by the researcher were corrected and clarified.

External Validity

External validity refers to generalizability, or how much the results of the study can be applied to other similar situations (Merriam, 1998). To increase the external validity, along with the results, this study provided thick and rich description about the context in which the research was conducted in order to help the readers and users of the findings recognize relevance to themselves and to their own context. These descriptions included the course, the tool, the nature of the learners, and the nature of the tasks that the students did for the course.

Reliability

Reliability refers to the extent to which the results of one study can be replicated by another. Merriam (1998) noted, however, "Replication of a qualitative study will not yield the

same results" (p. 206). She added, "Rather than demanding that outsiders get the same results, a researcher wishes outsiders to concur that, given the data collected, the results make sense" (p. 206). This study used three techniques that Merriam (1998) suggested to ensure the reliability of the study: (1) the investigator's position, (2) triangulation, and (3) audit trail. In addition to stating the investigator's position and using triangulation, which were also used for the internal validity, this study provided the description of the entire research process, and a detailed description of the research methods to increase the reliability.

Study Limitations

Certain limitations should be acknowledged in the study. Generalization of the study is limited. As is inherent for most qualitative study, it is significant to mention the purposeful sampling. The sample group used in this study cannot represent a more general course because the participants of the course should be able to access the Web easily. Although the number of Web accessible people has increased at the tremendous rate since 1996, many students still have difficulties in accessing the Web. The result of this study should not be applied or generalized beyond the specific target group which meets the criteria under which the purposeful sampling was conducted.

Other limitations of the study include the number of participants, prior Studio reflection experience, and the time frame of the study. Nine students participated in the study while a part of the purposeful sample, an increase in the number of participants may have yielded different results. They had been in Studio before and they knew what to expect. Students may have viewed the SRLS tool as something extra. Finally, the study took place over a 16-week academic term. This may not have been long enough time for participants to fully explore and take advantages of the affordances of the SRLS tool.

Researcher's Subjectivity

In qualitative research, a researcher plays a critical role in collecting and analyzing the data (Merriam, 1998; Patton, 2002). "Because qualitative inquiry depends, at every stage, on the skills, training, insights, and capabilities of the inquirer, qualitative analysis ultimately depends on the analytical intellect and style of the analyst" (Patton, 2002, p. 433). For this reason, the researchers are often called filters and instruments through which all aspects of the study, particularly data, are interpreted. Therefore, the statement of the subjectivities related to the research before a qualitative study begins is important for the data analyst because it makes the analyst aware of what preconceptions he or she may have that could affect the analysis of the data (Peshkin, 1988). Further, the statement of the researcher' subjectivities may give the readers the background information to understand why the researcher arrives at certain decisions throughout the research process.

This study is affected by my epistemological beliefs and professional experiences. I have worked on how to enhance learning using computer technology for the last nine years: two years for the masters degree in educational technology, three years as a researcher and instructional designer at a central government funded research and development institute for K12 through lifelong learning in Korea, and four years as a doctoral student in instructional technology. I have been influenced by literature in the fields of computer-based instruction and learning, instructional design, instructional technology (although it is an interdisciplinary field), learning theory, educational and cognitive psychology, and computer science. I was also influenced by three years of field experience at the institute, through which I designed numerous educational software from DOS-based through multimedia to Web-based applications in various subjects and evaluated more than 100 commercially developed software.

This past experience helped me observe the several critical and rapid changes in both the technology and the pedagogy in education. Through this observation, I believe that the Internet has emerged as one of the most powerful media for delivering educational contents and tools to share ideas between learners and teachers along with its fast and multimode delivery capability and various, asynchronous or synchronous, communicative tools. The role of technologies in education has become various. I believe that technology can be used to help learners take more responsibility for their learning, help them focus their cognition into higher order thinking, and help them analyze problems or tasks, organize knowledge representations, share what they have learned with others, and collaborate with each other.

In terms of pedagogy in education, I believe that social constructivism and situated cognition have recently emerged as main theoretical foundations in instructional technology. In this situation, through literature, coursework, and field experience, I see learning as a continuous process in which learners actively construct or co-construct the knowledge and change their mental model through interactions with the outer worlds. I also believe that learning should be examined in terms of "environmental factors, such as what is available to the learner in a concrete sense (books, tables, computers, instructional materials, or apparatus), as well as in a social sense (how individuals influence each other in the total learning experience)" (Lajoie, 2000, p. xv). I also believe that the emphasis should be on learning (learner-centered) rather than teaching (or teacher-centered). Educators have stressed learners' responsibility in, and control over, their acquisition of knowledge and skills. Learners are assumed to actively participate and mediate their own learning processes (Duffy & Cunningham, 1996).

Summary

An embedded designed case study design was used to understand the use of a SRLS tool in an educational software development course in higher education. The data were collected through the modified MSLQ, the general information questionnaire, the various artifacts, the open-ended questionnaire, and the interviews with nine individual participants. Descriptive statistics were used to analyze the quantitative data. Content analysis using the constant comparative method in a recursive nature was employed to analyze the qualitative data in order to generate meaningful, data-driven themes.

CHAPTER IV.

RESULTS

Overview

This chapter presents the results of the data analysis. The analysis began with the individual embedded cases. Several sources of data were used during analysis: MSLQ, artifacts from the SRLS tool, questionnaire responses, and interview responses. A cross-case analysis of the individual cases was conducted so that these data could be used as a part of the overall case study.

Results of Individual Case Analysis

Organization of Case Descriptions

Each case description begins with an introduction of the participants with background information and their project, followed by their modified MSLQ results. The next section shows their use of the SRLS tool throughout the semester in terms of update completion rate, how much time they spent, and what features they used. The final section features their perspectives about the use of the tool in the course. A brief summary closes the description. (Note: Appendix A, which contains an overview and screen shots of Friday5s®, may be helpful to readers not familiar with the software.) Within each case description, the specifics can vary, reflecting the themes in each individual data. Because of confidentiality concerns, minimal demographic information has been included in each account. Instead, the overview section provides an overall description of participants.

Overview of the Nine Cases

This section presents an overview of the nine embedded cases in this research study (see Table 4.1 for a summary). The total number of students in the course was nine. All nine students agreed and volunteered to participate in the study. Although Aidan did not participate in the student general information questionnaire at the beginning of the semester and Danica did not take a part in the open-ended questionnaire and the interview at the end of the course, all nine participants' data were included in the analysis. For the final grade, the project was 40% and the reflection in the SRLS tool was 10% of the total grade.

Table 4.1. Case Demographic Profile

Pseudonym	Gender	Age	Native Language	Teaching Experience	Teaching Area/Level	Highest Degree/Major	Final Grade
Aidan	M	?	English	N/A	N/A	BA	A
Brandy	F	49	English	9 years	Math/K-8	MA/Education	A
Chad	M	36	English	N/A	N/A	MA/Library Science	A
Danica	F	39	English	8 years	Elementary	BA	A
Eddy	M	31	English	8 months	Streaming Media/ Higher Ed	BA/ Anthropology	I
Frank	M	26	Asian	N/A	N/A	BS/Computer Science	B
Garnet	F	41	English	N/A	N/A	BA/Economics & History	I
Hal	M	33	Asian	8 years	Math, Science, & Computer/ High School	BS	B
Iria	F	27	Asian	3 years	Accounting/ High School	BA/Business	B

Aidan

Aidan is an English native speaker. He did not respond to the general information questionnaire that asked age, majors, learning style that he believed he had, and teaching

experience. Instead, from the interview with him, some of his personal situation and tendencies of doing tasks were provided. First, his motivation was low throughout the semester because he had some personal issues that he had to deal with outside of the course. He stated, "I think part of my motivation had to do with other issues that I was experiencing this semester, and so I can't really attribute that to the course itself or the Friday Five or anything. I was just dealing with other issues, so …." He also said, "I can't really justify saying, "OK, well I have to have this done by such-and-such date, otherwise the entire project's gonna be kaplooey," because in my mind, I've already set out a certain amount of time for all these different things, so it's not gonna work that way for me."

Aidan's project for the course was to build an instructional Website to introduce African American youth to the possibility of going to college as well teach them the fundamentals of word processing. The Web site provided a fictional college application process through which students could explore the possibility of going to college. At the same time, the Web site aimed to allow students to explore the many uses of word processing via online instruction. The population that this tool targeted was middle school students from the local Housing Authority. The product was developed mainly with Macromedia Dreamweaver.

The client for this project was an office focused on diversity at the university. Aidan confirmed his client in the second week of the semester and he did not express concerns or difficulties in finding his client much in his updates in Friday5s®.

Aidan got the second lowest score on the total modified MSLQ score (4.53, Mean 5.42, and SD .69). His scores for each scale are presented in the Table. Each acronym stands for each scale: IGO for Intrinsic Goal Orientation, EGO for Extrinsic Goal Orientation, TV for Task Value, CLB for Control of Learning Belief, SELP for Self-Efficacy for Learning and

Performance, MSL for Metacognitive Self-Regulation, TSEM for Time and Study Environment Management, ER for Effort Regulation, and HS for Help Seeking.

He had low scores in Intrinsic Goal Orientation (5, Mean 6.22, and SD .60), Task Value (5.67, Mean 6.52, and SD .53), Control of Learning Belief (3.33, Mean 5.70, and SD 1.36), Self-efficacy (4, Mean 5.41, and SD 1.30), and Time and Study Environment Management (3.67, Mean 5.33, and SD 1.02) by around one standard deviation from the group mean scores. As shown in Table 4.2, his ranks for each scale were relative low, with exemptions in Extrinsic Goal Orientation, Effort Regulation, and Help Seeking.

Table 4.2. Aidan's Pre and Modified MSLQ

Scale	IGO	EGO	TV	CLB	SELP	MSR	TSEM	ER	HS	Mean
Score	5	4.33	5.67	3.33	5	4.33	5	4.33	5	4.53
Rank	9	6	9	9	7	7	9	3	4	8
Group Mean	6.22	4.70	6.52	5.70	5.41	4.80	5.33	5.19	4.89	5.42
SD	.60	.90	.53	1.36	1.30	1.65	1.02	.97	1.50	.69

Aidan missed 7 updates among 15 mandatory ones with a 54% completion rate (see Table 4.3). He missed 2 updates during the first 8 weeks and 5 updates during the remaining 7 weeks. He set 4 goals: three for planning and one for design. He did not set any goals for development and evaluation. Although he actually completed the goals he set up usually in two or three weeks, he did not mark those goals as completed until the last week of the semester. He spent a total 33 minutes for 8 updates with an average of 4 minutes per update which was the least amount of the time spent among the students.

Table 4.3. Aidan's Use of the SRLS Tool

	Number of missed updates	Number of goals	Time for an update
Aidan's	7	4	33/8 (4)
Group Mean	3.3	5.67	
SD	2.5	2.87	
Total	30	51	

Aidan's responses to the guiding questions were usually short and focused to the questions. He did not answer the guiding question, "What resources / assistance do you need to help you reach your goals for the coming week?" at all throughout the semester. He reviewed GuideMe® one time in the first week, but did not use the content of it for his update. After then, he did not continue using it in the feature. He did not use the "Request Feedback" feature of Friday5s® at all.

As he missed almost half of the required updates, he spent little time updating in Friday5s®, and did not use many features of it, it is hard to tell if he used the tool at the degree he could get benefit from using it.

General opinion of the tool. Aidan indicated he did not think the tool helped him much for the course. He assumed the tool was better for younger students or inexperienced students. Because he believed he had already enough experience in doing reflections in previous courses he took, he did not feel he needed explicit reflective activities like writing journals for the course.

Aidan compared the use of Friday5s® to the design journal he kept in the EDIT6190 course as following: "I didn't see the added value in me sitting down and doing that as compared to doing just the regular reflections that I did for my 6190 project." He, however, valued the email reminders and the "Request Feedback" feature and praised the organization of Friday5s® as following: "I like, like I said, the organization of it. I like the reminders, you know, that it

sends you a reminder," and "I know for me feedback is important, and you know, like I said, to be able to just click on a button and to get that extra feedback from her was great."

Although Aidan said that the tool was well organized, he felt the tool was not useful because he did not design and develop his final product in a way that he would necessarily utilize a tool. For an example, weekly updating did not match up to his project conducting style according to him. He mentioned, "… to set it out by week, I can't do that because if I get stuck at one area, I obsess until it's finished. And so, for my type of personality, to set a goal like that doesn't make much sense."

Aidan thought the project of the course was too small for the tool. He stated, "I don't think that the information that it was requiring was necessary for the kind of project that we were engaged in. Maybe if, you know, I … if I'm working for, you know, say, IBM or Dell or something, or some instructional design firm, it might be useful." The scale of the project appears to be another factor that affects the use of the tool, at least in this participant's perspective.

How it helped. Although the data indicate that Aidan did not use the tool much and did not value the required activities through Friday5s® for his specific project, he stated that he valued reflective activities when he took previous courses and was not much experienced with reflections. He described his previous reflective activities and his feeling about reflective activities for this course as following: "It was a good experience. It made me think. The reflective activities were good to help me evaluate my progress and to keep me on track. So I enjoyed it. I think it just came to a point that, because I had done so much journaling in the past, that I knew myself well enough that I didn't really feel like I needed it this time."

Aidan recommended that the tool should provide the users with some explicit description about what the tool could help them do so that the users could have utility value on the tool.

Aidan mentioned that he felt the course's expectations for the students were not clearly defined. As a result, he thought, there was too much confusion and he wanted more direction for the course. It might be possible to use the tool to assist students with putting structure to what they have to do in an early stage of the semester to help reduce confusion. The instructor could then review the plans and give feedback to the students to facilitate additional guidance and direction.

Summary. Aidan did not feel that the tool was useful for the completion of the project in the course. He believed that he was experienced enough with doing reflective activities in previous courses so that he did not need explicit reflective activities through Friday5s® for the project, a task which was individual and small scale to him.

Brandy

Brandy is a native English speaker and 49 years old. She is a master's student in Instructional Technology. She was the only current teacher among participants and has been a math specialist teaching K-5 grades math enrichment for 9 years. Through the general information questionnaire, she reported she was a very eager learner. She mentioned that it took her longer than most to make connections, but once they were made, they were strong. She also reported she liked to learn in small groups and hands-on. And she found herself a musical learner who liked interactivity when she took a test in learning styles (Gardner's test). During the interview, she mentioned that because she was a mother of five, she believed that she was very self-directed and good at setting goals and accomplishing them. She described herself not good at reading directions provided with the software or books related to the software.

Very uniquely, Brandy's project for EDIT6200 was constructionist in nature. Her role in the project was to guide and help two fourth grade students from the elementary school at which she worked to develop educational software so that they could learn the content of the software by constructing it.

The client for the project was an art teacher from the same elementary school. Brandy confirmed her client by the second week without much difficulty according to her update on Friday5s®. The client was having an art show in late March, 2003. Therefore, the final product was developed about a month before the showcase of the EDIT6190 course. The purpose of the program was to teach about elements of design. As a part of the tutorial, the program had a scavenger hunt which the user would do to find samples of elements of design throughout the art show. The audience would be the parents of the students at the school and also the students themselves.

Brandy's score was higher than the average on the total score of the modified MSLQ (6.60, Mean 5.42, and SD .69) by one standard deviation from the group mean. She also had higher scores in the Extrinsic Goal Orientation (6, Mean 4.7, and SD .9), Metacognitive Self-Regulation (6.8, Mean 4.8, and SD 1.7), Time and Study Environment Management (7, Mean 5.3, and SD 1.02), Effort Regulation (7, Mean 5.2, and SD .97), and Help Seeking (6.5, Mean 4.89, and SD 1.5) by more than one standard deviation from the group mean scores (see Table 4.4).

Table 4.4. Brandy's Pre and Modified MSLQ

Scale	IGO	EGO	TV	CLB	SELP	MSR	TSEM	ER	HS	Mean
Score	7	6	7	6.33	5.67	6.83	7	7	6.5	6.60
Rank	1	1	1	4	5	1	1	1	2	1
Group Mean	6.22	4.70	6.52	5.70	5.41	4.80	5.33	5.19	4.89	5.42
SD	.60	.90	.53	1.36	1.30	1.65	1.02	.97	1.50	.69

Brandy did not miss any update among the 15 mandatory updates (see Table 4.5). She set 16 goals: three for planning, two for design, six for development, four for evaluation, and one for other. She used the tool in her own way and did not follow the guiding questions to set up her goals and to do her reflection. She entered her entire update into the goal section of the Friday5s® tool. Therefore, her goals shown on Friday5s® included goals, plans, things she did, and very rich reflection with self-evaluation. Because Brandy did not use "Complete Goal" button to mark the goals completed, her entire updates were always shown every week. It might make it hard for her to update because the "Current Update" page was getting longer as it went to the end of the semester to display all the uncompleted goals and related updates.

Table 4.5. Brandy's Use of the SRLS Tool

	Number of missed updates	Number of goals	Time for an update
Brandy's	0	16	454/15 (30min)
Group Mean	3.3	5.67	
SD	2.5	2.87	
Total	30	51	

Even though Brandy did not enter anything into the guiding questions but the goal setting question during the first four weeks, she started to input some responses into the guiding questions from the fifth week while she kept entering her reflections into a goal section. She mentioned people and books as the possible resources she would use to get help for the Flash program. She used "Request Feedback" function for every week's update except the first and second weeks. She looked at the content of "GuideMe®" two times at the beginning of the semester, but she did not use the content of it for her updates. As each of her updates was full of very rich reflection, she spent a lot of time updating in Friday5s® with an average 30 minutes per update.

General opinion of the tool. From the interview, even though Brandy used the Friday5s® tool without missing any updates, she did not feel she needed the tool. She commented, "I could see that somebody who wasn't very self-directed might use it, but I'm an extremely self-directed student and I keep on task very well." As mentioned above, she felt she was very self-directed and experienced with handling work because she was a mother of five children. She said, "I think it's important to know that I have five children of my own, and because of that, I've gotten very good at setting goals and accomplishing them, you know, just being a mother of five." Brandy's experience and belief that she was very self-directed reduced the functional value of the tool from her perspective.

Brandy indicated that she did not think the structure of the tool fit her style; therefore, she updated her status in her own style. She used the goal section of the Friday5s® tool as a main place to put her reflection. She mentioned, "I just found it a good place to just write it all. I don't think I like breaking up my writing like that. So I put it all together." The guiding questions did not work well with her style. But she valued the tool for others who were not goal oriented. She stated, "For people who aren't [goal oriented], I think it would be a very good tool because the reminders were good, and the place to put everything, and the questions were good if you didn't already think like that."

Brandy stated that she valued several features of the tool. First, she liked the emails that were sent to her every week to remind her to do the updates in Friday5s®. Another feature she liked was the Shared Update feature. Especially because she was at a distance (an hour driving time), she liked to know what her classmates were doing. She indicated that she liked using the request feedback feature, and getting feedback from the instructor.

She emphasized the value of reflection whether it was done in Friday5s® or in a simple document. "I think the whole idea of writing reflections as you go along on a project is great. And Friday5s®, you know, was a great place for me to put it. So, in that case, I think it was very effective. You know, I mean, if I hadn't put it in Friday5s®, I would have just put it on a blank, on a blank Dreamweaver page or whatever."

How it helped. Brandy's project was done with two 10 year olds. Therefore, the goals and updates in the Friday5s® tool were done with two 10 year old girls. She mentioned, "Actually, a lot of the times, they decided what we were going to do ... I wrote a lot in my reflections in Friday5s® about what the girls said to me." Working with two girls, she especially valued the short-term goals. She stated, "That [setting a short-term goal] was great for the two ten year olds to see that, because I bet, they've never have an experience like this, where it took four months to do something."

These short-term goals along with specific goals helped two 10 years old girls to maintain their motivation. Brandy set goals with the two students and they accomplished what they set out to do. She emphasized the importance of goals and accomplishments in the interview: "It was good for them to have the goals, and then accomplish them. And it was such a long term project. I think it was good for those two girls to see that you can work on something a little at a time and accomplish a goal and then accomplish a goal, you know, until you have a final product."

Although Brandy said she was very self-directed and she could do reflection without Friday5s®, when she did reflection in Friday5s®, she indicated the tool helped her. The tool gave her guiding questions, a place to write her reflection, and helped her easily send an email about her update to the course instructor and get feedback. And writing a reflection motivated her.

She mentioned, “Writing reflections motivates you. So I would say Friday5 probably did, you know, just because it encouraged me to set goals.” She also believed that doing reflections supported by Friday5s® helped keep people who were not goal oriented on track.

Summary. Brandy did not feel the need of Friday5s® because she thought she could do those activities guided by Friday5s® without it. However, she valued the goal setting, monitoring, help seeking, and reflection activities of experiences and emphasized the importance of them in a course that required a long-term commitment, and a lot of assignments. And she also valued the supports by Friday5s® like email reminders, shared updates, and feedback requests.

Chad

Chad is a native English speaker and 36 years old. He is a master’s student in Instructional Technology. He has a master’s degree in Library Science and has been a librarian for 9 years. Through the general information questionnaire, he described himself as a visual learner so that he learns best by reading, seeing, and hands on doing. And he also reported that he has to write down what he hears in order to remember it and he needs something to read to be able to remember it. Although he is not a teacher in the sense of a classroom, Chad has instructed students at the reference desk in terms of how to use library resources and how to do research.

Chad’s project for EDIT6200 was to develop a Web-based tutorial for undergraduate psychology students to learn how to effectively use the PsycINFO database. The tutorial covers search strategies, limiting searches to types of articles, finding full text online articles, getting call numbers for print journals, and providing learner assessment and feedback. He used the Dreamweaver as a main development tool.

Chad confirmed his client two weeks after the semester began. He expressed in a journal entry that finding a client was one of the challenges for his project. To find a client was one of the most important factors that affected his project. He expressed that he tried several possible options and finally got his client from the department that he had wanted to work with. Based on the journal entries and the project management site, he appeared to be on the track, updating in a timely manner from the beginning and through to the end of the semester.

Chad obtained the average on the total score on the pre-administered modified MSLQ (5.2, Mean 5.42, and SD .69). His scores for each scale are presented in Table 4.2. It is notable that he got lower scores in extrinsic goal orientation (3.7, Mean 4.7, and SD .9) and self-efficacy by more than one standard deviation (3.7, Mean 5.4, and SD 1.3) from the group mean scores. Information gathered during the interview created a different perspective than MSLQ scores. Chad indicated that he was highly motivated because he was working on a real world project during his interview (see Table 4.6).

Table 4.6. Chad's Pre and Modified MSLQ

Scale	IGO	EGO	TV	CLB	SELP	MSR	TSEM	ER	HS	Mean
Score	6	3.67	6	5.33	3.67	5.67	5.83	5.67	5	5.2
Rank	6	8	7	7	8	4	4	3	5	4
Group Mean	6.22	4.70	6.52	5.70	5.41	4.80	5.33	5.19	4.89	5.42
SD	.60	.90	.53	1.36	1.30	1.65	1.02	.97	1.50	.69

Chad did not miss any updates among the 15 mandatory updates (see Table 4.7). He set 11 goals, which were very specific and short-term: three of them for planning, two for design, two for development, and four for evaluation. He usually achieved the goals in two or three weeks except the last 4 goals. Interestingly, he set 4 goals and marked them as completed at the

last update. Three goals among them were for evaluation. The other one was about the completion of developing his tutorial.

Table 4.7. Chad's Use of the SRLS Tool

	Number of missed updates	Number of goals	Time for an update
Chad's	0	11	268/15 (18 min)
Group Mean	3.3	5.67	
SD	2.5	2.87	
Total	30	51	

Chad usually responded to the guiding questions with minimal answers. The responses were short and clear throughout the 15 updates. Even if the responses to the guiding questions were redundant, he tended not to skip answering any question. His responses were somewhat reflexive to the questions.

Chad mentioned various resources for the guiding question, "What resources / assistance do you need to help you reach your goals for the coming week?" For example, he answered the question by saying "Look at other project sites for example of how to do flow chart," and "Time, faster reading, and time management." He usually mentioned the already available resources or the resources that he knew could be easily found to achieve his goals. Textbooks and updates of others were the main resources he mentioned. He knew what he had to do to get the resources that he needed. He seemed to use the available and easily accessible resources rather than to use outside assistance from others. Interestingly, he regarded the time as an important resource. He frequently mentioned "time" as resources for his project (5 times). He mentioned human resources to this question only one time throughout the total 15 updates. The possible reason of this is that the tasks or goals were easily achieved without help from others. However, he always requested feedback from the facilitator when he did every update.

General opinion of the tool. From the interview, it was turned out that Chad, in general, liked the tool throughout the semester. He indicated he valued the tool: "It is well laid out. It is well structured. It makes sense. It flows as far as the process. So those are the strengths, I would say."

Chad liked the Friday5s® tool better than the design journal used in the EDIT6190 course because Friday5s® was more focused on the actual goals while the design journal included other things like reading. In the design journal of EDIT6190, the students were required to integrate their reading into the reflective journals. It appears that Chad liked to separate the goal setting, planning, monitoring, and evaluating activities from other activities like integrating the review of required readings.

Chad indicated that he normally used the tool for doing the goal setting, monitoring, evaluating, and planning activities with the help of the trigger emails and guiding questions in the current update template. He used to see others' updates to compare his progress. He said, "I primarily, I would update my goals and then would just do a quick view to see where the rest of the class was. I would normally use all parts of the update, you know, for my goal." Chad used the GuideMe® feature two times throughout the semester. He tried to see the content of the GuideMe® but did not use the content for his actual updates. He said "There was one time when I wasn't sure what to write. … at that point I used the GuideMe® to see what type of recommendations it would give." He guessed that the reason the students did not use the GuideMe® feature much was time.

How it helped. The data indicate that the Friday5s® tool gave Chad some structure and helped him to see all the various stages of the process. He mentioned, "I felt that it was a good tool to give some structure and to be able to see all the various stages. It was also good to be

able to set a goal for each week and to be able to see how far towards the goals that I was." It also helped him manage his time throughout the course. Chad said "It was good because I think it helped me keep more focused on the time line and on making sure that I didn't spend so much time on the design phase that I would actually have enough time to do the development phase." He used the pie chart in the tool that showed the types of goals the students set so far. By doing it, he was able to avoid spending too much time in one phase.

By setting specific goals, Chad indicated he could motivate himself. He said, "I think that actually typing up a goal that is not vague, which is more specific does give you more motivation to actually do it." This remark also implies that setting a goal in his mind is different from setting a goal by writing up. Short-term goals also helped him to be focused on what he needed to be done.

Self-evaluation each week also appeared to help Chad throughout the course. As he mentioned in the interview, "This was good because, again, I had to self-judge and to be specific about what I had done towards that goal. I would say that this part right here, for me, was the most useful part of the whole product." It also appears that the project and tool assisted with motivation. Although his MSLQ motivation scores were low, especially task value, intrinsic goal orientation, and extrinsic goal orientation, the interview data revealed that his actual motivation was quite high.

Summary. Chad did not miss any updates. He valued the tool in the course. Although his self-efficacy score was lowest among the students, he finished his project in a timely manner and expressed that he was pretty confident throughout the course during the interview.

Danica

Danica is a native English speaker and 39 years old. She is a master's student in Instructional Technology. Danica has teaching experiences. She taught middle school 6th and 7th grades for 8 years. She taught in a 5th grade self-contained classroom all subjects, and she taught middle school language arts, reading, and Spanish.

Through the general information questionnaire, she reported herself as a very visual and highly curious learner. She found herself low on the auditory. She described, "When people are describing something to me I find myself closing my eyes in order to picture it and "fix" it in my mind. I do the same thing even when I am explaining something to someone else." She had her own learning preference, which was "read about something, talk about it, and then do some sort of project."

Danica's update on Friday5s® indicated she confirmed her client in the second week of the semester without much difficulty. The client for Danica's project was a professor who needed to further develop a Web site previously created that presented information to foreign born adults interested in moving out of a para-educator job to becoming a certified teacher in a southern state in the USA. The Web site was intended to guide site users through the requirements and processes of becoming a certified teacher and included education options, certification requirements and resources in the state.

Danica's score was lower than the average on the total score of the modified MSLQ (4.90, Mean 5.42, and SD .69). Her scores for each scale are presented in Table 4.8. She significantly lower in several areas: Metacognitive Self-Regulation (2, Mean 4.8, and SD 1.7), Time and Study Environment Management (4.5, Mean 5.3, and SD 1), and Help Seeking (2.3,

Mean 4.9, and SD 1.5). In contrast, Danica had a higher score in Task Value (7, Mean 6.52, and SD .53).

Table 4.8. Danica's Pre and Modified MSLQ

Scale	IGO	EGO	TV	CLB	SELP	MSR	TSEM	ER	HS	Mean
Score	6.33	5.33	7	6	6.33	2	4.5	4.33	2.25	4.90
Rank	3	3	1	5	3	9	8	7	9	7
Group Mean	6.22	4.70	6.52	5.70	5.41	4.80	5.33	5.19	4.89	5.42
SD	.60	.90	.53	1.36	1.30	1.65	1.02	.97	1.50	.69

Danica stopped using the Friday5s® tool after she updated 3 times during the first 3 weeks of the semester (see Table 4.9). She set 4 goals: three for planning, and one for design. She spent a total 62 minutes for 3 updates with an average of 21 minutes per update. Her responses to the guiding questions in her first through third updates were short and succinct. She saw the GuideMe® one time in the first week, but did not use for her updates. Throughout the three updates, she asked feedback from the instructor when she finished each update by using the "Request Feedback Feature."

Table 4.9. Danica's Use of the SRLS Tool

	Number of missed updates	Number of goals	Time for an update
Danica's	12	4	62/3 (21 min.)
Group Mean	3.3	5.67	
SD	2.5	2.87	
Total	30	51	

Because Danica stopped using the tool after 3 updates and did not participate in the interview or open-ended questionnaire asking about her experience with the tool, her general opinion of the tool or how she benefited from the tool could not be analyzed. The reason she did

stop using the tool also could not be investigated due to lack of response from requests by the researcher.

Summary. Danica used Friday5s® only 3 times for the first three weeks. In addition, because she did not participate in the open-ended questionnaire and interview, no further individual analysis for her was conducted.

Eddy

Eddy is a native English speaker and 31 years old. He is a master's student in Instructional Technology. He has taught streaming media to undergraduate and graduate students for 8 months. He majored in anthropology for his BA. Through the general information questionnaire, he described himself as independent, self-motivated, design oriented, and project driven. He also prefers visual-based environments with logic-based problems that seek to meet authentic user needs. He reported he has a learning disability and had extensive testing done, followed by years of counseling with various disability service specialists.

Eddy's project for the EDIT6200 course was to develop a streaming media tutorial for which the main purpose was to help the faculty, staff, and students of the university clarify the conceptual and technical steps of streaming media. He planned to include professional resources, tools, and methods in this tutorial. Upon completion of this tutorial, instructors and support staff at the university should be able to utilize this tool as a resource for entry level streaming media learners. His project could be used a part of his work and the final product could be used alone while some of the products developed by others in the course should be used as a small part of a bigger program.

Eddy scored slightly higher than the average on the total score on the pre-administered modified MSLQ (6.07, Mean 5.42, and SD .69). His scores for each scale are presented in Table 4.10.

Table 4.10. Eddy's Pre and Modified MSLQ

Scale	IGO	EGO	TV	CLB	SELP	MSR	TSEM	ER	HS	Mean
Score	6	4.67	7	6	6.67	6.5	6	6	5.75	6.07
Rank	6	4	1	5	2	2	3	2	2	2
Group Mean	6.22	4.70	6.52	5.70	5.41	4.80	5.33	5.19	4.89	5.42
SD	.60	.90	.53	1.36	1.30	1.65	1.02	.97	1.50	.69

Eddy had high scores in Metacognitive Self-Regulation (MSR) by more than one standard deviation (6.5, Group Mean 4.80, and SD 1.65) and Self-Efficacy for Learning and Performance (SELP) by around one standard deviation (6.7, Group Mean 5.4, and SD 1.3). Even though his Task Value (TV) was 7, the highest score, there were 4 persons whose task value score was 7 including him.

Eddy had his client when he started the course. This was different from others in the course, who found their clients one or two weeks into the semester. Based on his journal entries and project management site, Eddy appeared to be on the right track with his project, with updates posted in a timely manner during the first half of the semester. However, during the last half of the semester, his progress was not displayed on the tool. Eddy missed 5 updates among 8 in the second half of the term.

Overall, Eddy missed 6 updates among the 15 mandatory updates (see Table 4.11). He set four goals: two for planning, one for design, and the last for development. He did not set any goals for evaluation; however, this may have been repeated by other factors. Eddy decided to finish his project during the summer. He had several challenges that he could not solve by

himself. He needed more content to be included in his final product but he could not acquire the contents that were supposed to be created by others.

Table 4.11. Eddy's Use of the SRLS Tool

	Number of missed updates	Number of goals	Time for an update
Eddy's	6	4	171/9 (19)
Group Mean	3.3	5.67	
SD	2.5	2.87	
Total	30	51	

His responses to the guiding questions were rich and detailed with reflection during the first 7 weeks. He missed one update during this period. In the case of resource/assistance questions, he already knew well what resources were needed and what resources were available.

During the first half of the term, his updates were full of reflective comments. Under the first question, "What have you done to achieve the goal?", he described what he had done, then added reflection on it, and had rough planning statement for future. He even added his thoughts when he set his goals. For example, "My second goal is to research the possible tools available to me and my audience for my product's development and implementation. I believe this goal can be completed concurrently with the first goal." It appears that he used the guiding questions as a structure for his reflection, adding additional reflections and idea rather than simply and briefly answering the questions.

Eddy missed his updates 5 times during the final 8 weeks. His responses to the guiding questions during this period were short and simple. He answered the guiding questions shortly without much reflection. Based on his interview data, it appears he found utility in using the tool at the beginning of the semester but he did not place much value on the tool at the end of the

semester. His lack of use of the tool during the final 8 weeks is reflected in his remarks about the tool.

General opinion of the tool. In general, Eddy indicated that he liked the tool at the beginning of the semester, but did not like it at the end of the semester. This is because he put more "utility value" on the tool in the planning and designing phases in the multimedia production. "Utility value" means the usefulness of a task or a tool with respect to helping a person achieve his or her long-term and short-term goals. For example, Eddy mentioned that the way the tool asked him questions helped him structure his design. He also mentioned, however, that after he passed the planning and designing phases, he was in the "go and make it" stage and did not need the tool much.

Eddy mentioned that he was provided with several more opportunities to update and add reflections through Friday5s® than the design journal that he used in EDIT6190 course. In the case of the design journal, many students postponed their updates until the end of the semester. He compared the use of the design journal to a kind of showcase about thinking in past weeks:

> "It became almost ineffective when we were working in the reflections for 6190 on the templates that they used … and it exactly that, everybody that I think, everybody that uses it waits until last minutes to post their reflections, which is kind of opposite of the point. It's a kind of showcase, you know, what your thinking was at week 2, what was your thinking at week 4, what was your thinking at week 8, and you know, show that development of your thinking as you go through the process."

While he appeared to indicate a value in the "showcase," Eddy also mentioned that the frequent requests of updates from Friday5s® were annoying for an individual project. He stated that the tool could be better used for a team or collaborative project because he thought the information of the updates in Friday5s® were important in communicating the progress of the project with other team members or clients. Interestingly, he mentioned that there was nobody in particular bothering him. "It's just yourself. You set it up, so it's you bothering yourself."

Eddy stated that he liked Friday5s® in terms of easy access to other students' journal entries. According to Eddy, to find and go to read somebody's journal entries in the design journal of EDIT6190 was very difficult compared to in Friday5s®. He also had other experience with other similar tools like Microsoft Outlook (a general planning, scheduling, and reminding tool) and Hotmail account in which he can create a bulletin board system to manage his team project. He said Friday5s® was better because the other tools were not customized to meet the specific purposes associated with the design process.

According to the Friday5s® log data, Eddy usually used the tool for the basic activities like goal setting, planning, monitoring, and reflection with the help of the trigger emails and guiding questions in the update templates. He used the GuideMe® feature one time at his first update. He thought he did not feel like he needed the GuideMe® feature. He stated "I … pretty comfortable with what I was doing, so I just didn't feel a need for it when I was working on it." In the case of the requesting feedback feature, he asked feedback only from the instructor who was added by default and did not add any other as a coach or mentor. He said "I never bothered to add anybody else to it or try branching out to whom was providing feedback to what." If he had more time at the beginning setting up coaches or mentors, he might have added more.

How it helped. In general, it appears the tool helped Eddy to manage a project and organize his information. The data also indicate it also enhanced his self-efficacy. First, by helping him to set up specific goals, the tool facilitated starting and moving his project forward. The following remark shows his experience with specific goals:

> "… when you jump into a project, usually you're overwhelmed with ideas and you've got all these things that you could possibly do, but you're not sure what you should do. And when it asked me to specify a goal and the steps I was gonna take to make that, it really helps me to narrow it down and say, ... It forces you to go ahead and pick something and write it down. And once you choose something, it kind of gives you direction. And I felt that in that way, it really helped me to speed my process of design and development

because it really helped me to narrow things down quickly and to specific goals and tasks that I was gonna accomplish."

Along with the specific goals, it also appears setting short-term goals provided him with doable and manageable goals that he could try to achieve within a week. It also gave him a direction and something to focus on for the week. This also appears to have helped him to enhance his self-efficacy. As Eddy mentioned:

"It kind of broke it down to where, instead of feeling overwhelmed by so many things to do, I could say, "Hey, if I finish this one little goal that I've set forth, I've done a good job this week." And then I'd get feedback from my coach: "Great, you finish that one little task." You know, "You've done a good job this week." So that was really nice."

Summary. Eddy's utility value on the tool was different, changing throughout the semester. He valued the tool at the beginning of the semester but did not at the end of the semester. He also expressed a different utility value for the tool based on the type of project. He put more value on the tool in a team-based or collaborative task than in an individual task.

Frank

Frank is a non-native English speaker and 26 years old. He is a master's student in Instructional Technology. He majored in computer science for his BA. Through the general information questionnaire, he said that he was not a learner who always kept up with class and he sometimes became very lazy and unsure of what to do next. He mentioned that he felt that planning and sticking to the plan were very important to him. He described himself as a visual learner, who preferred learning by watching. According to him, reading text without visuals does not help him much. He does not have any experience with teaching.

Frank's project for the course was to develop a maze game that would be used in a classroom environment. The game has a number of traps and a prize. Playing the game,

students are supposed to answer the questions when they meet the traps to proceed and win a prize. The game is Web-based and the instructors can input the questions and answers for each trap in the game easily through Web. The game was designed and programmed in Macromedia Flash MX with database connection technologies.

Frank found his client in the third week of the semester. He had a hard time finding his client according to his updates in Friday5s®. He mentioned, "I am having a hard time finding a client. I have visited some departments, but I have not been able to find a client. I am planning to visit several more departments and look for a client this week." Even after he found his client and finalized the scope of his product, he expressed concern that the project he was completing for his client was not good for the course because the product was a general purpose tool and did not have specific content.

Frank obtained an average score on the total modified MSLQ score. His scores for each scale are presented in Table 4.12. He received high scores in Intrinsic Goal Orientation (7, Mean 6.22, and SD .60), Extrinsic Goal Orientation (6, Mean 4.7, and SD .9), Task Value (7, Mean 6.52, and SD .53), Control of Learning Belief (7, Mean 5.7, and SD 1.36), and Self-Efficacy (7, Mean 5.4, and SD 1.3) by more than one standard deviation from the group means. But, he obtained low scores in Time and Study Environment Management (4.67, Mean 5.33, and SD 1.02) and Effort Regulation (4, Mean 5.19, and SD .97) by more than one standard deviation from the group means (see Table 4.10).

Table 4.12. Frank's Pre and Modified MSLQ

Scale	IGO	EGO	TV	CLB	SELP	MSR	TSEM	ER	HS	Mean
Score	7	6	7	7	7	4.33	4.67	4	4.75	5.75
Rank	1	1	1	1	1	6	7	9	5	3
Group Mean	6.22	4.70	6.52	5.70	5.41	4.80	5.33	5.19	4.89	5.42
SD	.60	.90	.53	1.36	1.30	1.65	1.02	.97	1.50	.69

Frank missed four updates among the 15 mandatory updates (see Table 4.13). He set 11 goals throughout the semester: two of them for planning, one for design, seven for development, and one for evaluation. After the second update, he did not respond to the guiding questions except the question that asked the week's progress about the goal achievement. This question field was the only required field to complete each week's update. He did not mark all the goals as completed until the last week of the semester. He marked 10 goals as completed at once in his last update. The last goal was not a goal but a statement that he finished developing his final product.

Table 4.13. Frank's Use of the SRLS Tool

	Number of missed updates	Number of goals	Time for an update
Frank's	4	11	163/11 (15)
Group Mean	3.3	5.67	
SD	2.5	2.87	
Total	30	51	

Frank did not follow the structure of the Friday5s® tool after the third week. He wrote his reflections in the Friday5s® tool as he did his reflections in the design journal of EDIT6190, using the goal field as a place to enter his entire update. For example, his goals included "what he did, what to do to achieve the goal, and/or what barriers are there" that could be dealt with in other guiding questions. Frank's goals were not always discernable. For example, he sometimes included several goals in a goal. His first goal had two goals: "I should look for a client and keep up with class reading requirement." Therefore, even if he finished one task for the goal, he could not mark the goal to be completed because he needed to finish the other tasks to achieve the goal.

As mentioned above, because Frank did not mark all the goals until the last week of the semester, all of his goals were displayed every week when he used the tool. Friday5s®' Current Update page shows all the goals that were not completed and the guiding questions and input boxes for each goal. This may have created difficulties in using the "Current Update" page because the page was getting longer as the semester moved ahead.

Frank did not use "Request Feedback" throughout the semester even though he mentioned that he would ask about some problems he had to the instructor on his reflection. He clicked the "GuideMe®" button one time at his first update but did not use the content of it for his update. He spent an average of about 15 minutes in doing update each week.

General opinion of the tool. Frank, in general, appears to have valued the use of Friday5s® in the course. He mentioned, "It is powerful in a sense that you can look back what you have done so far and then plan and write it in that Friday5s®' interface and then plan for the next week." He preferred the Friday5s® tool to the design journal he used in the EDIT6190 course. According to Frank, the design journal was a simple writing without any help, while Friday5s® reminded him of the time to do updating. It was hard for him to keep up the design journal because sometimes he just forgot to do it.

Although Frank valued Friday5s® in terms of looking back what he had done so far, he indicated he also wanted to see more supports for planning and seeing what he should do. For planning, he wanted to easily read and picture how the goals were related to each other. He mentioned, "if there are graphic tools that can relate them [goals], it will be really, really, helpful. That's a kind like … forming a tree or something." He also wanted Friday5s® to automatically send email reminders that noticed what he should do when the time he set for the goals or tasks came.

Frank tried to use GuideMe to see what kind of content he should put in his updates. During the interview, Frank indicated he regarded the content of GuideMe® as samples that he could use for his update, but he thought the content of it was too general. Frank mentioned that was why he tried to use it only one time. The date also indicated that he did not send any email to request feedback or ask any questions to the instructor through the Friday5s®' request feedback feature. However, he mentioned that he used his email to send the information about his update to the instructor because he felt more comfortable using his own email account than using another email account (the one embedded in Friday5s®). Frank also sought help from subject matter experts, peers, and Web resources when his motivation declined because of the problems he could not solve by himself for programming.

How it helped. The data indicate that the use of Friday5s® helped Frank continuously monitor and evaluate his progress by sending him email reminders. He mentioned, "It was a really good reminding tool because it's sending an email it's time to update mine. Then I go there, look through previous goals and then how much progress I made on my previous goals."

It appears that Friday5s® helped Frank think of what steps or smaller tasks he needed to achieve goals even though he did not put those specific tasks into the relevant guiding question. He included them in the goal section as described above. Selecting the types of goal (planning, design, development, and evaluation) when he was setting a goal, helped him know what stage he was in and what he had done until then.

To set short-term goals appears to have helped Frank enhance his self-efficacy. He thought that because he was supposed to set goals for the weeks, which were short-term goals, he was pretty confident about the goal accomplishment. He mentioned he set goals that could be manageable.

Frank also indicated that Friday5s® tool helped him report his up-to-date problems and issues to the instructor when they occurred during the week. The instructor could thus give him timely feedback. According to Frank, some problems were very time-sensitive. For example, the issues in defining the scope of the project might influence the entire semester unless it is solved and clarified in the early of the semester.

Frank did not use the "Complete Goal" button until almost the end of semester. When asked about it, Frank said it was because he did not know about the button. Interestingly, because of this, all of his goals appeared whenever he tried to set a new goal or update his progress. As indicated earlier, therefore, he reviewed all the goals he previously set in the process of setting new goals for the week or evaluating the week's goal. Through that process he could do reflection on the previous work he had accomplished or had been doing.

Summary. Frank valued Friday5s® in terms of looking back on what he had done. Although he wanted more for planning like graphical representation of relationships between goals, Friday5s® helped him set short-term goals and enhance his self-efficacy. It also enhanced the timely communication between him and the instructor to solve problems he had faced.

Garnet

Garnet is a native English speaker and 41 years old. She is a master's student in Instructional Technology. She has a bachelor's degree in Economics and History. In responses to the general information questionnaire, she described herself as self-directed, quick, interested, and motivated. She also reported she liked classroom lectures, because that was what she was used to. She had bad experiences with group work as an undergraduate but was growing to like it after some good experiences in the Instructional Technology master's program.

Garnet's project for the EDIT6200 course was to develop a tutorial for researchers who use Media Archives materials in the university. The main purpose of the tutorial was to teach users how to cite the media in the archives in scholarly works according to established standards.

Garnet's scores were average on the total score of the modified MSLQ. Her scores for each scale are presented in Table 14. Her extrinsic goal orientation was lower by more than one standard deviation (3.7, Mean 4.7, and SD .9) from the group mean. She obtained higher scores in the control of learning belief by around one standard deviation (7, Mean 5.7, and SD 1.4) and the help seeking by more than one standard deviation (7, Mean 4.9, and SD 1.5) from the group mean scores (see Table 4.14).

Table 4.14. Garnet's Pre and Modified MSLQ

Scale	IGO	EGO	TV	CLB	SELP	MSR	TSEM	ER	HS	Mean
Score	6.33	3.67	6.67	7	6	4.5	5.33	4.67	7	5.69
Rank	3	8	5	1	4	5	5	6	1	4
Group Mean	6.22	4.70	6.52	5.70	5.41	4.80	5.33	5.19	4.89	5.42
SD	.60	.90	.53	1.36	1.30	1.65	1.02	.97	1.50	.69

Garnet had her client when she started the course. Because her project for the course was her actual task for her job, her client was the library. Based on her journal entries and project management site, she appeared to be on the right track and updating in a timely manner during the first half semester. However, during the final 8 weeks of the semester, her progress was slow and did not meet the course's schedule.

Garnet missed 4 updates among 15 mandatory updates (see Table 4.15). She set seven goals: five for planning, and two for design. She did not set any goal for development and evaluation. Actually, her 7th goal could be classified as a development goal because the goal had two tasks and one of them was to develop the content, but she classified it as a planning one.

This might be because she set the goal in the 7th week, which might be regarded as the planning and designing phases. It was noticed that during the final of 8 weeks, she did not set any goal even though she updated her progress towards goals and wrote her reflections. She could not spend much time for the class because of personal reasons (traveling abroad, illness, and taking care of a sick person). Her goals were usually two or three week-term goals during the first 7 weeks.

Table 4.15. Garnet's Use of the SRLS Tool

	Number of missed updates	Number of goals	Time for an update
Garnet's	4	7	92/11 (8.3)
Group Mean	3.3	5.67	
SD	2.5	2.87	
Total	30	51	

Generally, Garnet provided succinct answers to the guiding questions with little reflection. There was one instance when she answered the guiding questions with some reflection. For example, she mentioned as following:

> Mostly I have just been thinking about it at odd moments, such as while walking the dogs every morning. (My dogs are going to be expert instructional technologists by the time I finish this program!) I am concerned about how create opportunities for users to write citations and get immediate feedback on whether they are using a correct format or not.

In the case of Garnet's goals, she added rich reflection on the two goals:

> I need to develop an overall vision of the module and an understanding of how it fits in to the bigger Media Archives picture. [The instructor] says that the most successful projects are the ones whose designers had a clear vision from early on in the project. So far, I am lacking that vision. Part of my problem is that "the bigger Media Archives picture" is in transition right now and has not been developed. It's hard to visualize a connection to an as-yet nonexistent entity. Sort of like an actor fighting the air in front of a blue screen - balrog to be added later. So how to get a vision? Well, I will be designing the overall Media Archives site so I can shape it as I want to, I guess. I know that the flowcharts aren't due for a couple of weeks but I may go ahead and do a rough one now.

Garnet used the GuideMe® feature a couple of times throughout the semester. At the first update, she tried to see it, but she did not use the content of it to her update. But it was found that she used the content of GuideMe® in the middle of the semester two times. She reviewed other students' update several times. She did not use the request feedback function, although her help seeking score of the MSLQ was highest of all course members.

General opinion of the tool. Generally, Garnet's perceived instrumentality on the Friday5s® tool was not high. During the interview, she indicated she did not feel the tool was useful for her although she thought it was useful for other people. She liked the design journal that she used in the EDIT6190 course better than the Friday5s® tool. She thought the Friday5s® restricted her reflection style. She mentioned, "… I felt that for me as a designer, design was all about bringing everything together, and the Friday5s® tool was all about cutting it back apart again. … I felt that rather with the design journal, I would sit and would think about everything that had happened and kind of put it all together into one thing."

Garnet indicated she felt that the Friday5s® tool was somewhat effective in helping her see the progression of things that was needed, goal setting and planning. She liked the prompting questions or guiding questions for them. The chart function of Friday5s® that showed the progress was useful to her. She also liked the way she could see everyone else's information regarding their updates. She valued the reminder emails the Friday5s® sent each week. Displaying the records of the past updates in Friday5s® helped her to review the process she did and to follow-through.

Garnet also indicated that she thought the design process was not linear and could not be compartmentalized. She felt that the Friday5s® tool was a better fit for a linear and compartmentalized design process. She liked to put her reflection about everything that had

happened all together into one area as she did in the design journal of EDIT6190. Therefore, she was still skeptical about the linearness and straightforwardness of the tool. She thought the process of design was systemic rather than linear. The tool seemed not to be flexible enough to meet those characteristic of her design process. The following remark shows her idea about the relationship between her perspectives on the design and development process and her opinion about Friday5s®:

"The thing that I didn't like, though, was sometimes, it seemed like there wasn't really, you know, plans sometimes change in the design process because it's kind of organic, and I felt like it really kept you on a straight path. It didn't allow for a path that was more like kind of windy and curvy and going off with tangents."

How it helped. According to the Friday5s®' log, Garnet used the basic elements of the tool. She set goals, planned, and evaluated the progress by answering the guiding questions. The content of the GuideMe® was a kind of example for goal settings to her. She did not request any feedback from the instructor through the Friday5s® request feedback feature because she felt the feedbacks the instructor sent regularly to her were enough. She said, especially, as she was struggling with external factors like illness and a trip, the instructor's supportive feedback helped her stay on track.

Although her help seeking of MSLQ score was highest, she did not often communicate with other students in the course. This may be because she did not do much on her project to get feedback on it.

While Garnet indicated in the interview that the tool was not valuable, goal setting, planning, monitoring, evaluating were helpful to her. She said, "Despite, you know, the design might be organic, but you do have to do specific things and you have to set goals and follow

through on them. So I think, having that, and sometimes, it was kind of unpleasant to see, "Oh, I had a goal for this week and I didn't meet it." But it was a good reminder of what needed to be done."

According to Garnet, she did not need to learn much from the course. She was very experienced with conducting a project and knowledgeable with instructional design and the developing software like Dreamweaver and Photoshop. She said, "… because I wasn't really, I mean what I was learning was a little less concrete because I already knew all the software that I needed and I had already learned instructional design, so I wasn't really learning those things."

Summary. The tool was not very useful to Garnet. Garnet was very experienced with conducting projects and was pretty knowledgeable in the instructional design and the software. She felt the tool's structure did not match well to her perspective on the design process. The external factors like her and her mother's illnesses and a trip out of the country challenged her coursework; thus, it may have influenced her use of the Friday5s® tool in the course.

Hal

Hal is a non-native speaker and 33 years old. He is a master's student in Instructional Technology. He majored in Physics and Mathematics for his BA in his native country. He described himself as a visual, hardworking, on task, and above average learner with very analytical mind. He taught Math, Science, and Computer Applications to high school and post high school students for 8 years in his native country.

Hal's project for the EDIT6200 course was to develop an interface through which college students can access the content in a CD-ROM on Natural Resources Recreation and Tourism Planning for the school of forestry at the university. This CD-ROM allows users/learners to access the two main applications on Natural Resource Recreation and Tourism Planning. His

product was designed to help students understand the organization of the content so that they could ultimately learn some of the intended concepts of forest resource recreation and tourism planning. Hal used Macromedia Flash to create the interface, however he was lacking programming and graphic skills. Hal sought help from the peers in the course.

Hal did not have much difficulty in finding his client. He got his client at the beginning. However, he worried about the type of his project from the early of the semester. The final product should be instructional because the course's object was for students to acquire the knowledge to integrate the instructional design principles and the skill to author the software. He mentioned one of his updates, "Effective communication is important as my initial idea of the project took a turn after finalizing the scope of the project with the client and the team. It turned up to be less instructional than I had thought and hoped for." In spite of the feedback from the instructor, he did not make his product more instructional.

Hal obtained an average score on the total score of the pre-administered modified MSLQ (5.68, Mean 5.42, and SD .69). His scores for each scale are presented in Table 16. He had high scores in Metacognitive Self-Regulation (6.3, Mean 4.80, and SD 1.65) and Time and Study Environment Management (6.17, Mean 5.33, and SD 1.02) by around one standard deviation from the group mean scores. His score for the Help Seeking scale was relatively low among the students (4.25, Mean 4.89, and SD 1.5) (see Table 4.16).

Table 4.16. Hal's Pre and Modified MSLQ

Scale	IGO	EGO	TV	CLB	SELP	MSR	TSEM	ER	HS	Mean
Score	6	4.67	6.33	6.67	5.67	6.33	6.17	5	4.25	5.68
Rank	6	4	5	3	5	3	2	5	7	5
Group Mean	6.22	4.70	6.52	5.70	5.41	4.80	5.33	5.19	4.89	5.42
SD	.60	.90	.53	1.36	1.30	1.65	1.02	.97	1.50	.69

Hal missed 3 updates among 15 mandatory ones (see Table 4.17). He set 5 goals: one for planning, two for development, and two for evaluation. During the first 10 weeks of the semester, he had only one goal, which was to develop the final product. During this period, he did not set up new goals but revised his first goal several times as he went on defining the scope of the final product. His first goal was finalized as "To design a trail navigation menu (using action script) which can show all the destinations but, at the same time, it has to be clean and not cluttered; is consistent with the rest of the content." Although his first goal was marked as a planning goal, he did not know he could select the type of goals when he set the first goal and the planning was default according to the interview with him. Instead of setting weekly goals, he had only weekly specific and short-term activities that he would do to achieve the long-term goal until around 10th week of the semester. After the 10th week, he set new goals and selected the type of each goal. Because he passed the design phase when he started to set a new goal and selected the type of the goal, he did not have any design goals.

Table 4.17. Hal's Use of the SRLS Tool

	Number of missed updates	Number of goals	Time for an update
Hal's	3	5	282/15 (24min)
Group Mean	3.3	5.67	
SD	2.5	2.87	
Total	30	51	

Generally, Hal's responses to the guiding questions were short. He did not include much of his reflection. His main problem was in learning and using Action Scripts of the Flash for his project. He mentioned that he would try to use books and websites to solve this problem during the first half of the semester on his updates. But, he tried to get help from other students to solve

his problem as the semester went toward the end. He requested the feedback from the instructor for the first three updates.

General opinion of the tool. From the interview with Hal, it was turned out that he, in general, liked the tool throughout the semester. It appears he valued the tool: "Without the Friday5s®, my progress would not be as far as, my goal accomplishment might not be as good." He liked the interactivity of the tool. He stated, "It's an active PDA [personal digital assistant]. And it's interactive, you need to input to see your progress and to know what have you done, and what should you do, it's more interactive."

Hal compared the Friday5s® tool with the design journal he used in the EDIT6190 course. The major difference between them to him was whether it required him to update his status on time. In the case of the design journal of EDIT6190, the users could postpone their updates whereas the users could not update if they missed the due date of each update. He said, "it [the design journal of EDIT6190]'s not really well time. I can do reflection later on." It seemed he liked to be controlled by due dates at a certain degree although he liked to control his task and wanted flexibility.

Following the sequence of the guiding questions on the current update page, Hal used the basic elements of the Friday5s® tool such as goal setting, updating his progress, reflecting on what he had done, defining difficulties, and the resources he would use. According to Friday5s®' log, he tried to look into the contents of the GuideMe® function 9 times throughout the 3 updates and actually used the contents of it for his planning at the second and fourth updates. He used the GuideMe® to see what kind of contents he should put in his updates. After using this feature two times, he did not use it because he knew what type of things he should write. He mentioned, "it [GuideMe®] was useful … along in the beginning. Later on, because I understand what to

do." He thought the GuideMe® was necessary for the students who need some samples for their updates.

How it helped. The use of Friday5s® appeared to help Hal organize his thoughts. He mentioned, "It's very useful for me because it can organize my thoughts and I can see what's my progress, I can reflect later on, and check my progress." The email reminders to ask him to update compelled him to take actions to keep up with his updates. To see his own progress in order to do his updates gave him a clear view about how far he had done and how much he had to go. It stimulated him to do his project. He stated, "You know I haven't achieved this goal yet in this week and I have to set a new goal for the next week."

Hal mentioned that the guiding questions helped him specify his goals. For example, by answering the questions that asked him what steps he would need to task, he could specify his goals. Specific goals provided him with a focus. The short-term goals helped him not to be lost. He mentioned, "That (short-term goal) helps me because with the long-term goal I would be lost sometimes, I don't want to be lost."

Setting his own goals may have given Hal a feeling of ownership over the tasks even though it was not a goal of the Friday5s® tool. He stated, "I realize that setting goal is very important and resources by writing down, it gives me responsibility, reminds me the responsibility to fulfill that goal. … You cannot blame anybody else because it's responsibility on my own."

Summary. Hal indicated considerable value for the Friday5s® tool much. Although he missed three updates, his missing rate was low compared to others. Writing down the specific and short-term goals and reflections helped him focused and monitor his progress. It also gave him the ownership on his work.

Iria

Iria is a non-native speaker and 27 years old. She is a master student of instructional technology. She majored in Business Administration for her BA in her native country. She described herself as a non-active learner in a general information questionnaire. She likes to learn from the valuable and reliable sources such as a master in a field or books. She taught Accounting to high school students for three years in her native country.

Iria's project for the EDIT6200 course was to develop an ear-training program to facilitate music major students in listening skills. The program included a tutorial to help students familiar with intervals and a drill to help students distinguish different intervals. The main development tool was Macromedia's Flash. The program was Web-based and designed for students to wirelessly access through mobile computers such as PDAs and notebook computers. To create the program that had the intended functions, she needed to use Action Scripts that required a programming knowledge. She regarded it as an advanced skill in the Flash and she expressed that she wanted to get some help from experts at an update in the early of the semester update on Friday5s®.

Iria found her client on the second week and did not express she had a difficulty in finding a client. Her client was a doctoral student in her department, who was developing a Web site that provided music lessons. Her module was a part of the entire Web site. The project was a part of the research that he was conducting with faculty in the music department. Although this project was cross-department, she communicated only with the doctoral student.

Iria had the lowest total score of the pre-administered modified MSLQ (4.36, Mean 5.42, and SD .69). Her scores for each scale are presented in Table 4.18. She had low scores in Control of Learning Belief (3.67, Mean 5.70, and SD 1.36), Self-efficacy (3.67, Mean 5.41, and

SD 1.30), Metacognitive Self-regulation (3.17, Mean 4.80, and SD 1.65), Time and Study Environment Management (4.83, Mean 5.33, and SD 1.02), and Help Seeking (3.25, Mean 4.89, and SD 1.50) by around one standard deviation from the group mean scores. As shown in Table 4.18, her ranks for each scale were low with the exception of exception of Intrinsic Goal Orientation (see Table 4.18).

Table 4.18. Iria's Pre and Modified MSLQ

Scale	IGO	EGO	TV	CLB	SELP	MSR	TSEM	ER	HS	Mean
Score	6.33	4	6	3.67	3.67	3.17	4.83	4.33	3.25	4.36
Rank	3	7	7	8	8	8	6	7	8	9
Group Mean	6.22	4.70	6.52	5.70	5.41	4.80	5.33	5.19	4.89	5.42
SD	.60	.90	.53	1.36	1.30	1.65	1.02	.97	1.50	.69

Iria missed 9 updates among 15 mandatory ones (see Table 4.19). She missed 3 updates during the first 8 weeks and 6 updates during the rest 7 weeks. She missed 8 updates in a row from 7th through 14th week. She set 6 goals: three for planning, one for design, one for development, and one for evaluation. She spent a total 132 minutes for 6 updates with an average of 22 minutes per update. She did not mark the third through sixth goals as completed. Her final goal, which was about evaluation, was set in the last week of the semester and she did not mark it as completed.

Table 4.19. Iria's Use of the SRLS Tool

	Number of missed updates	Number of goals	Time for an update
Iria's	9	6	132/7 (19)
Group Mean	3.3	5.67	
SD	2.5	2.87	
Total	30	51	

As mentioned above, Iria missed more than half of the required updates. Her responses to the guiding questions in her first through third updates were short and did not include any additional reflection other than the answers to the guiding questions. After the third update, she did not response to the guiding questions, but only set her goals and marked her progress. The way she set her goals changed from the third week. From her third goal, she included specific tasks she should do for a certain multimedia development phase. For example, her fourth goal was for design and she included tasks for the design phase like "Develop initial content ideas", "Conduct task and concept analyses", "Do a preliminary program description", "Prepare a prototype", "Create flowcharts and storyboards", and "Prepare scripts". Therefore, generally her goals were mid-term goals that seemed to take three or four weeks to complete except the first and second goals, each of which included only one or two tasks

Because her goals were not short-term goals, Iria seemed to have difficulties in completing the goals. For example, a response to a guiding question, "What have you done to make progress on this goal?" for her third goal was "None. I am far away behind this goal." It was in her sixth week. After the week, she missed eight updates in a row.

According to the Friday5s® log, Iria viewed GuideMe® two times in the first and second weeks, but seemed not use the contents of it for her updates. She tried to review other students' updates by using "Shared Learning" feature of Friday5s® two times in the third week, but did not continue using the feature after then. She did not use "Request Feedback" feature of Friday5s® at all.

General opinion of the tool. From the interview with Iria, it was turned out that she did not like to use Friday5s® throughout the semester. She repeated that the tool might be useful, but it just did not match up to her style. She stated that some people who were already organized

might not like the structure that the tool provided. She mentioned, "Maybe they like to organize things in their own way, and they don't want to follow the pattern in Friday5s®." Because she liked the less organized style for her reflection, she preferred the design journal that she used in EDIT6190 course to Friday5s®. In addition, as described above, because she missed more than half of the updates, it did not help much, she said.

Iria indicated she liked to keep some short reflection journals in her own computer instead of writing them into Friday5s®. She said, "I write some journals in my own computer, but I did not put it into Fridays5… I just kept tracking what I've done this week." Another reason she did not use Friday5s® at a good level was that she did not like to log into it. She mentioned, "Because you have to log in to Fridays5, but I can just write in my own PC. And I can just set it to the folder and I don't have to log in and I don't have to try to find a goal to set it in the tool."

How it helped. Because Iria missed many updates, she indicated she felt she did not actually use the tool. She said, "I think I'm not really using it. I just … to remind myself that there are still something that I must complete before the end of this semester. So I put those goals in there. But I did not actually to update my following actions."

Although Iria did not use Friday5s® much, she stated she valued some activities that she was supposed to do in Friday5s® such as goals setting, and monitoring. To set up specific goals helped her have a clearer structure of what she should do. She mentioned, "I think to set, to specify goal help me a lot. I would know what should I do in following week. I would have a more clear schema in head of me. A more clear structure." However, Iria mentioned that to set a goal and make a plan was done by her mind, not by the tool. She felt that the tool was the only a

place to put her reflections to her. Doing updates also helped her see and manage the progress of the project.

To Iria, the email reminder played a role of not only reminding of updating but also reminding of doing the project itself. According to this statement, the email reminder helped her at least to pay attention to the project although she missed many updates in spite of the email reminders.

Iria indicated she was not confident about the goal accomplishment when she set new goals. Her goals were pretty long-term goals that took several weeks to be completed. She stated, "Usually I set goals more than I can do. Because I don't know exactly how many things I can do in that week." When she found she did not complete a goal, her self-efficacy seemed to decline, therefore she recommended not to set too many goals for a week.

Summary. Iria did not like the way she should do her updates in Friday5s®. She used her own short journals in a less structured way for planning and monitoring while she missed many updates in Friday5s®. Although Iria did not use Friday5s® enough to see how it helped her or did not help, she valued goal settings for the course and the email reminders by Friday5s® from her experience.

Results of Cross-Case Analysis

This section presents the major themes and trends that emerged through comparative analyses of individual participant data with reference to the research questions. To extract the themes presented in this section, three levels of analyzing data were iteratively used. First, the codes from each participant's interview and open-ended questionnaire were categorized to draw themes. Second, the categories were compared looking for similarities, differences, and patterns. This process sometimes resulted in several iterations to the first level of categorization of codes

and new ways of representing data. Finally, the overarching themes that emerged from comparing codes and categories were organized by research questions through several iterations to the first and second level of categorization.

The results of the cross-case analysis are presented according to the research questions. The results and findings derived from the data collected from nine participants represent the culmination of the analysis process. The findings reported are a synopsis based or trends in the data across participants. Readers are reminded that the following discussion relates to nine participants. Findings are not included to be generalized beyond the scope of this study.

Question 1: How do students describe their perceived instrumentality (or utility value) on the use of a SRLS tool?

The students' perceived instrumentality or utility value on a SRLS tool varied according to the different points in the semester, the types of tasks (individual vs. team based tasks), and the difficulty of the task they felt, individual's level of experience they believe, and the personal design and reflection style for instructional software design and development. Figure 4.1 provides a visual overview of the perceived utility value.

Different Points in the Semester

Some participants perceived the SRLS tool as more useful in the beginning of the semester than the end of the semester. For example, Eddy initially used the tool for his planning and design stages but did not use it much for his development and evaluation phases. He mentioned, "It was really helpful at the beginning because it really helped me to plan and kinda of get my ideas in order and figure out what I was gonna do. And the way it kind of asks you questions helps you to structure your design. But towards the end I didn't find it very helpful

because I was past the planning and development stage, and I was on the "go and make it" stage."

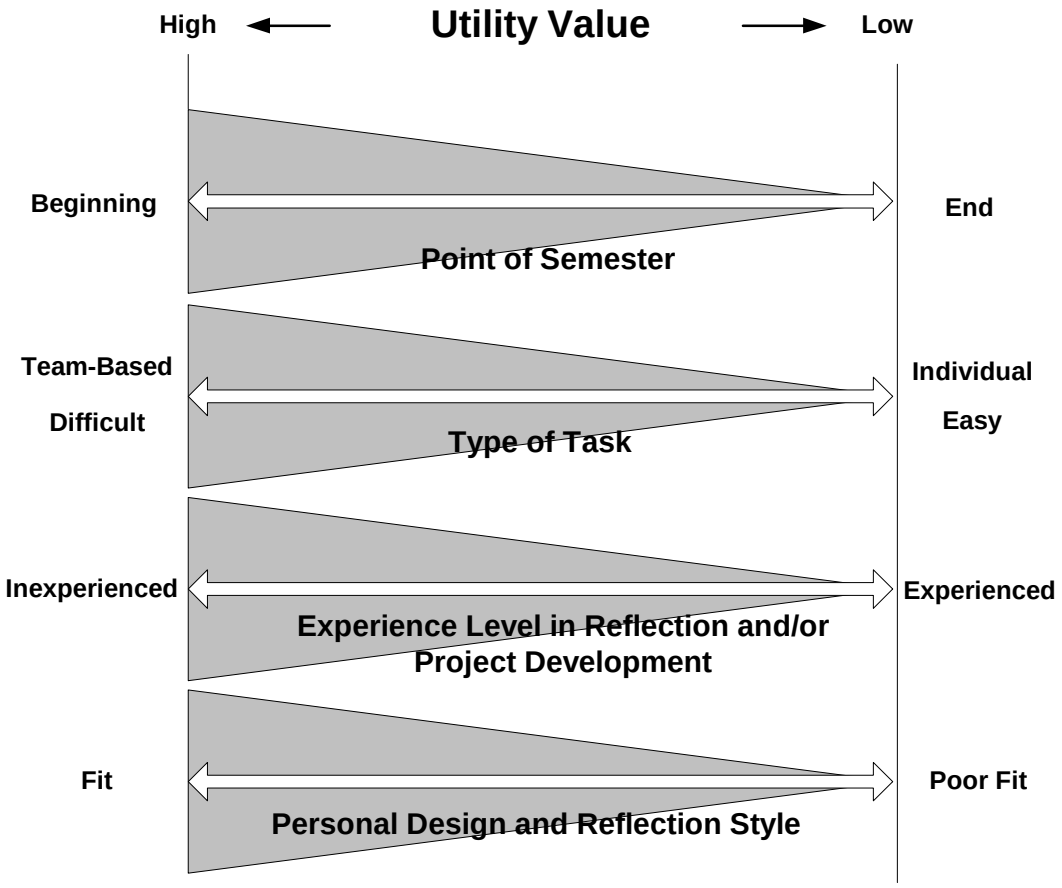

Figure 4.1. Instrumentality on the use of the SRLS tool

Towards the end of the semester, Eddy looked to be regulated and controlled by the approaching due date and other constrains. He looked as if he could keep doing his work to complete all the requirements without the activities with the tool. As it approached the end of the semester, he put a lower priority to the use of the tool while giving higher priorities to the actual development of multimedia products. He described this situation:

> When you start out with designing a project, you say, you know, "I'm gonna do the coolest, latest, greatest thing. And this is what it's gonna do." Then, and that's like, you know, the whole Piaget's cognitive processing thing, where, you know, you come up with this schema that you think you're going to do. Then you go through the whole

> assimilation, disequilibration, and then finally equilibration, and you come out with something and you say, "Well, this is what I can do given the time, given the money, given the constraints of the users, given the constraints of the technology. This is what you get. It's not as pretty as I had hoped for, but that's what you get."

In the case of Frank, he emphasized the overall planning at the beginning of the semester and wanted more function to help students do it. He stated, "It will be really helpful, if graphically relate those goals. Because sometimes, it's hard to read and then, picture how these goals relate to each other. But if there are graphic tools that can relate them, it will be really, really, helpful. That's a kind like … forming a tree or something." To him, planning a semester long project could have been better supported by the SRLS tool if the tool had had a graphical representation feature to organize many goals for the course.

Overall, some participants found that the planning and designing phases needed more self-regulatory activities than the development and evaluation phases in the course. Also planning for the entire course at the beginning of the semester was critical in this student-centered learning environment. Therefore, the SRLS tool and the related activities like goal setting, planning, monitoring, and evaluating might be more useful at the beginning of the semester.

Types of Tasks

Several students expressed that the SRLS tool would be more useful for team-based or collaborative tasks which need active communications between members or peers than individual tasks. One reason for this might be because the tool is Web-based. As the tool is Web-based, the tool basically has powerful functions to help communicate and share ideas between members in distant or blended learning environments such as the course in which this research was conducted. Eddy mentioned, "I think if I was working on a larger project with more people, it would be very helpful because it would help me to answer to people and keep

people aware of what I'm working on and the problems that I'm having. So I think it would work well for a team project, but not so much for an individual project."

In the case of Aidan, he implied that the tool would be more useful in team-based project. He mentioned, "It seems to be a little much for what we were doing. I don't think that the information that it was requiring was necessary for the kind of project that we were engaged in. Maybe if, you know, I … if I'm working for, you know, say, IBM or Dell or something, or some instructional design firm, it might be useful."

In addition, the level of difficulty of the task that the students felt was another factor that impacted the users' utility value on the use of the tool. This is indicated in Aidan's quote. This finding is supported by the meaning and definition of support or scaffolding: Assistance which needs when learners are not able to do a certain task by themselves because the task is beyond their ability. If the task is not hard enough for students to need any support, the students may not find the support useful.

Individual's Belief about the Experienced Level

Perceptions of experience also influenced utility value. If students believed that they were well experienced, their utility value on the tool was relatively low. There were three kinds of experiences: experiences with conducting instructional design and development projects, experience in doing reflections, and experience with managing daily life.

First, some students who had experience in conducting design and development projects expressed that the tool was not very useful. For an example, Garnet had an authentic experience with a big project. She said, "I was on a big project a couple of years ago working on a grant …, and I was supervising six other people on the grant. … it was a big task that was divided into segments, and we used spreadsheets to track it." She said the tool was not very useful to her

even though she valued the explicit writing up goals, checking the progress towards the goals, and reflecting on what had been done.

Aidan also believed that he was experienced with instructional design and development tasks. However, he did not think that the tool was useful. He mentioned, "I think that's more important as you're beginning, beginning designer or beginner designer, you know when you're doing your first and second project and then as ... you know, when you get to a certain level - and I'm not saying that, you know, I'm the pinnacle of instructional designers - but once you get to a certain level, it's not so much…" In Aidan's case, the SRLS tool was perceived as a tool to support the novice designer.

Experience level in managing busy daily lives was another area that was related with the utility value of the tool. Brandy was so confident in managing her tasks for the course and expressed that she would do well even without the tool. She stated, "In general, I didn't think I really needed it. I could see that somebody who wasn't very self-directed might use it, but I'm an extremely self-directed student and I keep on task very well." She also described her experience from her daily lives with her children. She added, "I think it's important to know that I have five children of my own, and because of that, I've gotten very good at setting goals and accomplishing them, you know, just being a mother of five." She believed that she could manage her project in the course without the tool because she had built necessary skills through the experience of managing her busy daily lives with her children.

Finally, experience in doing reflections was another area that was related to the perceived utility value of the tool. Aidan mentioned, "I did journals in different courses that I've had before. … The reflective activities were good to help me evaluate my progress and to keep me on track. So I enjoyed it. I think it just came to a point that, because I had done so much journaling

in the past that I knew myself well enough that I didn't really feel like I needed it this time." It seemed that he already internalized the reflection skills through much journal experiences in previous courses to a degree he did not need explicit activities either in his mind or on a tool for reflection.

Personal Design and Reflection Style

The fit of the participants' reflection style for multimedia product design and development style to the tool's structure also impacted the perceived utility value and the use of the tool. Some of students expressed that they preferred the loosely structured reflection style to the less flexible style of Friday5s®. However, ironically, the structure of the tool was what others really liked about the tool. For example, Chad, Eddy, and Hal liked the structure of the tool that provided the guiding questions and input forms. Chad mentioned, "It is well laid out. It is well structured. It makes sense. It flows as far as the process. So those are the strengths, I would say." He liked the structure of the tool because it helped him focused on the goals. Eddy also stated, "I think, again the thing that I liked most about the tool was the questions that it asked me and the thinking that it asked me to, kinda prompted me to think." Hal also expressed the sequences of the questions helped him organize his thoughts. In addition, although the guiding questions did not work well with her style, Brandy valued the guiding questions. She stated, "For people who aren't [goal oriented], I think it would be a very good tool because … and the questions were good if you didn't already think like that."

Iria liked the EDIT6190's design journal that she thought was less structured. She mentioned, "I think this tool is useful, but not everyone can fit into the style of Friday5s®. Maybe, they don't, they are not so organized people, and then they don't want to… Maybe they like to organize things in their own way." She added, "I think maybe I prefer the journal thing

we used in previous class [EDIT6190], so maybe I don't need such an organized tool. But that's not its weakness. It's just my problem."

Garnet had her own well-grounded view about the process of the instructional design from her experiences with real projects and course works. She viewed the design process as more organic than discrete and straight forward. She stated, "… it was useful in setting out a plan for the week. The thing that I didn't like, though, was sometimes, it seemed like there wasn't really, you know, plans sometimes change in the design process because it's kind of organic, and I felt like it really kept you on a straight path. It didn't allow for a path that was more like kind of windy and curvy and going off with tangents."

Aidan also pointed out that the mismatch between the tool's structure and his style was the one of the reasons that the tool was not useful to him. He stated, "It just wasn't very useful for me because I don't design in a way that I would necessarily utilize a tool like that every week." In all three instances, the user's design style or reflections style did not match up with the way s/he should follow in the tool.

In sum, the points of the semester, the types of tasks, individual's experience level, and the match between personal style and the tool's structure impacted the participants' utility value on the tool. Students had 1) higher utility value for the use of the tool in the beginning of the semester than the end; 2) higher utility value for the difficult, big, and team-based tasks than the easy, small, and individual-based tasks; 3) higher utility value for inexperienced students than experienced students; and 4) higher utility value when their design and reflection style matched up with the tool's structure.

Question 2. How do students engage in self-regulated learning activities provided by a SRLS tool (e.g., goal setting, planning, monitoring, evaluation, and resources use)?

Based on the journal entries that the students put in the SRLS tool and the interviews with them, all of the students engaged in some degree of self-regulated learning activities such as goal setting, planning, monitoring, evaluating, and resources use. The description of the students' self-regulated learning activities starts with goal setting, planning, monitoring, and evaluation followed by resources use.

Goal Setting, Planning, Monitoring and Evaluation

Table 4.20 shows an overview of the student activities based on the updates in the SRLS tool. If a student updated their progress through the SRLS tool at least two times, he or she should engage in goal setting and evaluation at least one time because they were supposed to do it in the tool. Therefore, for further understanding, the number of goals and the number of updates are provided as well as whether they engaged in goal setting, planning, monitoring, and evaluation. Overall, the more updates they did, the more goal setting, planning, monitoring, and evaluation they usually engaged in.

Table 4.20. Overview of Goal Setting, Metacognition, and Use of the Tool

Pseudonym	Goal Setting & Planning	Monitoring & Evaluation	Number of Goals	Number of Updates	Time (min.) per Update
Aidan	✔	✔	4	8	4
Brandy	✔	✔	14	15	30
Chad	✔	✔	11	15	18
Danica	✔	✔	4	3	21
Eddy	✔	✔	4	9	19
Frank	✔	✔	11	11	15
Garnet	✔	✔	7	11	8.3
Hal	✔	✔	5	12	24
Iria	✔	✔	6	6	19
Mean			7.8	10.9	17.1

SD			3.8	3.2	8.3

The table 4.20 reflects that each student showed different pattern of use with the SRLS tool. For example, each individual participant showed different types of activities in the SRLS tool in terms of goal setting and answering the guiding questions. First, each goal they set took different time to be achieved. Some students spent as much as 3 weeks to achieve each goal while some students spent relatively short like one or two weeks to complete each goal. One reason that they spent a long time in completing each goal was that they usually included many tasks in one goal. Second, some students did not answer the guiding questions well and did skip the questions while some other students answered the guiding questions well.

It is more important to note that even though some students did not follow the structure of the tool in not answering the guiding questions, they included enough planning and reflection in their own way. This usually occurred in the goal section of the SRLS tool. For example, Iria missed 8 updates among 15 required ones and set 6 goals. From her third goal, she included many tasks in one goal. In her third goal, which was for planning for her project, she included many tasks for the planning phase like “Define the scope,” “Identify learner characteristics,” “Establish the constraints,” “Produce a planning document,” “Produce a style manual,” “Determine and collect resources,” and “Obtain client sign-off.” These tasks were hard to be completed in a week or two. But, she did not plan how to achieve this goal. She had difficulties in completing this goal. A response to a guiding question, “What have you done to make progress on this goal?” for this goal in a later week was “None. I am far away behind this goal.” It was in her sixth week. The instructor gave her feedback which was “Maybe you should break it up into smaller components so it doesn't look like so much. Maybe target your learner characteristics and constraints this week. Then move on to other aspects. I have found that

having smaller pieces can make it feel like it is not so overwhelming, and then I can get things done." But she did not follow the instructor's feedback and did miss 8 updates in a row.

In the case of Frank, he included two things in his first goal, which was "I should look for a client and keep up with class reading requirement." One task was to find a client, which should be completed within one or two weeks while the other task was to complete reading requirements which would take several weeks. Therefore, he could not mark his first goal until the final week which was due for all assignments.

In contrast, Chad did not miss any update among the 15 mandatory updates and did set 11 goals, which were very specified and short-term except a goal about the reading assignment that took nine weeks. Although his responses to the guiding questions were short, he hardly missed any guiding questions when he updated. The example in Figure 4.2 was from his seventh week's updates.

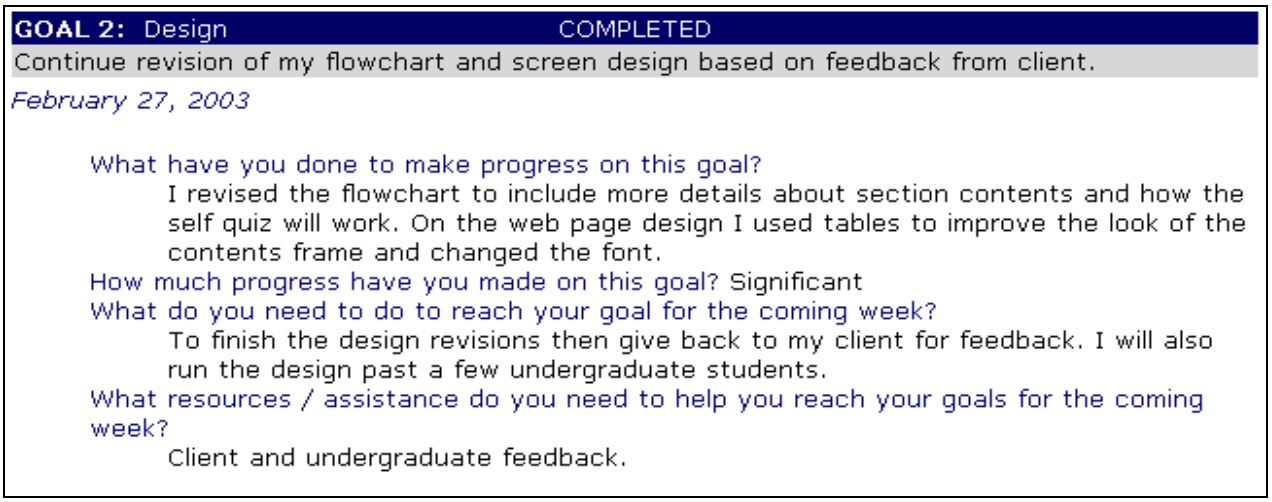

Figure 4.2. An example of Chad's updates

In the mean while, Brandy, who did not miss any update and did set 14 goals, did not answer all the guiding questions. Instead, she included all the planning, evaluation, and reflections in her goal section. Therefore, her goals shown on the SRLS tool included goals,

plans, things she did, and very rich reflection with self-evaluation. Even though Brandy did not enter anything into the guiding questions but the goal setting question during the first four weeks, she started putting some responses into the guiding questions from the fifth week additionally while she kept entering reflections into a goal section.

Frank, who missed 4 updates and set up 11 goals, also did not follow the SRLS tool's structure. As Brandy did, he used the goal field as a place to enter his entire updates from his fourth update. For example, his goals included "what he did, what to do to achieve the goal, and/or what barriers are there" that could be dealt with in other guiding questions.

In sum, the SRLS tool provided evidence that all nine students engaged in self-regulated activities like goal setting, planning, monitoring, and evaluation in some way. However, there were big variances in the number of updates and goals among the students. Also the use of the SRLS tool was different for each student. Some of them followed the guiding questions while some students used the tool in their own way by including all their reflections in the goal section.

Resources Use

Most of the students mentioned the use of various resources in their updates. This may be because they were supposed to answer the guiding question, "What resources / assistance do you need to help you reach your goals for the coming week?" Those who did not follow the structure of the SRLS, such as Brandy and Frank, also included the needed resources or assistances in their reflections, but in the goals section, Aidan did not mention the use of resources in any updates. Those who did mention resources indicated all of a variety of sources can be categorized into several kinds: books, human resources, time, and Web-sites (see Table 4.21 for an overview).

First, books were one of the most frequently mentioned resources. Usually, students mentioned authoring tools' manuals as main resources of books such as "Action Scripts for Flash," "Flash manual," "Dreamweaver manual," or "Fireworks" when they had difficulties in programming. For an example, Hal answered the guiding question, "What resources / assistance do you need to help you reach your goals for the coming week?" with "Read the Action Script book and Flash MX game design principles." In the case of Frank, he mentioned resources in his book and Flash MX game design principles." In the case of Frank, he mentioned resources in his reflection like "I found out that XML is used to connect Flash and Database. But unfortunately, I do not know any XML. I bought an XML book, "Learn XML in a weekend." I hope the book is as good as the title claims."

Table 4.21. Overview of Resources Use

Resources	Types and Purpose
Books	• Manuals for programming • Textbook: Alessi & Trollip (2001)
Human	• Clients • Programming experts for technical helps • Subject matter experts (SME) • Instructor
Web	• Samples from other class mates • Programming solutions and resources • Graphics files
Time	• Time to focus on their project

Another kind of book resource was the text book for the course, "Multimedia for learning: Methods and development" (Alessi & Trollip, 2001). For example, Hal answered the guiding question with "At the same time reading the relevant resources I know of (I found the chapter 4 on Hypermedia in the Alessi's and Trollip's book very useful)."

Human resources were another kind of resource frequently mentioned in the reflection. Because the projects in the course should be done with clients, in many cases, they mentioned their clients as resources to solve problems in defining the specifics of the final program, needs analysis, audience analysis, technologies to be used, and others related to the project. The participants also turned to their clients for context related information if the clients were the SMEs. In other instances, other people were contacted for content. In the case of Garnet, she tried to find persons who could help her citation tutorial's content. For example, she answered the guiding question with "I need to ask a friend in the Association of Moving Image Archivists about the best people to talk to at the organizations I am trying to get information from."

Another instance in which human resources were used was for technical help. When the students needed some technical problem in programming, they also tried to find someone who could provide a solution to a specific problem, like database-flash connection, Action Script for a game, etc. In this case, they usually got help from peers or ex-students from the same course, EDIT6210 or EDIT6190 in the Studio series course. For example, Hal got help from Frank for programming and from other students for graphics in the EDIT6210 course. Eddy also tried to get help from his colleagues to select best tools for his project. He posted, "I will seek assistance from the NMI network administrator and office manager."

The instructor of the course was also a human resource. Most frequently, the students mentioned the instructor as resource when they needed to clarify the aptness of their project to the course requirements. A few students also requested feedback on their updates from the instructor through the feedback request feature of the SRLS tool. When asked why they did not request more feedback, the participants indicated it was because they were satisfied with the feedback regularly sent to them by the instructor without request. The instructor sent feedback

almost every two weeks (seven times among 15 weeks) through the SRLS tool. There were also some other communication through their own email system or face-to-face when the issues were more personal and the students did not want to make the conversation public.

Another important resource was the Web. There were several types of use of the Web. Some students mentioned other students' updates in the SRLS tool or their project management sites for the EDIT6200 course. They tried to get some idea for their project or updates from the other students. For example, Chad mentioned, "Review of others goals and objectives" and "Look at other project sites for example of how to do flow chart" as resources. In the case of Garnet, she stated, "Need to check against examples from past 6200 classes" as resources for her project design.

Another use of the Web was for looking for solutions for programming. Some students browsed the Web to find out programming sources for their projects. They sometimes visited the related forums and asked for solutions. Hal mentioned, "Explore developers' sites further for source files and good design for navigation." Frank also tried to find a solution for connecting database and Flash from the related forums on the Web. Some students used the Web to get graphics and some layout examples. In the case of Brandy, when she worked with two 10 year olds, she used the Web to get graphics. She wrote in her reflection, "This involves some looking on the Internet for graphics to fit her needs." Hal also stated, "I will have to scour the net for graphics and pictures."

Finally, time was another important resource. This was especially true for the part-time students who had a full time job, like Chad and Garnet who frequently mentioned time as a resource. In the case of Chad, he explicitly mentioned time as a resource four times in his updates in the SRLS tool. For example, he stated, "Time to read and summarize this weekend,"

and “Time for focused work on development.” Garnet also mentioned time as a resource a couple of times. For example, she mentioned needing “More free time than I am likely to get.” Garnet provided examples of how she could get more time. She posted, “The main things I need to do are hire somebody else to take care of my pets and get up 2 hours earlier! Petsitter and alarm clock! Seriously, I need some quiet time and some index cards so I can write down the steps and shift the cards around till the sequence makes sense to me.” Time was indeed a needed resource for all the participants, especially the busier students.

In sum, all the students except Aidan planned resource use to help their reach their goals. Books, human resources, and the Web were frequently mentioned throughout the students’ updates. Time was also regarded as an important resource especially by the part-time students who did not have much time for the course. In terms of help-seeking related with resources, the students tried to get help from other students in the course or colleagues in their jobs. The main purposes for seeking help were to get solutions for their programming and to get help for the content to be used in the final product. When they needed solutions for programming, they also tried to get help from the related forums on the Internet.

Question 3. What factors appear to impact, and in what ways do they impact, the students’ use of the SRLS tool (including the level of motivation and metacognitive learning strategies)?

Patterns in the use of the tool might be affected by many factors. In this section, the key factors that affected the use of the tool are presented. First, how levels of motivation and metacognitive learning strategies influenced the use of the tool is presented. Second, the points of the semester are presented as another factor affecting the use of the tool. Finally, other factors that might affect the use of the tool are presented.

Level of Motivation and Metacognitive Learning Strategies

A Pearson correlation (a descriptive statistic) was used to assist with analysis of how level of motivation and metacognitive learning strategies influenced the use of the SRLS tool. In the case of motivation, the intrinsic goal orientation (IG), extrinsic goal orientation (EG), and task value (TV) among the motivation sub-scales of MSLQ were compared with the use of the tool to find any co-relation between them. Second, the metacognitive learning strategies (MS) was the mean of the subscales, Metacognitive Self-Regulation, Time and Study Environment Management, Effort Regulation, and Help Seeking for metacognitive learning strategies of MSLQ that was administered at the beginning of the semester. The number of missed updates (MU), the time (minute unit) the students spent for each update (TIME), the number of goals they set up (GOALS) were used to represent the use of the tool. Table 4.22 shows the each value by each participant.

Table 4.22. Motivation, Metacognitive Learning Strategies, and the Use of SRLS tool

Pseudonym	IG	EG	TV	SE	MS	MU	TIME (min)	GOALS
Aidan	5	4.33	5.67	5	4.73	7	4	4
Brandi	7	6	7	5.67	6.6	0	30	14
Chad	6	3.67	6	3.67	5.17	0	18	11
Danica	6.33	5.33	7	6.33	3.27	12	21	4
Eddy	6	4.67	7	6.67	6.18	6	19	4
Frank	7	6	7	7	4.95	4	15	11
Garnet	6.33	3.67	6.67	6	5.5	4	8.3	7
Hal	6	4.67	6.33	5.67	5.48	3	24	5
Iria	6.33	4	6	3.67	3.85	9	19	6
Mean	6.2	4.6	6.5	5.4	5.3	4.1	17.1	7.8
SD	.64	.93	.53	1.2	.85	3.2	8.3	3.8

The Pearson correlations were calculated by using SPSS. In Table 4.23, correlations above .6 were grayed to mark high correlation.

Table 4.23. Pearson Correlations between Motivation, Metacognition, and the Tool Use

	MU	TIME	GOALS
IG	-.246	.580	.668
EG	-.143	.496	.379
TV	.001	.450	.238
SE	.121	.033	-.089
MS	-.791	.245	.449

Two areas were found to have a high correlation. First, intrinsic goal orientation was positively correlated with the number of goals (.668). For example, Brandy's intrinsic goal orientation score was 7 and she set 15 goals. In contrast, Aidan's intrinsic goal orientation score was 5 and he set 5 goals. That is, if the students had a higher intrinsic goal orientation, they tended to set more goals than those who had a lower intrinsic goal orientation in this case study.

Metacognitive learning strategies were negatively correlated with the number of missed updates in this case study (Person r = -.791). For example, Iria's metacognitive learning strategies score was 3.85 and she missed 9 times among 15 required updates. Aidan's metacognitive learning strategies score was 4.73 and missed 7. That is, if the students had a lower metacognitive learning strategies score, they tended to miss more updates than those who had a higher score in this case study.

Points of the Semester

The number of participants completing each week's update among all nine participants throughout the semester was rated in percentage and presented as a bar graph in the Figure 4.3.

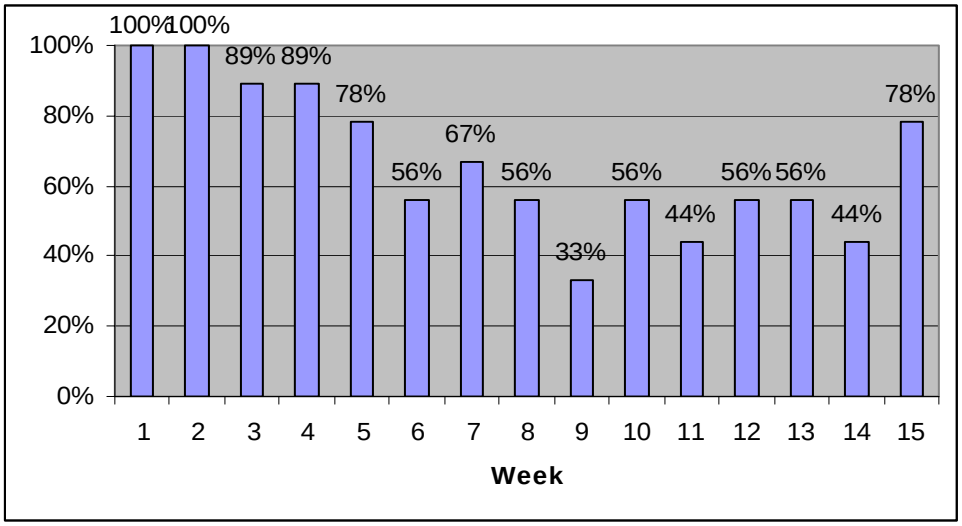

Figure 4.3. The percent of students who updated per week

As illustrated in the bar graph, the completion rate during the first half of the semester was higher than that of the second half of the semester. This is congruent with the theme about the utility value, which was that some students perceived more utility value in the use of the tool at the beginning of the semester than the end of the semester.

There are several other points in the term where low or high use of the tool might be explained. The reason of the very low completion rate (33%) in the ninth week is probably because it was the Spring break period. The final week's completion rate was relatively higher than others during the second half of the semester. It might be because the instructor's feedback on their completion rate which would impact their final grade.

Other Factors

In addition to the factors described so far, there may be several other factors that affected the use of the tool in this case study. First, failure to get external resources appears to have affected the use of the tool. For example, Eddy needed video content for his project. However, because he could not get the video products which should be done for another course, he could not proceed with his project after the middle of the semester. Further Eddy did not consistently

update much about his status because he did not make any progress about it. In the case of Garnet, she also had a hard time in getting content for her tutorial. Because the content was developed by other people, she could not make any progress until she got the content.

There were some personal factors that impacted the projects and also impacted the use of the tool. In case of Chad, he was ill at the beginning of the semester. Even though he did not miss any updates during that period, he said he had a hard time and did not make any progress for his tasks. Garnet also had several personal issues. She was ill, was out of town for personal reasons, and also had to take care of an ill relative for awhile. As a result, she missed several updates.

In sum, the use of the tool was impacted by several factors in this case study. One factor was the time of the semester. The completion rate of the first half of the semester was higher than that of the second half of the semester. Other factors included metacognitive learning strategies and intrinsic goal orientation. Metacognitive learning strategies appeared to be negatively correlated with the number of missed updates. Intrinsic goal orientation was positively correlated with the number of goals. Finally, other factors also impacted the use of the SRLS tool including a few perceptions of lack of utility, failure getting external resources such as content, and personal factors such as illness and family events.

Summary

This chapter presented the findings from the study. First, the results from the individual case analysis of nine participants were presented. It began with the background information of each participant followed by their MSLQ scores. And then how each participant valued the use of the SRLS tool, how each one used the tool, and how the use of the tool helped each student in the course were described.

Second, the results from the cross-case analysis were presented according to the research questions. The first question dealt with the perceived instrumentality of the SRLS tool. Each participant showed the different perceived instrumentality of the SRLS tool in the course according to the time of semester, the types of task, the level of experience, and their own reflection or design styles. The second question was about how the students engaged in the self-regulatory activities like goal setting, planning, monitoring, evaluating, and resource use. All the students in the course who used the SRLS tool appeared to engage in the activities. But the nature of the activities was different from each other based on how they used the tool. The final question explored what factors appeared to impact the use of the SRLS tool. The level of intrinsic goal orientation and the metacognitive learning strategies appeared to impact the number of goals and the updates that the participants completed. Other factors such as failure getting external resources, personal illness, and family events affected the process of the projects and the use of the SRLS tool.

CHAPTER V.

DISCUSSION AND IMPLICATIONS

Overview

In order to design a better learner support system to help students experience successful learning, this study was designed to understand the use of a Self-Regulated Learning Support tool (SRLS tool) in a postsecondary educational software development course which was student-centered. This study has explored how participants perceived the instrumentality of the SRLS tool in the course, how they used it, and how the SRLS tool helped them in the completion of a multimedia development project.

This chapter provides a discussion of the meaning and implications of the findings from the investigation. The chapter consists of three sections. The first section presents a discussion of the research findings. The next section discusses the implications for practices. The final section provides a summary of implications for further research.

Discussion of Findings

This section presents the summary and discussion of the major findings from the study with reference to three the categories: (a) perceived instrumentality on the SRLS tool, (b) benefit derived from SRLS tool, and (c) issues in promoting the use of the SRLS tool.

Perceived Instrumentality on the SRLS tool

Question one asked: "How do students describe their perceived instrumentality (or utility value) on the use of a SRLS tool?" The participants' perceived instrumentality (or utility value) on the use of the SRLS tool varied according to several factors. This section discusses these

differences into four categories: (a) different points in the semester, (b) types of tasks, (c) individual's belief about the experienced level, and (d) personal design and reflection style.

Points of Semester

Some of the participants perceived the tool more useful at the beginning of the course than the end of the course. There might be two reasons for this finding. One might be because of the nature of the instructional development phases which are planning, design, development, and evaluation in this course. While this study did not specifically explore how the students' self-regulatory activities differ according to each phase of the instructional design or instructional development, there was some evidence to support this relationship.

The other possible reason might be found with the nature of the course in this study, which was a student-centered or/and open learning environment. Student-centered learning or open learning environments usually require learners to set their own learning goals, learn in more authentic situation, learn by doing, and solve ill-structured problems (Jonassen, 1999; Land & Hannafin, 2000). Designed based on constructivist learning perspectives, the course in this study allows or requires the students chose their own clients and defined the scope of the project including topic, contents covered in the program, technologies used, and so forth. While the learners have a lot of control, the project plans need to meet the criteria of the course requirement for the project. Therefore, the students also need to clarify what they have to do in the course as requirements, especially in the beginning of the semester when the initial plan may affect the entire project. Aidan described the feeling toward the course when he was asked what additional assistance was needed:

> Clearer directions. I just felt like part of the directions, just, nothing was really clear. I just, there was too much confusion, and I don't like that. … I just didn't feel like everyone knew what was going on. … I just felt as if, like the expectation for me or for a student in the class weren't clearly defined, and as a result, I didn't feel motivated to do

> anything, because I didn't really know what to do during parts of it. There was just too much confusion, and the handbook didn't help. The Studio handbook didn't really give me any definite … I mean it gave me ideas and it kinda told me, but it didn't really tell me everything that I needed to know."

Although Aidan was the only person who explicitly mentioned his feeling about the course itself in the interview, the researcher could find that many of the participants felt like him during the non-formal talks with them.

Eddy mentioned about the challenges when he involved in a project in a course as "When you jump into a project, usually you're overwhelmed with ideas and you've got all these things that you could possibly do, but you're not sure what you should do." He emphasized that it was important to figure out what he should do when he started a project.

This implies that the use of the tool may be more important at the beginning of the semester in that the students need to clarify what they know and what they are doing by posting their progress updates and the instructor can give direct feedback based on their updates. As they worked through the semester, they could get clearer picture of what they have to do so that the need of the reflective activities with the SRLS tool might decrease.

Types of Tasks

The value of the use of the SRLS tool also varied according to the types of tasks in which the students were involved. Some of the students felt that the SRLS tool might be more useful for team-based or collaborative tasks while the major goal of the course for the students is conducting an individual project so that they could get active knowledge about the instructional design and development and the tool use as mentioned in the Chapter Three. One reason the students may have perceived it would be better for team or collaborative work is because the SRLS tool used the Web. Previous research has indicated that the Web can provide powerful communication tools between users (Dede, Whitehouse, L'Bahy, 2002; Greer, McCalla, Cooke,

Collins, Kumar, Bishop, & Vassileva, 2000; Khan, 1997). For example, Greer and his colleagues (2000) used a Web-based bulletin board system to provide asynchronous communication in their Peer Help System. Dede and his colleagues (2002) also used Web for asynchronous and synchronous communication for their course. The SRLS tool provided the shared updates and request feedback features including basic features like templates for updating and easy access to previous updates. As mentioned in the interaction section later in this chapter, the SRLS tool was one of the places or tools through which the interactions between the students and the instructor happened. The students could easily access to other student's updates and see what others were doing and get idea for their own updates and projects. This supports that the SRLS tool can also be used in the team-based or collaborative tasks.

Some of the students felt the SRLS tool would be more useful for more difficult tasks. The difficult level could be relative based on the participants' experience level. If the students are experienced in the tasks (in this case, the instructional design and development), they may felt that the task is not difficult to a degree that they need additional support for the process.

This result is largely consistent with the literature that describes the role of support or scaffolding in various contexts and the learners' level of expertise (Hogan & Pressley, 1997). Support or scaffolding is assistance that is provided when learners are not able to complete a certain task by themselves because the task is beyond their ability. If the task is not beyond students' ability, they do not need scaffolding to support the completion of the task. This is also discussed in the next section in relation to the individual's experience level as the level of the participants' experience affects the perceived level of the difficulty of the tasks.

Individual's Belief about the Experienced Level

The participants who believed themselves experienced in design and development (as described in the previous section), reflections, or/and managing daily life did not place much value on the use of the SRLS tool in the course. Aidan, who believed he had considerable experience with reflections in previous courses stated that he felt he could have done as good job with reflection without the use of the SRLS tool. He believed he did not need an explicit reflective activity for this course. According to his remarks, he already internalized the self-regulatory skills like planning and evaluating skills for the instructional design and development projects. Brandy, who believed she was very self-directed through managing daily life with five children, used the SRLS tool as a place to post her reflections including planning and evaluating and said the SRLS tool would be more useful for those who were not self-directed already and could not reflect well without the guiding question. The self-regulation was not very domain-specific to her.

One of the issues in providing learning supports is determining when the learners do not need the support because they already have the skills that the support intends to provide. However, in a real-world classroom situation, where various levels of students take a course together, it can be difficult for a SRLS tool to meet the various needs. This implies that the SRLS tool should play a role of scaffolding, adapting based on the level of experience of the user. If the students are ready to self-regulate their learning without the tool, the use of the tool should fade according the level of their ability (Lepper, Drake, & O'Donnell-Johnson, 1997; Roehler, & Cantlon, 1997). One challenge that arises is how to check to see if students are ready to self-regulate without support. There may be a possibility that students believe they are self-

regulated even though actually they are not ready. Including individual assessment of self-regulation skills may help address this issue.

In this study, although Brandy felt that she was already self-regulated, she used the SRLS tool in her own style and did not miss any update. Her metacognitive learning strategies score was the highest among the participants. In contrast, Aidan, who felt that he was experienced in reflections and did not need explicit reflective activities, missed many updates and indicated he had a hard time working on his project. In this instance, there might be a possibility that Aidan's perception of his ability was over stated. One of the important functions of metacognition is to enable assessment of one's current level of knowing (Flavell, 1976; Hacker, 1998). However, if one does not have well-developed metacognitive abilities, she or he may overestimate their level of understanding. For example, Aidan's metacognitive learning strategies score of the modified MSLQ was the second lowest among the participants. The assessment score of MSLQ looked more valid than his perception according to his relatively poor performance through the course.

To help address this issue, it might be helpful to provide an individual assessment of self-regulation skills that are needed for a course at the beginning of a semester (e.g., MSLQ). Students in the course complete the assessment and get results with the recommendations based on the diagnostic test results. For example, if the students are assessed as they lack metacognitive learning strategies like goal setting, planning, monitoring, and/or evaluating from the assessment, the students are given the recommendations to actively use the tool to help them do those activities. On the other hand, if the students score highly on the assessment of their self-regulation skills, they may be advised not to use certain aspects of the tool. While researchers have argued that providing self-regulated learning strategies does not decrease the achievement in more self-regulated students (Young, 1996), it may be perceived as an

unnecessary burden to those who were already self-regulated. Therefore, the requirement of the use of the tool should be minimized (as needed) if the tool is to assist all students.

Personal Design and Reflection Style

The personal design and development style, as well as the reflection style, for educational software design and development affected the perceived instrumentality and the use of the SRLS tool. Although the structure (e.g., the guiding questions) of the SRLS tool that facilitated reflection was perceived as the strength of the tool, some of students expressed that they preferred less structure so that they could do reflections in their own style. Some students mentioned specific structures that would have worked better for them. Others adjusted the use of the tool to better match their style. For example, Brandy and Frank posted their entire reflection in the goal section (vs. using individual sections).

Brandy and Frank provided one example of how the tool might be adjusted for individual style. There may be other ways to address individual needs or styles. One is giving several formats among which students can choose a style that meets their needs. The formats may include high level of structure consisting of many specific guiding questions, medium level of structure consisting of moderate number of guiding questions, and very loosely structured format consisting of one or two general guiding questions and input fields.

Another way to provide more flexibility with reflection is using a more adaptable platform for posting the updates such as a Web log. These are commonly referred to "blogs." According to an online dictionary for computers and internet terms, the Webopedia dictionary (http://www.webopedia.com), "Blog is short for We**b log**." Blog technology enables people to easily post and publish Web-pages for purposes of journaling. While there may be some limitations in how information is displayed in a blog, initial reports of use of blogs indicate that

the technology enables participants to easily create and share personal journal pages (Kennedy, 2003; Weiler, 2003).

Yet another way to meet individual needs is for students to create their own journal pages using Web authoring tools such as Dreamweaver as a way to create reflective journals. The course taken previously to the one in which the student in this study participated used this structure (i.e. EDIT 6190 Design and Development Tools). A few Web templates were provided to students, but they could adjust the structure to meet their needs. It is noteworthy that the latter two cases would sacrifice a feature that the students liked in the SRLS tool: email reminders to complete their reflections. While the instructor or someone else could do this independent of a system, it takes more time and effort, and therefore might not be done as consistently as when it is database driven.

Results from this study seem to indicate that providing flexibility and choice with reflection tools is an important consideration. Several participants provided insight that led to the conclusion that personal preferences on structures of reflective activities differ from person to person. It may also be that elements that need to be included in the journal may differ according to the courses and the specific tasks that are required in the courses. The importance of providing flexibility and variety with reflection tools, and how best to do this in various contexts, need more exploration.

Benefit Derived from SRLS Tool Use

The discussion for the individual research questions indicates considerable variances related to reaction to the SRLS tool. Some students did not like to use the SRLS tool, felt the tool did not help them, and put little value on the use of the tool; other students liked to use the tool and felt the tool helped them. Despite the variance in use and perceived value, there were

benefits resulting from the use of the tool. This section presents how the activities that the students engaged with the tool assisted them with their work. When the tool was used in the course context, it appears it helped students in three primary areas: enhanced self-efficacy, structure (or schema), and ownership over the tasks they were conducting. It also appears that the tool helped extend interactions between students and instructor and the resource use. Each of these benefits is described in more detail in the following sections.

Enhanced Self-efficacy

Self-efficacy refers to "people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances" (Bandura, 1986, p. 391). High self-efficacy toward certain tasks helps determine the level of effort directed toward a task. It may also affect the persistence of continuing the tasks in the face of difficulties (Shin, 1998). Therefore, self-efficacy has been regarded a strong indicator of successful learning (Graham & Weiner, 1996).

In this study, participants reported enhanced self-efficacy through weekly goal setting, planning, monitoring and evaluation. This result largely matched with the literature on self-efficacy (Bandura, 1986; Pajares, 1996; Schunk & Ertmer, 2000), where the research indicates that setting short-term and specific goals, and continuously monitoring progress, enhanced the self-efficacy of students.

The goal setting and planning through the SRLS tool helped students with two things: starting the project and keeping it moving forward. Participants indicated the SRLS tool helped them start the project by helping them set short-term and specific goals. To require students to set weekly goals facilitated the students to set short-term goals.

In this study, the guiding questions on the "Current Progress" page in the tool helped them specify the goals and plans to achieve the goals. Eddy stated that the guiding questions helped him to set specific goals and plans. He mentioned, "I think this one [Friday5s®] was better [than the design journal used in EDIT 6190] because it actually prompts the different users to provide input and answer very specific questions and make specific plans." Frank also described how the tool helped him specify his plan to achieve his goals as following: "Yes, it makes me think of what elements do I need in order to complete this goal because many times you just write up and don't really think about what elements, which elements I need." Hal also stated that short-term goals were useful. He said, "That [short-term goal] helps me because with the long-term goal I would be lost sometimes, I don't want to be lost. So I didn't do that." These kinds short-term and specific goals helped students clarify and define what they have to do and focus on them and led students to have enhanced self-efficacy (Schunk & Ertmer, 2000). The enhanced high self-efficacy also helped to avoid being overwhelmed by the big tasks and to start the project. The following remarks from Eddy support the role of those goals.

> Because the short-term goals, I think, kind of the same as the last one, that they gave me very doable and very manageable goals that I could try to achieve within that week, but it also gave me a direction and something to focus on that week. It kind of broke it down to where, instead of feeling overwhelmed by so many things to do.

The important of goal setting was also reflected in Brandy's case. Brandy indicated that as she worked with two ten year old girls, the short-term and specific goals were critical to her and her students success. It appears that short-term and specific goals helped Brandy's two 4th grade students start the project and keep doing it by enhancing and keeping a high level of self-efficacy. She described the importance of those kinds of goals as following:

> It was good because, you know, I was working with the two ten year olds, the two girls. And it was good for them to have the goals, and then accomplish them. And it was such a long term project. I think it was good for those two girls to see that you can work on

> something a little at a time and accomplish a goal and then accomplish a goal, you know, until you have a final product.

Short-term goals also helped students to avoid being overwhelmed by the big tasks and to start the project so that it helped to enhance or/and maintain their self-efficacy. Eddy mentioned, "I could say, "Hey, if I finish this one little goal that I've set forth, I've done a good job this week." And then I'd get feedback from my coach: "Great, you finish that one little task." You know, "You've done a good job this week." So that was really nice." This means that the short-term and specific goals also enhance the possibility that students experience positive self-evaluation of progress because they are easier to achieve than the counterparts. These positive feedback from the self-evaluation of progress lead students to have enhanced self-efficacy (Bandura, 1986; Ertmer & Newby, 1996; Schunk & Ertmer, 2000).

In general, the SRLS tool helped to enhance the self-efficacy of the students by guiding them to set short-term and specific goals and monitor and evaluate the progress. The participants in this study reflect what is indicated in the literature (Bandura, 1986; Pintrich, 2000; Schunk & Ertmer, 2000):short-term goals looked more manageable to them and specific goals and provided a clearer and more specific guide for the type and amount of effort needed to accomplish the goals. As a result, the SRLS tool played an important role in this regard to those who used the tool.

Structure

Goals are commonly thought to be organized hierarchically. As stated by Shah and Kruglanski (2000), goals also represent a specific type of knowledge structure, one that defines a future positive state. . When people set goals and plan to achieve those goals, first, they may set big goals, usually long-term goals and then list smaller goals or tasks for each big goal.

Therefore, goal setting and planning may facilitate people to analyze and organize the structure of certain tasks, potentially leading to a more in-depth understanding of the task.

The activities participants in this study engaged in with the SRLS tool (e.g., goal setting, planning, monitoring, and evaluation) appear to have helped students get a better understanding of their tasks. Hal mentioned, "First, it makes me set a goal. So once I set a goal, I have destination, and it asks me on my progress, and it asks me how much more I have to go, I assess … it just gives me a clear view, the clear understanding about how far I have done, and how much I have to go. So in that way, it helps me a lot."

Iria also thought the specific goal setting helped to get clearer structure over what she would do in the course. She mentioned, "I think to set, to specify goal help me lot. I would know what should I do in following week. I would have a more clear schema in head of me. A more clear structure." Chad also believed the activities with the tool helped him get a structure over the task. He mentioned, "It was good to give some structure, and to be able to see all the various stages."

The use of the SRLS tool helped students have clearer and more detailed structure over their tasks. The clearer and more detailed structure over their tasks the students could have, the better they could plan, initially and iteratively. If the participants get a clearer and detailed picture over a task by goal setting and planning, they can set better goals and plans based on their better understanding the task. Therefore, the continuous use the tool over a task may improve the declarative metacognitive knowledge (Ertmer & Newby, 1996) about the task requirements.

The finding also implies that the SRLS tool may need to provide the feature that can help students make visual relationships between goals so that they can easily get an overview of the task. This feature can be similar to semantic networking tools. Semantic networking tools can be

any tool that provides visual and verbal screen tools for developing concept maps. Concept maps are one example of a semantic network tool that enables the creation of graphical representations of ideas (node) and their interrelationships (link) that are stored in memory. Semantic networking helps learning by requiring students to analyze the organization of ideas and the underlying structural relationships among the content being studied.

Jonassen and Reeves (1996) stated constructing semantic networks engages students in "(a) reorganization of knowledge through the explicit description of concepts and their interrelationships; (b) deep processing of knowledge, which promotes better remembering, retrieval, and the ability to apply knowledge in new situations; (c) relating new concepts to existing concepts and idea, which improves understanding (Davis, 1990); and (d) spatial learning through the spatial representation of concepts within an area of study (Fisher, Faletti, Patterson, Lipson, Thornton & Spring, 1990)" (p. 207). Therefore, using a semantic networking tool for setting goals and making relationships among the goals may further assist students in developing a deeper understanding of the task.

Ownership

Ownership in learning refers to the learners' sense of regulating their own learning (Shin, 1998). Learners can feel ownership over learning when they can build personal commitment to meaningful goals and influence desired changes in themselves as well as processes of learning on their own learning. Therefore, the self-regulated learners generally feel ownership over the goals and processes of learning because they set their own goals, planning, monitoring, and evaluating their progress. Feeling of responsibility for controlling their own learning comes from their own choices and results in students' getting ownership (Barab & Duffy, 2000; Ertmer & Newby, 1996).

Literature related to a constructivist view of learning (Hill & Hannafin, 2001; Jonassen & Land, 2000) also emphasizes having the student as the principal negotiator in determining what and how they will study or gain understanding. Central to this concept is the idea of student ownership in their learning goals and process. Because of the nature of the course in this study, the participants should set their own goals by themselves and control their learning. This active role in their own learning can facilitate feelings of ownership over their learning. Some of the students expressed that writing up goals and plans facilitated them to feel responsibility and ownership.

Hal expressed he felt being responsible for the goals and plans that he set. He mentioned, "I realize that setting goal is very important and, by writing down, it gives me responsibility, reminds me the responsibility to fulfill that goal. And you set your… you cannot blame anybody else because it's responsibility on my own." Actually writing down goals and plans may make the students feel more responsibility and ownership than no goal setting or goal setting in their mind.

Eddy also explicitly expressed the ownership and responsibilities associated with setting goals. He described about the email reminders bothering him when he did not complete the week's update. He said, "There's nobody in particular bothering you. It's just yourself. You set it up, so it's you bothering yourself." Actually, it was the SRLS tool that sent the email reminders up to three times per update when the students needed to update their progress. This means, Eddy regarded receiving the email reminders as his responsibility when he did not update.

The course itself was student-centered and designed to lead the student to have ownership over their learning. The use of the SRLS tool facilitated to improve the feeling of ownership by

letting the students write down their goals and plans. These self-set goals and plans may have produced a higher commitment to their goals and plans, leading to enhanced motivation to achieve those goals (Schunk, 1995). This implies that the explicit self-regulatory activities by writing down the goals and plans are a way to let the student recognize their responsibility and ownership over their learning.

Interaction

Interaction has been recognized as one of the most important factors that compose learning in traditional or distance learning (Moore, 1989; Vygotsky, 1978). Berge (1999) stated that the inevitability of interaction in formal education as "to provide the necessary feedback between learner and instructor, interaction will continue to be seen as a critical component of formal education (p. 5)." The students in the course who used the SRLS tool reported benefiting from the communication and interactivities of the tool. Although the project of the course was individual and there were few face-to-face meetings, a certain level of interaction among the students and instructor were observed in their updates and were described in the interviews.

Interactions through the SRLS tool in this study appeared in two ways: students and instructor, and students and updates created by other students. First, the SRLS tool provided convenient communication opportunities between the students and the instructor. According to Moore (1989), this type of interaction is regarded as fundamental to education. With student-instructor interaction, the individual learner can receive feedback from instructor, which makes learning more individualized. Frank and the instructor's interactions show an example of a convenient way of this kind of interaction for both of them. In the case of Frank, one of the most challenging things was planning the final product that met the criteria in addition to finding a solution to connect Flash and a database management system. He posted his plan and concern

on his project in the SRLS tool in the eighth week and the instructor gave him a feedback based on his update (see Figure 5.1).

[Frank]
I also have to update my project website.
My website does not have any sections for ADDIE model.
But I still do not know what to write on Analysis part.
This project does not require user analysis.
There is no performance discrepancy.

[Instructor]
Before I address your question about documentation, I have a few questions for you to contemplate from an instructional design perspective...
1. if a user analysis is not needed, how do you know how to develop the project? was an analysis ever completed?
2. if there is no performance discrepancy, why is the tool needed?
3. what are the overall goals and objectives of the project?
4. do you have a vision of what the learners will be able to do after completing your tutorial?

I would encourage you to take a look at the information in Alessi and Trollip and the GuideMe® section of Friday5s® to help trigger some of your thinking about the documentation. I would also suggest going back and reviewing the information from your 6170 course to guide the creation of your documentation.

Figure 5.1. An example of interaction between a student and the instructor

According to this example, the instructor could give feedback on the participants' update in a timely manner. If Frank did not report the problem in doing his project in his update, he could not get the feedback. Most of the participants also expressed they liked using a request feedback feature or/and getting feedback from the instructor through the SRLS tool.

Other participants indicated that additional student-instructor interactions were needed. For example, Eddy described the challenges that students could have when they are involved in a project. He recommended a solution to this as following:

> When they're involved in the project, they have difficulty managing what is the most important thing, what is the least important, and what is something that's outside of the scope and what's something within the scope. So … I would really try to impress on the instructors is more small meetings with the students along the way, especially in 6200. There're only a few students in there. So every two weeks to meet for five or ten minutes during our scheduled class time isn't really a big deal. … It's a small amount of time spent out of the day. … So there was an easy way to get around that. I think Friday5s® is really close to doing that, too. Not quite, but it almost allows you to do that.

He described what he thought would be useful for the 6200 students. When the face-to-face meeting was not possible, he could get feedback based on his postings. He emphasized the importance of interaction between students and teacher to check the status and give and take feedback.

This type of interaction – student-instructor – is important in any learning context, but appears to be particularly important in student-centered learning environments where the students need supports like modeling, coaching, and scaffolding (Jonassen, 1999). The feedback or coaching given by the instructor through the SRLS tool might be very effective because they were highly situated responses to student's task performance (Collins, Brown, & Newman, 1989).

Another kind of interaction observed was between students and updates created by other students. This can be considered as indirect interaction between learner and learner. The SRLS tool helped participants easily review other participants' updates. They could see what others were doing by browsing the tool. Brandy was one hour away from the main campus and liked to see others' updates. She said, "I liked the way that you can look at other people's answers and stuff. That's all good. I liked to look at them, see what they were doing. You know, because I went to Gwinnett mostly, and I didn't see my fellow classmates very much, so it was kinda nice to know what they were up to." The SRLS tool enabled her get a sort of feeling of

connectedness to others in the course in the situation she could not see them and their work through face-to-face meeting frequently.

In the case of Chad, he used this shared reflection feature to compare his progress to others' and motivate himself to work on his project as others did. He said, "It was useful just to see where other folks were as well and know that I had all those categories of things to get through and I needed to keep moving to be able to get through them." He got self-feedback from this comparison for his performance.

The SRLS tool helped to improve the direct interactions between students and the instructor by allowing the students to easily report their status and the instructor to review them and give feedback with relatively easy. This implies that the SRLS tool has a potential to enable the instructor to provide situated coaching to the students (Collins, Brown, & Newman, 1989). In addition, it also helped the indirect interactions between students by giving them easy access to other students' update so that they could benefit from reviewing others. This kind of interaction was necessary to help student have feeling of connectedness in addition to getting self-feedback by comparing others update to their own because the face-to-face interactions between the students was limited due to the nature of the course. It is noteworthy that both kinds of interactions could be possible only if most of students should do their reflective activities in timely manner.

Resource Use

In terms of resource use, the study found that the participants tried to actively seek and use various resources based on the students' plan in the SRLS tool. The students frequently mentioned books, people, Web sites, and time as resources for their work. The main purposes that they tried to seek books, people, and Web sites were for solving technical problems, helping

their design, and defining the scope of their work. Time was regarded important resource especially by the part-time students who had full time jobs.

In the course where goals and plans were set and created by the student themselves, the resources should also be acquired by the students in most cases (Hill & Hannafin, 2001). Therefore, to know what resources they need and how to get them is an important ability to be successful in that learning situation (see Hill and Hannafin, 2001, for an in-depth discussion of resource use for learning). To facilitate resource use, the SRLS tool provided a link to the resource page of the Studio course Web site, and a guiding question that provokes student to think of the resources for the goals. They preferred using manuals for the tools, finding peers or colleagues who might help them, or searching Web sites such as developers' Web forums to using the provided resources. The list of people who could help specific tools like Flash, Dreamweaver, Photoshop, etc. might be especially helpful because several students mentioned they found solutions for their programming problems from the colleagues.

In sum, in open-ended learning environments like this EDIT 6200 course, students emphasized the importance of catching up (getting to know) what they have to do. In this sense, the use of the tool helped some students to start their projects in a situation overwhelmed by so many things to do and unclear about what they had to do, and to keep going by giving the self-efficacy, ownership, and clearer structure over the tasks. By achieving small and short-term goals, and keeping going on their projects, students enhanced their self-efficacy and established a clearer structure over their tasks iteratively. The nature of the less structured or open-ended course based on constructivist learning perspective caused the control movement from the teacher or syllabus to the students. In the process of writing up and planning by themselves, they got ownership on their goals and plans and felt responsibility in this student-centered learning

environment. And the powerful communication functions of the Web enabled the direct and indirect interactions between the students and the instructor. The students also actively looked for the resources such as books, Web sites, and human resources when they needed help for their project.

There were some students who did not like to use the SRLS tool or/and felt the SRLS tool did not help them. They were the students who reported little utility value with the use of the tool. For these students, using the SRLS tool was regarded as an extra work; indeed some of these students missed more than 5 updates among 15 required ones. In the next section, some issues related to these problems are discussed.

Issues in the Use of the SRLS Tool

All nine participants engaged in self-regulated activities like goal setting, planning, monitoring, and evaluation using the SRLS tool. The number of updates and goals of each student, however, widely ranged. The use of the SRLS tool also was different from each student. For example, two participants did not follow the SRLS tools' guiding question but did reflection in their own way while most of the students followed the guiding questions. This section provides issues in the use of the SRLS tool in the course. Issues of infrequent self-regulatory activities from missing updates in the SRLS tool, motivation to use the tool, and the weakness of the tool are described below.

Infrequent Self-regulatory Activities

If the students use the SRLS tool and answer the guiding questions, they engage in goal setting, planning, monitoring, and evaluating in some way. However, just using it several times in a semester is not enough to assist with self-regulation and performance. How often they monitor their progress and set new goals are critical to determine if the use of the SRLS tool

helped the participants' self-regulation and performance because the self-regulated learning requires frequent goal setting, planning, monitoring, and evaluating (Kitsantas & Baylor, 2001; Ley & Young, 2001; Orange, 1999; Schunk & Ertmer, 2000; Zimmerman & Kitsantas, 1997). Research that compared lower-scoring college statistics students (Lan, 1996) and college students who did not get the minimum standardized test score for college entrance (Ley & Young, 1998) to their higher-achieving or scoring counterparts suggests that higher-achieving students may evaluate learning and identify deficits more frequently than do their counterparts (Ley & Young, 2001). Therefore, frequent use of the SRLS tool needs to facilitate students to monitor and evaluate frequently so that it can assist with the successful completion of their tasks.

Individual active reflection related to what one knows and one does not know (Flavell, 1976) appears to be an important factor impacting successful performance. If the students do not frequently update reflections, it may be difficult to monitor and evaluate progress. The lack of frequent updates may also impede the internal feedback which comes from self-evaluation (Butler & Winne, 1995). As a result, they may not be able to set proper new goals as quickly so as to meet the need of situations. Those who missed many updates might not benefit from the SRLS tool. Therefore, finding ways to encourage students not to miss updates needs to be considered.

Another important finding, although it was limited in this case, was that the metacognitive learning strategies was negatively correlated with the number of missed updates (Pearson r = -.791). That is, if the students' metacognitive abilities such as Metacognitive Self-Regulation including goal setting, planning, monitoring, evaluating, Time and Study Environment Management, Effort Regulation, and Help Seeking were low, the students missed more updates in the SRLS tool and if the abilities were high, they missed less updates. This was

an issue because one of the tool's main purposes was to provide support to the students who lack necessary strategies such as metacognitive strategies here. In this case, because they did not use the tool much, there was no way to find how they could benefit from the tool or the activities the tool provided. This issue needs to be further investigated.

Motivation to Use

The willingness to invest time and effort in engaging in the use of the SRLS tool may influence the students' use of the tool. The mean of the time that the students spent per update was 17.1 minutes with a maximum of 30 minutes (Brandy) and a minimum of 4 minutes (Aidan). Both internal and external sources of motivation may affect the amount and quality of self-regulatory activities engaged by the participants. One internal motivation factor related with the use of the tool, perceived instrumentality or utility value, was investigated through interviews with the participants. The majority of the participants stated they found the SRLS tool valuable, but a few were very open in expressing their dissatisfaction with the tool. For example, Aidan was one of those who thought the use of the tool was not useful and was negative toward doing reflection for this course. For Aidan, the perceived instrumentality was low – and therefore not a source of motivation.

An external source of motivation was grade. The completion rate of updates was a factor that affected their grade. However, it was not investigated if the grade was a critical factor that affected their updates. Three participants missed more than 5 updates and the grade might not be critical to promote their update. But, given that the number of the participants who completed the update in the final week, when the instructor reminded that the completion rate of the updates would affect their grade, increased to seven from four among nine participants, the grade might be one critical external source of motivation to affect their use of the SRLS tool.

As one criterion for grade, due dates were strictly checked. Compared to the previous semester, the students who took EDIT6200 in the current semester should meet the due date for their reflections. If they missed a due date, which was every Wednesday, they could not add their reflection of the week in the SRLS tool. Instead, they needed to add the reflection of the two weeks, the current week and the previous week in the following week. This also resulted in losing the number of their updates, which affects their final grade. In the previous semester, they could do postpone their updates by the end of the semester because the instructor may not check each week to see if the students met the due dates for each reflection. This enabled them to establish a pattern of posting their reflections as Web pages they created at the end of the term..

Although autonomy or ownership is often regarded as an advantage of student-centered learning environments (Barab & Duffy, 1999: Cockrell, Caplow, & Donaldson, 2000), the students' increased responsibility for their own learning has been found to be uncomfortable for some students when the environment is not prescribed, especially when studying ill-defined domains in open learning environments (Hill & Hannafin, 2001). Online learners who had more responsibility for learning own learning in a study (Bullen, 1998) described "procrastination" as a concern in such a flexible learning environment.

Habits developed in the previous course (EDIT 6190) may provide some insight into this issue. Eddy mentioned about the pattern in the previous course EDIT 6190 as following:

> It became almost ineffective when we were working in the reflections for 6190 on the templates that they used … and it exactly that, everybody that I think, every body that uses it waits until last minutes to post their reflections, which is kind of opposite of the point. It's a kind of showcase, you know, what your thinking was at week two, what was your thinking at week four, what was your thinking at week eight, and you know, show that development of your thinking as you go through the process.

This means that if the update had not been done timely, the updates might be useless in helping their self-regulation.

Hal also compared the SRLS tool with the design journal for EDIT6190 he used in the previous semester, and commented, "it's [the design journal of EDIT6190] not really well time. I can do reflection later on." To him one of the major differences between the SRLS tool and the design journal was whether it required him to update his status on time. In this aspect, the implementation of the SRLS tool in the course with the strict due dates played an intended role to facilitate the students to evaluate their progress and set news goals frequently so that their updates were effective to meet time-sensitive demands although four of the students missed many updates (more than 5 updates among 15 required ones). How to promote students to consistently use a tool like the SRLS tool still needs to be investigated.

Weakness of the SRLS Tool

The most frequently mentioned weaknesses of the SRLS tool related to its interface (or screen design) and a lack of goal representation feature. The participants in the study were well-versed in using computer programs. All of them had experiences in developing multimedia products from at least one previous course, if not more. Despite their experience with using computer technologies, some of the participants expressed they had a hard time learning how to use the SRLS tool.

One of the main reasons for the confusion reported by the participants was that the tool was filled with too much text-based information. As stated by Hal, "It is too much and not flexible, … Maybe it should be designed with more graphics, icons, and … like normal web pages, if you click, you could go to another page, … It should be that way rather than a whole (full) page." Aidan also mentioned the intensity of the information on the screen:

> It's well organized, but it's too much information. To have all those things on one page was just too complicated. It's well organized, but it's too much information. To have all those things on one page was just too complicated. I think that the page, like you know you could have goal one, and you know, whatever you need to do just for goal one on one page. And then go over to another page for goal two.

Both Hall and Aidan stated that the tool had too much text information in a page and it made it hard to find the place they wanted to access.

Another weakness of the SRLS tool was lack of a goal display function. Goals usually have a structure, which is hierarchical or procedural (Shah & Kruglanski, 2000). Several of the participants mentioned that the lack of a clear structure created challenges in using the tool. To address this issue, some of the students suggested a function to draw relations between goals like a goal tree. Eddy stated, "It would have been nicer if there was something that allowed me to structure out a number of goals very quickly and easily, … some graphic interface where you can kind of like in using Inspiration." [Inspiration® is a concept mapping tool that enables the creation of tree-like representations. See http://inspiration.com for more information.] Frank also wanted a graphic tool that had a function to picture how the goals were related to each other because he sometimes felt it was hard to read the relationships between goals.

In sum, this section discussed the issues related to the use of the SRLS tool. The issues included challenges with infrequent self-regulatory activities from missing updates in the tool, lack of perceived instrumentality and grade as sources of motivation to use the tool, and the weakness of the tool, including interface problems and lack of a graphical tool or feature to represent goals' relationships.

Implications for Practice

The results of this study can inform educational practice about technology mediated learner support and self-regulated learning in a student-centered oriented learning environment

like the course in this study. Because of the nature of this study, however, the implications for practice focus on the design and implementation of the SRLS tool in the same course. This is in alignment with the notion that self-regulation is a contextual activity and should be examined within the context in which the activities occur (Demetriou, 2000; Hofer, Yu, & Pintrich, 1998; McCaslin & Hickey, 2001).

The first implication is about whether to adopt Friday5s® in the course. It should be noted that because the main goal of this research was not to evaluate Friday5s® for deciding whether to use the tool in the course, more evaluation research focused on adoption of the tool needs to be conducted to get more specific information for decision. At this point, the researcher cannot strongly recommend the Friday5s® tool for future use in the course. This recommendation is based on several factors from the research. First, the research indicates that tool had at least two weaknesses, one with the interface and the other with the absence of visual representation feature for goals relationships. In addition, many features of the tool like GuideMe® and the request feedback features were not used by the students to as a great degree while they usually used basic features like goal setting, planning, monitoring, and evaluation in Friday5s® throughout the course. While good features to include, the additional overhead – both in terms of cost and cognitive load – appear to have created more challenges than assistance.

The second implication relates to the design of a SRLS tool. A SRLS tool should be designed to meet the various students' style and preference in doing their reflective activities in the course. As suggested with the research question 1, there might be three possibilities. One is to provide multiple platforms such as (a) loosely structured with one or two guiding questions and input boxes so that students can have more flexibility in the structure of their reflective journals, (b) medium level of structure with several guiding questions and input boxes, and (c)

high level of structure with many guiding questions and input boxes. Another suggestion is to use a Web log (Blog) or Web pages for the place in which the student can put their reflective journals. In all cases, it is recommended to provide a guide what to be included in the reflective journals. Even if students like the less structured style, they should be encouraged to include setting short-term goals, planning what they need and how to solve expected problems to achieve the goals, monitoring, and evaluating with self-feedback to set following goals.

The email reminders are the feature all the students liked in the SRLS tool. The email reminders included personal goals that should be completed and the link to the SRLS tool. These personalized emails will be more effective in reminding students of their goals and doing updates. It is recommended to send email reminders of any types whether system generated or instructor created.

The third implication relates to the implementation of a SRLS tool. An explicit explanation of the purpose of the use of a SRLS tool and how to use it should be addressed at the beginning of the course to enhance the students' perceived instrumentality of the tool. Further, the value of the tool and review of the features should happen periodically throughout the first third of the course. According to Gaskins and Elliot (1991), in learning strategy instructions, it increases students' value of the strategies to explain why the strategies are important and when students would find them useful. Snyder and Pressley (1995) also argued that students are most likely to be motivated to use strategies if they are aware that strategies procedures do help them (Snyder & Pressley, 1995). Through this initial orientation session and follow-up reminders, students and teacher may come to an agreement about what should be included in their reflective journals and how often they need to update their goals, reflections, and other areas of the tool.

In this course, the main goal is to develop interactive educational software by using knowledge acquired in the instructional design course and the authoring tool learning course as an individual project. Planning and design are more challenging and difficult than development and evaluation because when they moved to the development phase, there is not much time remaining to change the design. As many students mentioned, they are overwhelmed, wondering what they have to do at the beginning of the course. Therefore, it is recommended to require the use of the tool at least during the first half of a semester that covers the planning and design phases. It is also important to encourage the students to set goals and plan, monitor, and evaluate in timely manner so that they can get self-feedback on their goals and performance and set better goals frequently. During this period, more frequent interactions between students and instructors about defining the scope of the project and confirming it may be needed, especially to avoid planning and designing software that poorly matches up with the criteria.

Implications for Research

Through this study, several areas for further research can be identified. First, further research on the impact of a technology-mediated self-regulated learning support for team-based or collaborative tasks in student-centered learning environments is necessary. In those situations, there may be more peer-support, peer pressure, responsibility to peer, and shared experiences. A Web-based SRLS tool which embeds powerful communication tools may show different patterns of use and interactions between the tool, the students, instructor, and the context.

Second, another area of needed research addresses differences in students' self-regulated learning according to each phase of instructional design and development. The participants in this study appeared to have different level of instrumentality on the use of the SRLS tool according to the time of the semester. This may come from the different level of complexity or

required efforts for each phase such as planning, designing, development, and evaluation in this study or analysis, design, development, implementation, and evaluation in other contexts. This needs to be confirmed through empirical research. The findings may help to design more specified support for each phase.

Third, it should also be investigated how the use of a SRLS tool should fade according to the level of students' readiness to do a task without the tool. This matter should also deal with how to check to see if students are ready to self-regulate without support. Students might believe that they are already self-regulated even though they are not ready. In addition, it may also be valuable to investigate how to require the use of a tool by some students while other students are not required to use the same tool in the same class.

Fourth, additional research needs to explore or develop a "critical usage" measure. "Critical usage" would assist in determining how much a person would have to work with a tool in order for it to truly be considered a cognitive tool for that person. The data in this research indicated that several of the participants did not use the SRLS tool very much. In that case, there were not specific criteria against which the researcher could judge if the SRLS tool played a role as a cognitive tool for them. A critical usage measure may assist in this regard. Further, it may also enable an assessment to determine if students are ready to self-regulate without support.

Conclusion

The goal of this research was to provide rich information to understand the use of a SRLS tool in an educational software development course in order to design a better learner support in those kinds of learning environments. The design and implementation of the technology-mediated learner support in student-centered and distributed learning environments like this course appeared to require much consideration on various aspects in the situation. This study

provided the findings from nine individual case analysis, cross-case analysis, and discussions and implications from the findings. It is hoped that the findings of this research will assist other designers and researchers in creating effective learner support in student-centered learning environments.

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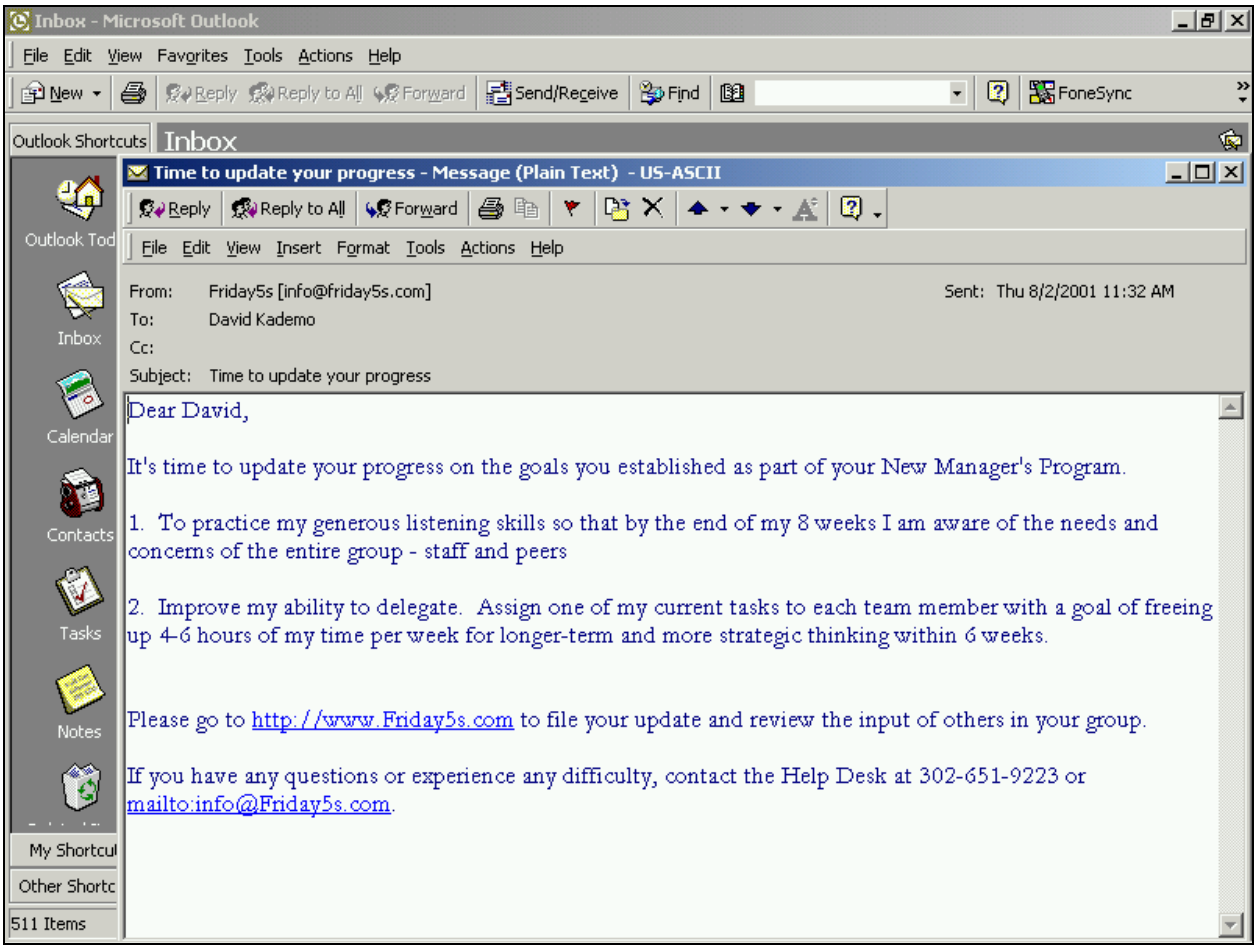
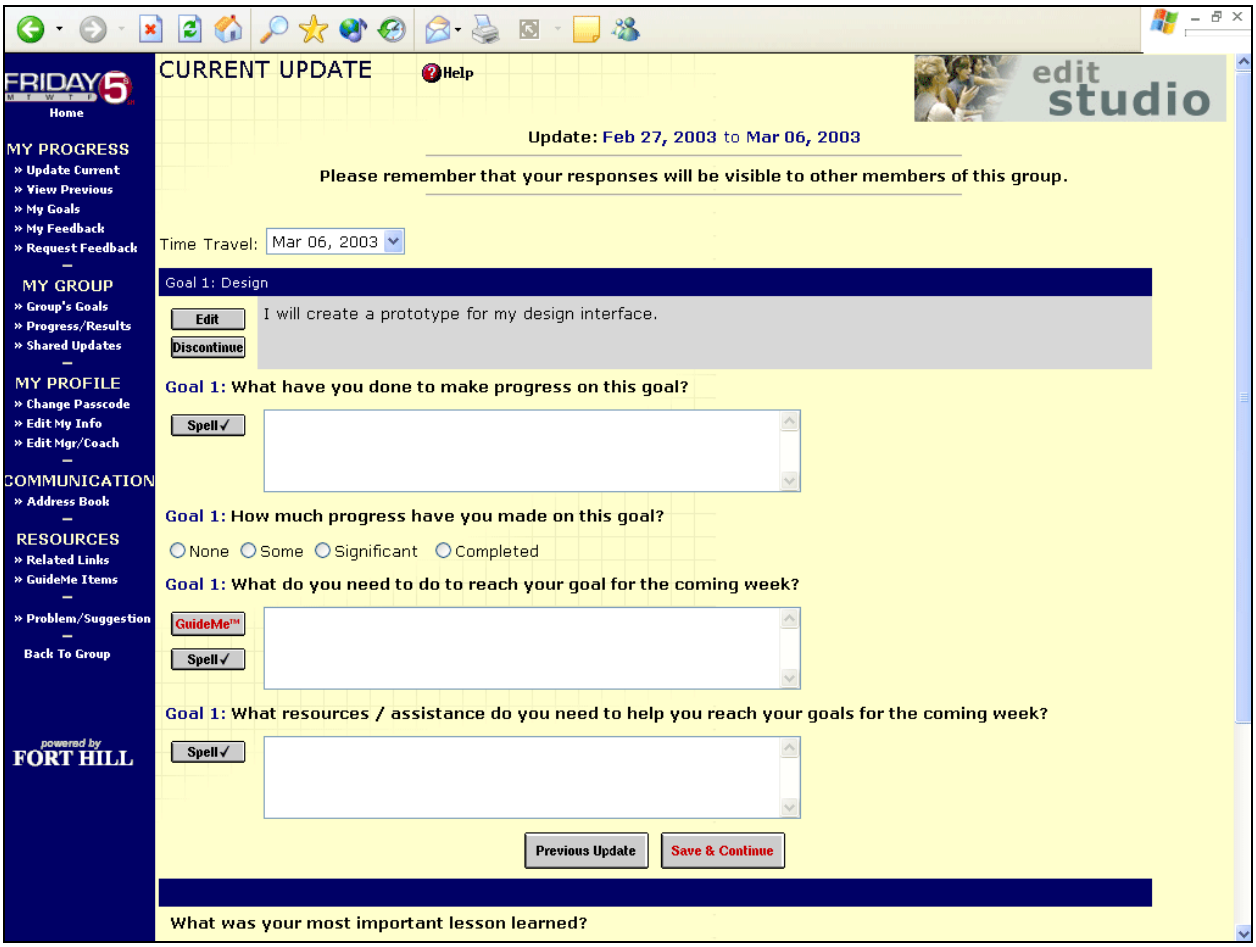
APPENDICES

Appendix A: Overview and Sample Screens from Friday5s®

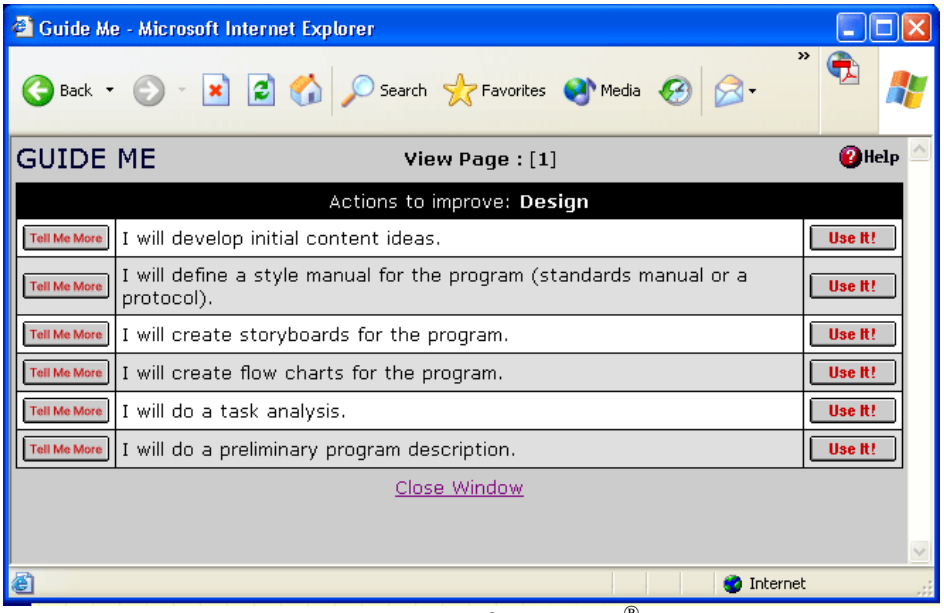
Friday5s® (http://www.friday5.com) was originally designed to support "follow through," the transfer of the learning from the training into real job situations in the corporate training field. Friday5s® provides functions to prompt employees to put learning into action and to let managers monitor progress and provide coaching. However, Friday5s® has potential to be used in various learning situations in which students have more control, flexibility, and responsibility for their learning. The following screens show some examples of the features: Email Reminders, Current Updates with guiding questions, GuideMe® and its Tell Me More, and Shared Reflection's Group Goals that are described more detailed in the Chapter Three.



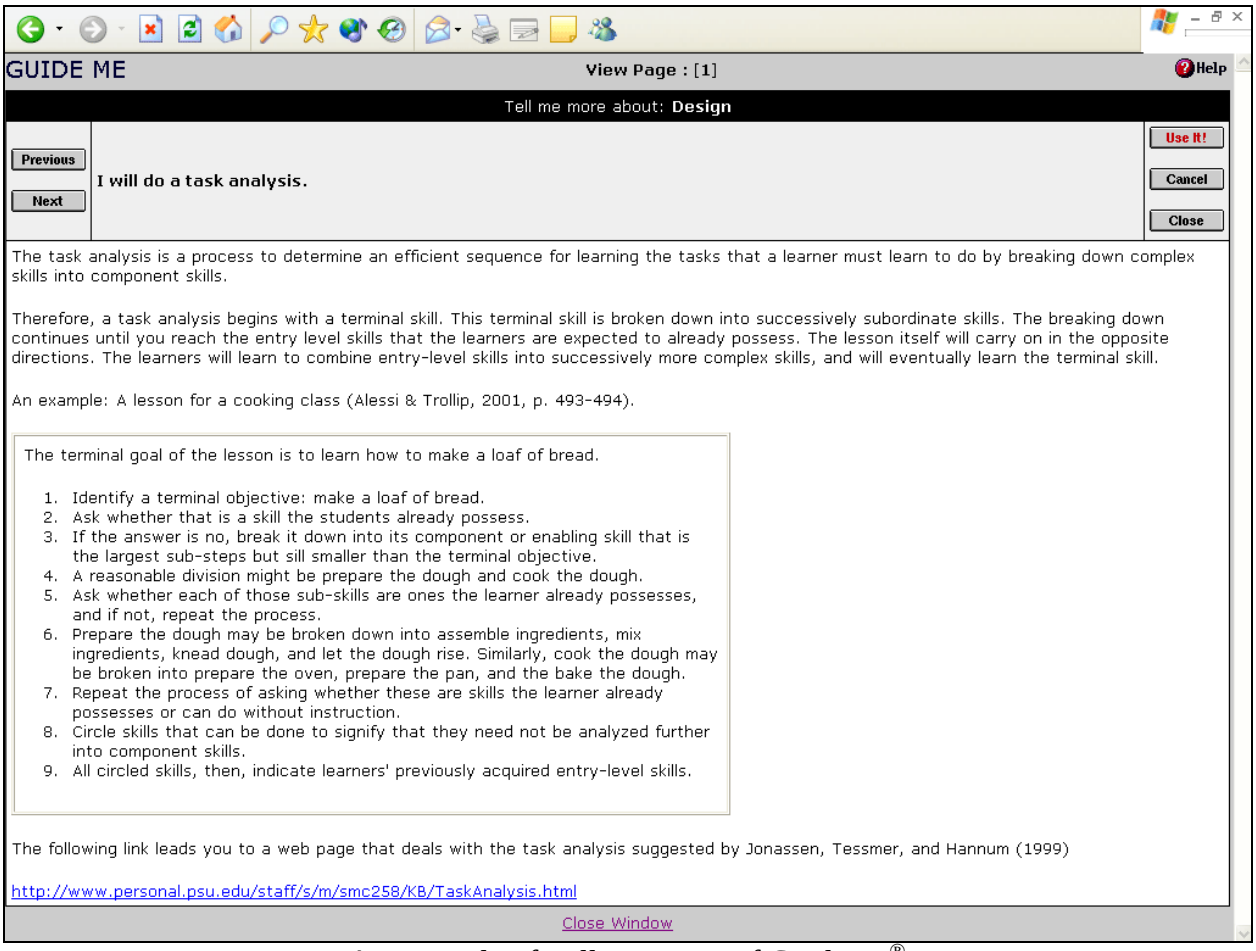
<An example of email reminders>



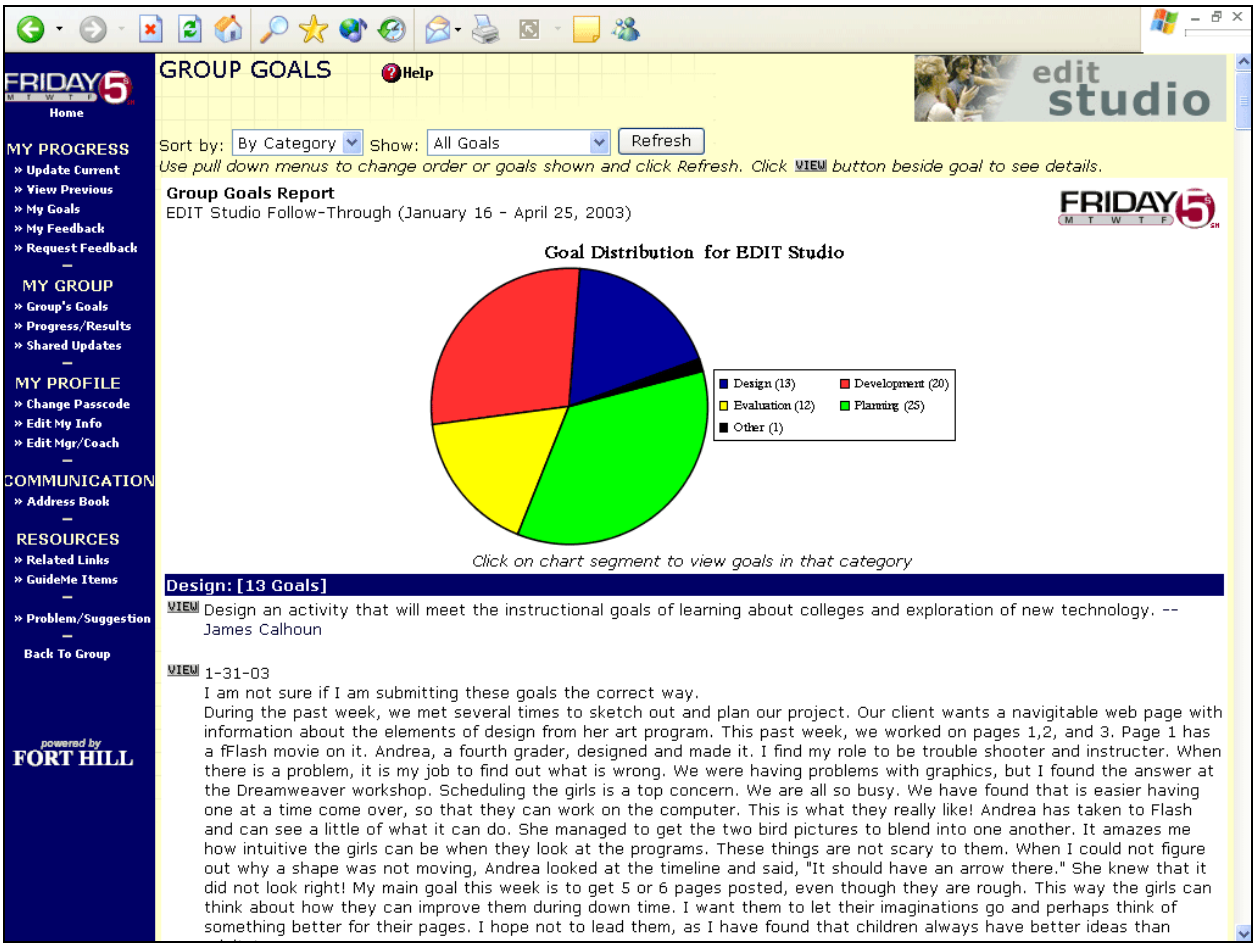
<Current Update page>



<An example of GuideMe®>



<An example of Tell Me More of GuideMe®>



<Group Goals of Shared Reflection>

Appendix B: Research Participation Consent Form

I _____ agree to take a part in the research titled " Impact of a Web-based self-regulated learning support tool: A case study in post secondary education " being conducted by Hyungkook Park (Dept. of Instructional Technology, 604 Aderhold, The University of Georgia, hyunpark@coe.uga.edu), a doctoral student in Instructional Technology Department at UGA, under the direction of Janette R. Hill (Dept. of Instructional Technology, 604 Aderhold, The University of Georgia, janette@coe.uga.edu). I understand that I do not have to take part if I do not want to. I can stop taking part without giving any reason, and without penalty. I can ask to have all of the information about me returned to me, removed from the research records, or destroyed.

The goal of the study is to investigate the impact of a Web-based Self-Regulated Learning Support tool (SRLS tool) that helps students manage their own learning by themselves especially when they participate in self-directed projects. If I volunteer to take part in this study, I agree to answer the Motivated Strategies for Learning Questionnaire (MSLQ) that is developed to measure the motivation and learning strategies. It will take less than 20 minutes. I also agree to allow researchers to use my artifacts that I created while using the SRLS tool and the final project product.

Further I understand that I will be able to volunteer to answer the questionnaire of investigating my experiences with the SRLS tool and the final project of the course, EDIT 6200 and I will be able to volunteer for follow up interviews. I also understand that the researcher will select several students among the volunteers. I understand that this participation is entirely voluntary.

These will cause no discomforts or stresses to me as well as no risks. All the results of this participation will be confidential, and will not be related in any individually identifiable form without my prior consent, unless otherwise required by law. The MSLQ questionnaires will be kept in secure office storage for thirty-six months, and then destroyed.

The researcher will answer any further questions about the research, now or during the course of the project (583-1907/ 542-4035).

I understand that I am agreeing by my signature on this form to take part in the research by allowing the researcher to use my artifacts and answering the questionnaire and understand that I will receive a signed copy of this consent form for my records.

_____ _____

Signature of Participant Date Signature of Researcher Date

For questions or problems about your rights please call or write: Chris A. Joseph, Ph.D., Human Subjects Office, University of Georgia, 606A Boyd Graduate Studies Research Center, Athens, Georgia 30602-7411; Telephone (706) 542-6514; E-Mail Address IRB@uga.edu.

Appendix C: Motivated Strategies for Learning Questionnaire (MSLQ)

Part A: Motivation

The following questions ask about your motivation for and attitudes toward the multimedia project. Remember there are no right or wrong answers. Just answer as accurately as possible. Use the scale below to answer the questions. If you think the statement is very true of you, circle 7; if a statement is not at all true of you, circle 1. If the statement is more or less true of you, circle the number between 1 and 7 that best describes you.

		1 = not at all true of me	2	3	4	5	6	7 = very true of me
1.	I like the challenge of creating multimedia because I can learn new things.	❍1	❍2	❍3	❍4	❍5	❍6	❍7
2.	If I study and practice, then I will be able to master the skills of creating multimedia.	❍1	❍2	❍3	❍4	❍5	❍6	❍7
3.	I believe I will receive an excellent grade for the multimedia project.	❍1	❍2	❍3	❍4	❍5	❍6	❍7
4.	Getting a good grade from the multimedia project is the most important thing for me right now.	❍1	❍2	❍3	❍4	❍5	❍6	❍7
5.	It is my own fault if I don't learn the skills for creating multimedia in this course.	❍1	❍2	❍3	❍4	❍5	❍6	❍7
6.	It is important for me to learn the skills of creating multimedia programs.	❍1	❍2	❍3	❍4	❍5	❍6	❍7
7.	If I can, I want to get a better grade from this project than most of the other students in the class.	❍1	❍2	❍3	❍4	❍5	❍6	❍7
8.	I'm confident I can understand the most complex techniques presented by the instructor for producing multimedia.	❍1	❍2	❍3	❍4	❍5	❍6	❍7
9.	The multimedia project arouses my curiosity.	❍1	❍2	❍3	❍4	❍5	❍6	❍7
10.	I am very interested in creating the multimedia program.	❍1	❍2	❍3	❍4	❍5	❍6	❍7
11.	If I try hard enough, then I will master the skills of creating multimedia.	❍1	❍2	❍3	❍4	❍5	❍6	❍7
12.	I'm confident I can do an excellent job on the multimedia project.	❍1	❍2	❍3	❍4	❍5	❍6	❍7
13.	I think the skills of producing multimedia are useful for me to learn.	❍1	❍2	❍3	❍4	❍5	❍6	❍7
14.	The project topic and design are of my own choice. I believe this allows me to learn the most even if it doesn't guarantee a good grade.	❍1	❍2	❍3	❍4	❍5	❍6	❍7
15.	I want to do well in the multimedia project because it is important to show my ability to my family, friends, employer, or others.	❍1	❍2	❍3	❍4	❍5	❍6	❍7

Part B: Learning Strategies

The following questions ask about your learning strategies and study skills this course. Remember there are no right or wrong answers. Just answer as accurately as possible. Use the scale below to answer the questions. If you think the statement is very true of you, circle 7; if a statement is not at all true of you, circle 1. If the statement is more or less true of you, circle the number between 1 and 7 that best describes you.

		1 = not at all true of me	2	3	4	5	6	7 = very true of me
16.	When I study for this class, I set goals for myself in order to direct my activities in each study period.	❍1	❍2	❍3	❍4	❍5	❍6	❍7
17.	I usually work in a place where I can concentrate on my course work.	❍1	❍2	❍3	❍4	❍5	❍6	❍7
18.	I often feel so lazy or bored when I study for this course that I quit before I finish what I planned to do.	❍1	❍2	❍3	❍4	❍5	❍6	❍7
19.	Even if I have trouble creating multimedia program in this course, I try to do the work on my own, without help from anyone.	❍1	❍2	❍3	❍4	❍5	❍6	❍7
20.	When I study for this course, I make an overall plan to complete my project.	❍1	❍2	❍3	❍4	❍5	❍6	❍7
21.	I make good use of my study time for this course.	❍1	❍2	❍3	❍4	❍5	❍6	❍7
22.	I review my design plan to see what I need to do before I start developing my multimedia program.	❍1	❍2	❍3	❍4	❍5	❍6	❍7
23.	I find it hard to stick to a timeline for completing my multimedia program.	❍1	❍2	❍3	❍4	❍5	❍6	❍7
24.	I work hard to do well in this course even if I don't like what we are doing.	❍1	❍2	❍3	❍4	❍5	❍6	❍7
25.	I ask the instructor to clarify complex techniques for producing multimedia when I don't understand well.	❍1	❍2	❍3	❍4	❍5	❍6	❍7
26.	I divide the whole project in this course into manageable segments.	❍1	❍2	❍3	❍4	❍5	❍6	❍7
27.	I have a regular computer set aside for developing multimedia program.	❍1	❍2	❍3	❍4	❍5	❍6	❍7
28.	During this project, I occasionally check my progress and estimate how much more work needs to be done.	❍1	❍2	❍3	❍4	❍5	❍6	❍7
29.	Even when course contents are dull and uninteresting, I manage to keep working until I finish.	❍1	❍2	❍3	❍4	❍5	❍6	❍7
30.	When I can't make a progress to create multimedia program in this course, I ask another student in this course for help.	❍1	❍2	❍3	❍4	❍5	❍6	❍7
31.	I make sure I keep up with the weekly readings and assignments for this course.	❍1	❍2	❍3	❍4	❍5	❍6	❍7
32.	When creating multimedia in this course, I make up questions to help check the progress.	❍1	❍2	❍3	❍4	❍5	❍6	❍7
33.	I try to identify persons in this course whom I can ask for help if necessary.	❍1	❍2	❍3	❍4	❍5	❍6	❍7
34.	For this course project, I organize my computer files and other materials so I can find them easily.	❍1	❍2	❍3	❍4	❍5	❍6	❍7

Appendix D: Student General Information Questionnaire

Please fill out the following demographic information.

- Name:
- Age:
- Gender:
- Native Language:

Majors and degrees achieved and seeking:

How would you describe yourself as a learner?

Tell me about your preferred styles of learning. How did you come to know about these preferences of yours?

If you are/were a teacher,

- How long have you taught?
- What year are you teaching?
- What subject(s) are you teaching?

Appendix E: An Example of Students' Log on Friday5s®

Activity Graph

University >EDIT Studio Project - Jan 01, 2003

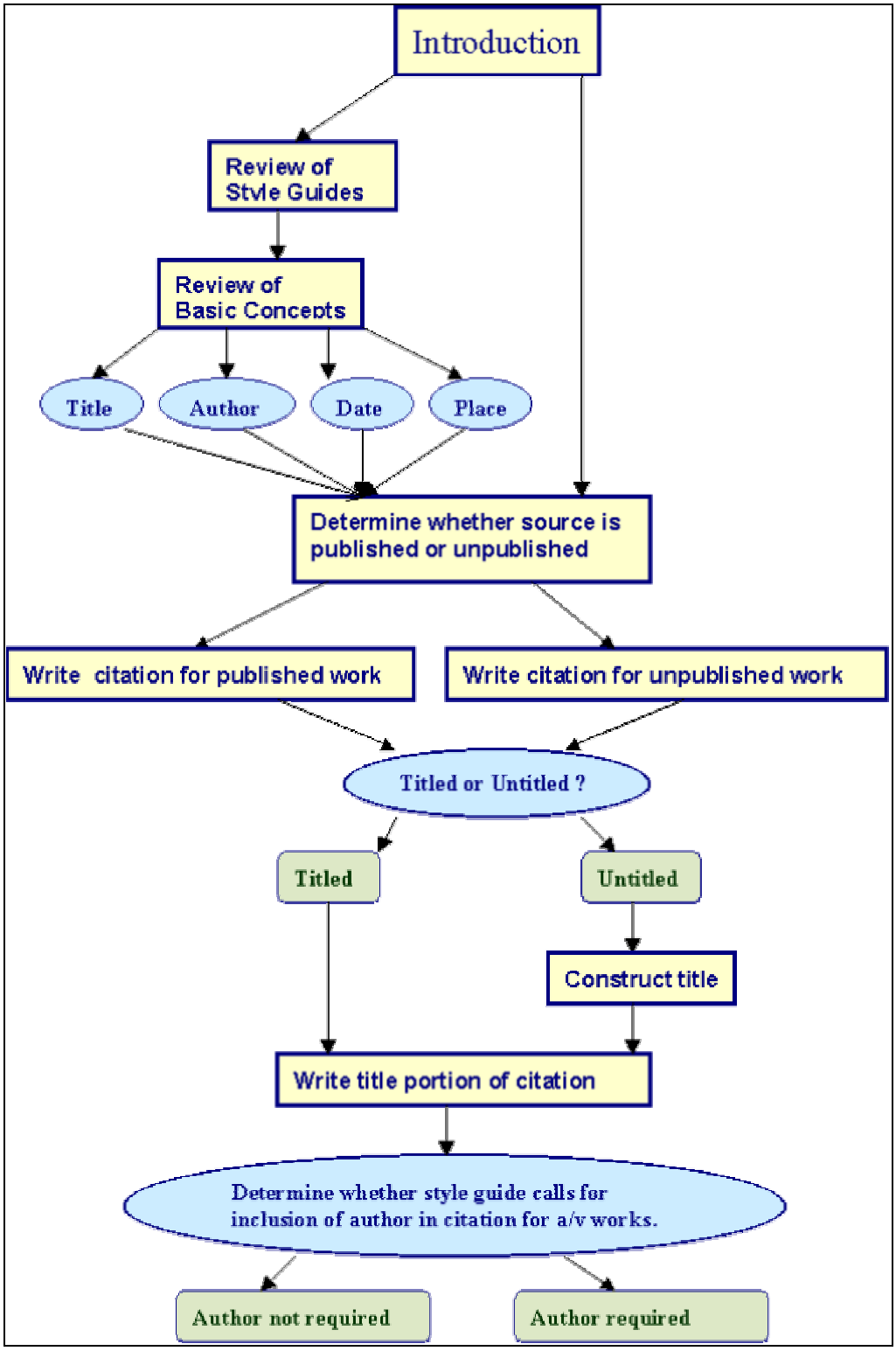
Activity for
from 10:55 AM to 11:28 AM on January 31, 2003

Go In | View Report

Time	Page	Button Clicked
10:55 AM	Home.asp	
10:55 AM	CurrentProgress.asp	
10:55 AM	CurrentProgress.asp	Completed
10:59 AM	CurrentProgress.asp	SaveAndContinue
11:00 AM	CurrentProgress.asp	AddNewGoal
11:03 AM	CurrentProgress.asp	SaveAndContinue
11:06 AM	CurrentProgress.asp	Edit
11:07 AM	CurrentProgress.asp	
11:23 AM	ShowGuideMe.asp	
11:25 AM	CurrentProgress.asp	SaveAndContinue
11:26 AM	CurrentProgress.asp	SaveAndReview
11:26 AM	AfterUpdate.asp	Send
11:27 AM	UserReport.asp	

<An activity log of a student>

Appendix F: Examples of Product Artifacts



<An example of flowcharts of Garnet>

<Brandy's constructionist product artifact developed with two students>

Appendix G: Open-Ended Survey

Survey on Friday5s®

This questionnaire is for the research study on the use of Friday5s®, an online learning support tool. Most of the questions are open-ended asking for your opinions and feedback about your experience with Friday5s®. Your answers will be collected and analyzed solely by the researcher (Hyungkook Park, hyunpark@coe.uga.edu). Feel free to contact the researcher if you have any questions about this study. Thank you!

- *Do you think the tool helped you manage your learning? Why or why not?*

- *What activities of the tool do you think helped your learning most and why?*

- *What changes would you like to make in the tool if you could?*

- *Would you recommend others using this tool for their learning? Why or why not?*

- *Did you have any problems using the tool? If so, what were they?*

- *If you had problems, did this have any influence on your thoughts about the tool?*

- *How helpful do you think the tool-related activities such as goal setting, self-evaluating, and reflections are for managing your learning?*

Appendix H: Interview Protocol

The purpose of this interview is to get some information that will help designers of self-regulated learning support tool to design the tool more effectively. As someone who has experienced the self-regulated learning support tool in your course, you are in a good position to describe your experience and how you found it.

Overall SRLS tool experience and background

- *What do you think of the self-regulated learning support tool?*
- *Have you ever used a tool similar to the self-regulated learning support tool before? If so, when and how?*
- *Have you used any similar activities like journaling to your students? If so, what is your experience?*

Effectiveness of the SRLS tool and pattern of use in general

- *When you were working with the self-regulated learning support tool, what elements of the tool did you use?*
- *What were the strengths of the SRLS tool?*
- *What were the weaknesses of the SRLS tool?*
- *How confident have you been about the goal accomplishment when you set the short-term goals every week? And why do you think like that?*
- *What were your projects? Can you describe about it?*
- *How effective do you think the SRLS tool helping your learning (projects)?*
- *What are some of the things you really liked about the SRLS tool?*
- *What are some of the things you disliked about the SRLS tool?*
- *If you had the power to change the SRLS tool, what would you make different?*

- *If a friend of yours is about to use the self-regulated learning support tool for the first time, what advice would you give?*

Effect of critical elements of SRLS tool

- *We've been talking about your experiences with the self-regulated learning support tool in general. I'd like now to ask your opinion on some of the specific features of the self-regulated learning support tool.*
- *How did the self-regulated learning support tool enable you to set goals and plan on your learning as you went on the course?*
- *How do you think specifying your goal help your learning?*
- *How do you think the short-term goals help your learning?*
- *How did the self-regulated learning support tool help you to reflect on your learning?*
- *What did you find when you evaluate on previous works?*
- *There is a GuideMe function in the SRLS tool. How did you use it?*
- *There is a help-seeking function like sending an email to course instructors or coaches. How did you use it?*
- *How did you like Q&A bulletin board?*
- *There are various resources on the course Web site. How did you use them?*
- *How did you feel motivated throughout the course?*
- *When did you feel your motivation declining? And why?*
- *How did you maintain your motivation at that time?*
- *What other assistances do you think you need as you worked on?*

Closing comments

You've been very helpful. Do you have any other thoughts or feelings on using Friday5s?

Thank you.

Appendix I: An Example of Case Report

He is a native English speaker and 36 years old. He is a master's student in Instructional Technology. He has a master's degree in Library Science and has been a librarian for 9 years. Through the general information questionnaire, he described himself as a visual learner so that he learns best by reading, seeing, and hands on doing. And he also reported that he has to write down what he hears in order to remember it and he needs something to read to be able to remember it. Although he is not a teacher in the sense of a classroom, he has instructed students at the reference desk in terms of how to use library resources and how to do research.

His project for EDIT6200 was to develop a Web-based tutorial for undergraduate psychology students to learn how to effectively use the PsycINFO database. The tutorial covers search strategies, limiting searches to types of articles, finding full text online articles, getting call numbers for print journals, and providing learner assessment and feedback. He used the Dreamweaver as a main development tool.

He confirmed his client two weeks after the semester began. He expressed in a journal entry that finding a client was one of the challenges for his project. To find a client was one of the most important factors that affected his project. He expressed that he tried several possible options and finally got his client from the department that he had wanted to work with. Based on the journal entries and the project management site, he appeared to be on the track, updating in a timely manner from the beginning and through to the end of the semester.

General opinion of the tool. From the interview, it was turned out that he, in general, liked the tool throughout the semester. He indicated he valued the tool: "It is well laid out. It is well structured. It makes sense. It flows as far as the process. So those are the strengths, I would say."

He liked the Friday5s tool better than the design journal used in the EDIT6190 course because Friday5s was more focused on the actual goals while the design journal included other things like reading. In the design journal of EDIT6190, the students were required to integrate their reading into the reflective journals. It appears that he liked to separate the goal setting, planning, monitoring, and evaluating activities from other activities like integrating the review of required readings.

He indicated that he normally used the tool for doing the goal setting, monitoring, evaluating, and planning activities with the help of the trigger emails and guiding questions in the current update template. He used to see others' updates to compare his progress. He said, "I primarily, I would update my goals and then would just do a quick view to see where the rest of the class was. I would normally use all parts of the update, you know, for my goal." He used the GuideMe feature two times throughout the semester. He tried to see the content of the GuideMe but did not use the content for his actual updates. He said "There was one time when I wasn't sure what to write. … at that point I used the GudieMe to see what type of recommendations it would give." He guessed that the reason the students did not use the GuideMe feature much was time.

How it helped. The Friday5s tool gave him some structure and helped him to see all the various stages of the process. He mentioned, "I felt that it was a good tool to give some structure and to be able to see all the various stages. It was also good to be able to set a goal for each week and to be able to see how far towards the goals that I was." It also helped him manage his time throughout the course. He said "It was good because I think it helped me keep more focused on the time line and on making sure that I didn't spend so much time on the design phase that I would actually have enough time to do the development phase." He used the pie

chart in the tool that showed the types of goals the students set so far. By doing it, he was able to avoid spending too much time in one phase.

By setting specific goals, he could motivate himself. He said, "I think that actually typing up a goal that is not vague, which is more specific does give you more motivation to actually do it." This remark also implies that setting a goal in his mind is different from setting a goal by writing up. Short-term goals also helped him to be focused on what he needed to be done.

Self-evaluation each week also helped him throughout the course. As he mentioned in the interview, "This was good because, again, I had to self-judge and to be specific about what I had done towards that goal. I would say that this part right here, for me, was the most useful part of the whole product." It also appears that the project and tool assisted with motivation. Although his MSLQ motivation scores were low, especially task value, intrinsic goal orientation, and extrinsic goal orientation, the interview data revealed that his actual motivation was quite high.

Summary. He did not miss any updates. He valued the tool in the course. Although his self-efficacy score was lowest among the students, he finished his project in a timely manner and expressed that he was pretty confident throughout the course during the interview.