VIDEO PROMPTS FOR SELF-REGULATED LEARNING: METACOGNITION AND REFLECTION ACTIVITY

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Video prompts for self-regulated learning: Metacognition and reflection activity

Chairperson: Dr. Nader Shooshtari

This study explored video metacognitive prompts as a method of engaging students in self-regulated learning. The study was completed in the naturalistic setting of fully online learning. Such learning environments imply a distance between faculty and students that makes student self-direction vital to success. However, students are only infrequently practicing self-regulated learning skills.

The main questions included: “What impact do video and text prompts have on self-regulated learning, metacognition, and their components?”; ‘What impact do video and text prompts have on academic success?’ and “Do learners’ personal characteristics moderate the effects of the prompts?”

Students were prompted by video versus text prompts during multiple trials of either a between-group, pretest-posttest quantitative Pilot Study or a repeated-measures, between-groups, pretest-posttest quantitative Final Study. Instruments included the Motivated Strategies for Learning Questionnaire (MSLQ) and the Metacognitive Awareness Inventory (MAI) questionnaires along with demographics and a between-trial Confidence and Satisfaction measure.

Voluntary participation was low, despite offering extra credit and incentives. Several of the measures achieved significance and supported a positive effect for prompts. They were however not significant for the effect of video versus text prompts. There are several possible explanations for the results, including the timing of the final measurements and the fact that participants who engaged in self-regulated learning through metacognitive activation were self-selecting by their voluntary participation in the study.
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Thank you all from the bottom of my heart. Yahoo, I’m finally done!
Chapter 1: Introduction

Learning environments and practices have changed dramatically in the past 30 years. Accordingly, The New Media Consortium produced “The Report of the 21st Century Literacy Summit” in 2005, which describes a profound shift in the way people communicate and that 21st-century literacy may change the way we learn. The need for “21st-century skills,” such as creativity, flexibility, and independence among tech-savvy learners, is ever increasing, new digital networked technologies offer unparalleled opportunities for creative and independent learning (Pink, 2009).

Education is often presented in online and web-based learning environments (WBLE); information is available immediately through Google searches, and technology is ubiquitous. Education has shifted from a focus on teachers to attention on learners, just-in-time learning, project-based learning, technology-based learning supports, and web-based learning (Lin, Hsu, Lin, Changlai, Yang, & Lai, 2012). Learners are more frequently in information-overloaded and ill-structured situations and are thus required to be more independent while processing information.

Self-regulated learning (SRL) and metacognitive monitoring have been considered an answer to this challenging/perplexing learning environment. The concept of self-regulated, self-directed learning is a complex of constructs and theoretical traditions. SRL is, essentially, students regulating their own learning through metacognitive monitoring and watching their own learning process. These processes are particularly helpful in online WBLE. Such environments are ideal for the activation of SRL because currently they are so ill-structured. Ill-structured tasks and environments “do not make obvious the operations to use in creating products, offer erratic evaluations, and have moot standards for judging the product” (Lodewyk & Winn, 2005).
Researchers note that both externally related learning (learning controlled by teachers) and fading scaffolds are helpful in developing SRL awareness and habits in learners, specifically if learners are prompted to use metacognitive monitoring (Azevedo, Moos, Greene, & Winter, 2008). Even so, these meta-strategies are not being fully utilized by learners.

Scaffolding and one of its subcategories, prompts, offers promise. Scaffolding is the idea of transfer of modeling from instructor to learner. For example, a teacher, as expert, structures a lesson so students can more easily absorb the main points, or a teacher consistently models checking for comprehension after reading so students apply that practice on their own. Scaffolding has been partially useful in helping learners engage in their own SRL (Azevedo & Hadwin, 2005; Perry, Hutchinson, & Thauberger, 2008). Prompts, a subcategory of scaffolding, have been proposed as a vehicle for instructor-learner interaction and SRL activation. Prompts are brief reminders of recommended review or metacognitive activities inserted in the learning process. Devolder, Van Braak, and Tondeur (2012) conclude: “In the field of cognition, prompts appear to be the most effective scaffolds, especially for processes during the control phase.”

Prompts have been labeled “strategy activators” by Nückles, Hubner, and Renkl (2009, p. 261). Numerous researchers have shown prompts to be successful, especially when combined with SRL training (Bannert & Reimann, 2012) and in all phases of SRL (Nückles et al., 2009, p. 261). However, results have varied, and research continues in these areas to determine the optimum characteristics of prompts for activating cognition and metacognition.

An additional area of educational focus has been the upswing of educational videos in a new form: video podcasts (digital, portable videos). In 2009 the Video and Higher Education Project found that educational use of video on campuses is accelerating rapidly and that faculty, librarians, and administrators expect its use to grow significantly. The ability to create, edit, and
archive videos is now easily accessible, and the portability of media is accelerating exponentially (p. 4). Video podcasts have been used, especially in online courses or as online supplements, for many purposes, which include helping learners create mental models, assisting teachers to learn new teaching methods, and as a retrospective tool to understand self-regulated learning (Tung & Chin, 2011).

Short video (podcast) prompts may be particularly effective in the online environment for activating SRL. While external regulation (Azevedo et al., 2008), training, and prompts have been found to be useful to learners, human and adaptive scaffolding has been the most effective (Azevedo et al., 2008). Therefore, video prompts are proposed as a way to provide humanlike and consistent prompts in an online learning environment for SRL and metacognitive monitoring and their activation.

Researchers still have not defined a complete prompting process: a practical application that activates learners’ use of SRL and is strongly linked to academic success. During the proposed research, the researcher merged metacognitive prompts with video podcasts to determine whether an answer lies at their intersection.

**Statement of the Problem**

SRL, with its associated metacognitive monitoring, is generally understood to be crucial to 21st-century learning, especially within the inherently ill-structured yet increasingly common online learning environments. While SRL is understood to be imperative to learning, results have not always been conclusive about SRL: how SRL components are activated, how they relate to academic and other successes, and how to develop optimum environments for SRL. In addition, as much as SRL is recognized as a crucial component of academic and lifelong learning success,
especially in the online learning environment, learners are not automatically using it (Narciss, Proske, & Koerndle, 2007). According to Bernacki, Aguilar, and Byrnes, “educators should aim to increase students’ SRL propensity if they intend to instruct using TELEs [technology-enhanced learning environments]. Without raising students’ SRL acumen, the opportunities that TELEs provide are likely to be underutilized” (2011, p. 16).

Although some answers are available, the question remains: How can educators activate the requisite metacognitive and reflective processes needed for 21st-century education? A partial answer may come from another rapidly growing area of educational practices comprised of educational videos, screencasts, and video podcasts.

In the study, the researcher examined how scaffolding through the use of video prompts affects students’ online SRL activation, particularly with metacognitive monitoring and reflection, and whether activation is directly linked to academic success through grades.

The three research questions ask:

1. What impact do video and text prompts have on SRL, metacognition, and their components?
2. What impact do video and text prompts have on academic success?
3. Do learners’ personal characteristics moderate the effects of the prompts?

**Significance of the Study**

SRL within online learning environments, particularly web-based learning environments (WBLE), is crucial to learners’ success. This is especially true as MOOC (Massive Open Online Courses) become more commonplace (McKiernan, 2012). While educators are accepting online learning environments as standard in 21st-century education, they also understand the need for
SRL. However, the question of how to activate SRL in learners so they can become less
dependent on externally regulated learning (ERL) is not yet completely answered. Moreover, “it
is largely unknown how to prompt effective self-regulation during unsupervised, self-directed
study” (Bednall & Kehoe, 2011, p. 206) such as asynchronous web-based learning.

The study is significant because it links three educational trends that have not previously
been researched together: 1. metacognitive monitoring and reflection, 2. self-regulated learning
and 3. video prompts. The research records and analyzes the effectiveness of video prompts for
activating metacognitive monitoring and reflection toward increased SRL.

In addition, the study provided further practical information, directly related to theories
and highly adaptive to multiple online or web-based learning environments (WBLE). Chen and
Bradshaw (2007) assert, “ill-structured problems are the kinds of problems that students face
routinely in everyday life” (Jonassen, 2002, as quoted on page 360). Thus, understanding
metacognitive activation and self-regulated learning activities has ramifications for lifelong
learning along with the WBLE more common in 21st-century education.

Furthermore, considering the issues from a different perspective, SRL may be helpful in
managing the “problems inherent in multimedia environments [about which] relatively little
knowledge … is offered in the literature” (Deimann & Keller, 2006, p. 139). By enhancing
understanding about SRL relationship to multimedia, the proposed research may tangentially
offer information to another large body of educational application and research: multimedia,
hypermedia, and video podcasts.
Conceptual Framework

SRL and its concomitant metacognitive monitoring have been seen as an answer to the ill-structured WBLE of the 21st century, even though these strategies are not being automatically used by learners. Many researchers within several SRL traditions apply theory to practice to determine how to encourage this crucial, underutilized skill. SRL was conceptualized in the 1980s, and studies on it occurred regularly during the 1990s. Attention increased and an explosion of theories occurred just before and at the turn of the 21st century (Pintrich, 2000; Winne & Hadwin, 1998; Deci & Ryan, 2000; Zimmerman & Schunk, 2001), which cemented the theories and the relevance of SRL. Three main SRL traditions emerged: Sociocognitive, Information-Processing Theory (IPT), and student approaches to learning (SAL). The Sociocognitive tradition is more a tradition than a theory and, without a specific theoretical nomenclature, for this proposed research is simply referred to as SRL.

Although the proposed research focuses on the Sociocognitive tradition, it is informed by the other two main self-regulated learning traditions. Zimmerman, Schunk, and Pintrich, representative of the sociocognitive branch of SRL, conceptualize the key components of the learning process as motivation, self-efficacy, and goal orientations (Greene & Azevedo, 2007). The Information-Processing Theory (IPT) tradition utilizes computer metaphors and attributes learning difficulties to several factors including biomechanical memory storage and retrieval process, along with poor strategy use due to inadequate rules (Greene & Azevedo, 2007). Researchers within this tradition were the first to focus on measurements beyond the standard questionnaire. This focus has affected the Sociocognitive approach and is reflected in the study. The Student Approaches to Learning (SAL) tradition focuses upon each individual learner, adopting one of several generic approaches. SAL theories propose a more trait-like approach
compared to the contextual variation and individual control of SRL. SAL theories are also based more on one-to-one correspondence between motivation and strategies for learning. Thus, SAL theories “are known for linking extrinsic goals to surface learning strategies and intrinsic goals to deeper learning strategies (Biggs, 1993)” (Pintrich, 2004, p. 387-8). The study acknowledges the influence of the SAL tradition in linking volition (Boekaerts, 1996; Pintrich, 2004), multimedia, and reflection (Phan, 2008) more intimately with SRL.

Scaffolding has long been the cornerstone of education with the goal of transferring teachers’ expertise to students so that learners can become more self-regulating. However, there is no one central theory of scaffolding or its subset, prompting. In this study, prompts are categorized as occurring along the following dimensions: which stages the SRL phase prompts are designed for; whether they are focused on subject matter, cognitive learning or metacognition; whether they are highly structured or more open-ended; and whether the learner is required to respond.

The 21st-century environment is one of sharply increasing information and the subsequent overload caused by information and technology. WBLE are flexible and information rich but, consequentially, ill-structured. However, even educational elements proposed as solutions, such as SRL and prompting, have potential for cognitive overload. In addition, educational video, done poorly, can also cause confusion (cognitive overload) rather than clarity. Each of these educational elements contains the ability to assist learning yet include the potential for initial cognitive overload.

Cognitive overload is a concept that developed with cognitive psychology. Miller (1956) highlighted the limitations of human short-term memory, which can hold seven (plus or minus two) chunks of information. Swiller (1988), who developed the Cognitive Load Theory (CLT),
observed that learners can be overwhelmed by new information and may employ ineffective means of problem solving.

Since all new skills and habits cause overload at first, there is hope that the learning curve for applying SRL with metacognitive monitoring, once accomplished, can help learners navigate WBLE and all other ill-structured learning environments. Perhaps there is a way to help learners find scaffolding less distractive, more coherent with course content, and more integrated so that the disadvantages decrease and the learning benefits increase.

The researcher proposes an approach that uses prompts in a way that should not contribute to cognitive load: video podcast for prompting. Using video podcasts as prompts incorporates benefits highlighted in Mayer’s Cognitive Theory of Multimedia Learning. Mayer proposes that humans possess two separate information-processing channels: auditory input and verbal representations, and visual input and pictorial representations (Mayer & Moreno, 2003, p. 44). Mayer highlights the benefits of dual channels—contiguous visual and auditory inputs—for reducing cognitive load. Mayer’s theory applies cognitive psychology concepts to humans’ ability to absorb and process incoming information. The theory posits several principles for instructional design and teaching. For example, Mayer suggests conversational styles and virtual coaches (the personalization principle) to reduce cognitive load and increase learning.

The use of video prompts reflects New Media Consortium’s assertion that the new concept of language includes multimodal, visual, and auditory elements and immediacy (New Media Consortium, 2005, p. 1). Video prompts may be similar to educational video in engaging learners, reducing cognitive load, providing more immediate externally facilitated regulation, and combating the transaction distance of asynchronous WBLE.
Twenty-first century education and WBLE may provide increased instructive opportunities but may also require new approaches to learning. Approaches such as SRL and prompting, for example, may offer increased support when applied to elements of the new literacy.

**Summary of Methodology**

In the study, the researcher compared the effects of prompts on SRL, metacognitive activation, and reflection. The study was a between-group quasi-experimental research design with the type of prompting used—video podcasts or written—as the independent variable. Participants were enrolled in two sections of an online undergraduate course taught by the same instructor. Prompts were built into the learning management system, and prompt responses analyzed quantitatively and qualitatively for SRL, metacognitive monitoring, and reflection.

The researcher tested the effects of video prompts with standard SRL (Motivated Strategies for Self-regulated Learning, MSLQ) and metacognitive measurements (Metacognitive Awareness Inventory, MAI) inventories during pre- and post-tests. T-tests and correlations were run to determine the significance of video prompts compared to written prompts. The researcher ran ANOVAs to determine whether learner characteristics covary significantly with various MSLQ, MAI, and Confidence and Satisfaction measures.

**Definition of Terms**

**Online learning in web-based learning environments (WBLE).**

Online learning has carried many different names, most of which refer to specific qualities of a particular “branch” of online learning. For example, distance learning is a learning activity where time and/or place separate students and teachers (Lever-Duffy, 1996). Most online
learning environments have been used for distance learning, but that is changing with the trend toward blended courses (face-to-face plus an online element). The study is focused on fully online asynchronous learning, which represents a distinct educational branch—a shift away from the industrial production of prepackaged study materials—to learning “rooted in computer conferencing and collaborative constructivist approaches to learning” (Garrison, 2011, p. 2). Fully online asynchronous learning is referred to in this study as WBLE–Web-based learning environments (Hsu, Ching, Mathews, & Carr-Chellman, 2009). However, relevant research referenced may use TELE–technology-enhanced learning environments (Bernacki et al., 2011) or online learning.

**Self-regulated learning.**

Butler and Winne (1995) describe self-regulated learning as a way of engaging with learning that uses powerful skills such as “setting goals for upgrading knowledge; deliberating about strategies to select those that balance progress toward goals against unwanted costs; and, as steps are taken and the task evolves, monitoring the accumulating effects of their engagement” (p. 245). SRL has also been referred to as the desired outcome of the process of “students’ self-generated thoughts and behaviors that are systematically oriented toward the attainment of their learning goals” (Zimmerman & Schunk, 2001, p. 125). Pintrich (2000) defines self-regulated learning (SRL) as “an active, constructive process whereby students 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.” This study uses this definition of SRL.
**Metacognition.**

Metacognition is often characterized as “thinking about thinking.” Flavell (1978) coined the term and defined it as “any knowledge or cognitive activity that takes as its cognitive object, or what regulates, any aspect of any cognitive activity” (Flavell et al., 1993, p. 150). Metacognition, compared to cognition, occurs in the frontal lobe of the brain instead of other regions and is more teachable, supportable, and durable than specific cognitive activities (Prins, 2006, p. 375). Cognitive activities help gain, retain, and transfer knowledge in the execution of tasks, whereas metacognitive activities govern and regulate this execution to satisfactory levels.

SRL is most often understood to work in conjunction with metacognitive monitoring and processing. Oort and Vrugt (2008) observe that although the major models of SRL differ in specific perspective, there is consensus that SRL includes goal setting, metacognition, and the use of metacognitive strategies (p. 123).

**Scaffolding.**

Scaffolding is a temporary supportive structure that helps learners complete a new or complex task that they would not have been able to complete on their own (Van de Pol, Volman, & Beishuizen, 2010). Azevedo, Cromley, Moos, Greene, and Winters (2011) characterize scaffolds as tools, strategies, and guides used by teachers and tutors (human and computer) during learning that support learners’ understanding. Van de Pol et al. (2010) establish the distinctive characteristics of scaffolding as contingency, fading, and transfer of responsibility (p. 275). Three scaffolding goals are often differentiated: supporting conceptual understanding, developing or highlighting procedural and strategic skills, and sustaining metacognition and epistemology (Lin, Hsu, Changlai, Lin, Yang, & Lai, 2011).
Prompts.

Both scaffolding and prompts are not part of course content. Rather, instructors build scaffolding into a course to help students with metacognitive or cognitive suggestions about learning the course content. Prompts are episodic communications that instigate activity based on reference to theory, strategies, and the existing scaffolds (Van de Pol et al., p. 274).

Prompting students can indirectly guide and support their regulation of problem-solving processes (Ifenthaler, 2012) and their existing self-monitoring skills (Kauffman et al., 2008). Prompting can also stimulate cognitive and metacognitive strategies and clarify the assignment goals, thus cueing students to self-monitor and self-regulate (Schunk & Ertmer, 1999; Schunk & Swartz, 1993). Prompts, in a classroom can be paper (Bannert, Hildebrand, & Mengelkamp, 2009). Prompts can also be text or verbal.

Scope and Limitations

Delimitations.

This study is focused primarily on undergraduate students taking Computer Science and graduate students taking Business courses at the University of Montana. Both classes are primarily asynchronous online courses. Students were not required to have completed the course to be included in the study. Students may or may not have been taking other online courses, were enrolled full or part time, and were not required to be enrolled in a specific degree program. The study also ignores specific cultural perceptions and viewpoints based on individuals’ ethnicity, disability, or religious/philosophical orientation.
The results can be generalized primarily to students similar to those described above. However, demographic data from the study was compared to the characteristics of online students categorized by Liu (2006) and to the most recent statistics of the Sloan Consortium.

**Limitations.**

Limitations of the study include its time-bound nature and the data collection method. The study was conducted over several units of two semesters rather than long-term. It is also possible that the amount of data collection via web-based multiple choice questions was daunting to some students and caused fatigue or overload.

The study is based largely on student opinion and self-report data, although there was data triangulation with grade point average and other student behavioral observations and written statements. Self-report always has the potential to be a limiting factor as humans are not always reliable observers of their own behavior. However, the focus of this study on students' awareness of their own study and learning processes may be best served by such self-report.

**Summary**

SRL, with its concomitant metacognitive monitoring and reflection, is understood as an important component of 21st-century learning but is not always utilized by learners. Though not completely understood by learners/instructors, scaffolding and prompts have been helpful as a form of externally facilitated learning that activates SRL. Video prompts may provide a way to avoid cognitive overload while prompting SRL. The study researched the connections between video prompts, SRL, metacognitive monitoring, and learner success.
Chapter 2: Review of Related Literature

There has been an increase in what is called 21st-century education, which includes educational trends such as self-regulated learning (SRL) with concomitant metacognition, online learning environments, and educational video. This study brings these three elements together to help answer the question, “Can video prompts activate SRL and metacognition in students in online learning environments?”

Literature Review Approach

This study examined the relevance of video prompts to the activation of SRL behaviors and metacognition monitoring in web-based learning environments. The following literature review provides an overview of research relevant to the theories of SRL and metacognition; their application, particularly in WBLE; the use of prompts to activate both SRL and metacognition; and the relevance of video podcasts as prompts.

SRL, metacognition, and WBLE each have a rich research history. Because of the volume of research (almost 7,000 online search engine hits since the early 1990s for “self-regulated learning” alone), the research included in this discussion was primarily found through searches that combined two or more of the primary topics in this study: self-regulated learning (SRL), metacognition, web-based learning environments (WBLE), and prompts. Additionally, the following terms were used in these searches: multimedia, educational video, video podcasts, and screencasts.

Since the research focused on higher education, studies pertaining to elementary school students were excluded along with studies that relied primarily on the two SRL traditions that were not the theoretical foundation of this study (the “European” Student Approaches to
Learning [SAL], and Information Processing traditions [IPT]) unless the studies specifically focused on the topics of prompts or multimedia/video. Research focused on self-regulated learning topics such as personal epistemology, motivation, and affect were not included in the literature review because of the proposed focus on activating metacognitive monitoring and SRL through video and prompts. Nor were the following learning topics included, even in their intersection with the main topics of the proposed research: collaboration, active learning, engagement, peer learning, project-based learning, problem-solving and worked examples, game-playing learning, artificial intelligence, agents, avatars, or computer simulations.

Due to the amount of research and thus consistent changes in the body of knowledge, the researcher gave preference to research completed since 2005, except in the case of pivotal or foundational studies.

**Web- and Computer-Based Learning**

One element of early 21st-century learning environments is WBLE. As stated on the Sloan Consortium’s web site, “Online learning is one of the most talked about and fastest growing sectors in higher education and corporate training today” (Sloan Consortium). Nearly one in every four US college students completed at least one online course by the fall of 2007, while the growth rate for online enrollments by that time had exceeded that of the overall higher education student population (as noted in an annual report by the Sloan Consortium On Online Education; Allen & Seaman, 2008).

Although online learning environments may open new possibilities for teaching and learning, studying in this environment can also increase learner cognitive load by being “ill-structured.” Chen and Bradshaw (2007) define ill-structured problems as having “vague and less-
defined goals and unstated constraint information ...[They have] no right or wrong concepts, rules, and principles for arriving at the solution and possess multiple solutions or may not have any definite solution at all” (p. 361). Papadopoulos, Demetriadis, Stamelos, and Tsoukalas (2011) characterize ill-structured problems as “highly contextualized problems with vagueness and ambiguity dominating some or all aspects of the problem.” Ill-structured problems require “extensive problem representation, active construction of the problem space, justification, monitoring and evaluating” (p. 73). WBLE have similar characteristics. Researchers assert that the less structured, nonlinear, multi-representative, hypermedia environment that is usually characteristic of online learning requires increased learner involvement and responsibility (Azevedo et al., 2011; Schuller, Scheirer, & Gerjets, 2008). Students are required to process large amounts of loosely constructed or prioritized information in an environment with little structure or synchronous support (Kauffman et al., 2011).

One of the key benefits of multimedia learning environments is flexibility, which comes from the potential of high levels of interactivity and large amounts of learner control (Deimann & Keller, 2006). While there are benefits to WBLE’s wealth of information and open-endedness, these same opportunities bring additional challenges. Learners must choose appropriate representations from the wide range of non-linearly structured text, graphics, animation, audio, and video. They must also develop sequences and deploy multiple strategies to meet their learning goals (Azevedo & Jacobson, 2008, p. 108). Kalyuga (2012) notes that “from a cognitive load perspective, the design of interactive multimedia materials for distance education involves some additional challenges in comparison with instructional design for traditional face-to-face classroom settings” (p. 191). Indeed, Devolder, van Braak, and Tondeur posit that WBLE are used to “foster the learning of challenging or complex topics” characterized by “open-
endedness,” many formats, and “non-linear and non-sequential structured information” where students can exercise great control (Devolder, van Braak, & Tondeur, 2012, p. 557). Thus, flexibility is not advantageous to all learners. Deiman and Keller (2006) present some of the common phenomena that learners can experience in multimedia/hypermedia (WBLE) as being overloaded, “lost in space,” being drawn into seductive but nonrelevant details along with other obstacles to persistence and learning (p. 137). Similarly, Cifuentes, Xochihua, and Edwards (2011) found that the technical requirements of a Web 2.0 environment (synonymous with WBLE) increase learners’ cognitive flexibility and can cause learners to experience chaos and overload. The increased cognitive load from learning both the web environment and content causes split attention, increased extraneous cognitive load, and decreased learning (p. 17-18).

WBLE, with their open-endedness and flexibility, are a perfect place to activate SRL. It is generally understood that students need to be more independent, organized, and self-activating when learning online (Andrade & Bunker, 2011; Harris, Lindner, & Pina, 2011; Kauffman, Gi, Xie, & Chen, 2008; Deiman & Keller, 2006). For example, Artino (2008) states that “[a]nypne who has ever completed an online course understands that learning on the web requires considerable self-direction” (Artino, 2008, p. 38).

SRL is a viable answer to learners’ need for independence and increased responsibility. Self-regulation can be viewed as the requisite discipline of the individual in their learning process, whether this process takes place in an online or face-to-face environment (Bandura, 1986, p. 1). Numerous researchers have found that “the importance of self-regulation in improving learning outcomes in online and face-to-face formats cannot be overstated” (Schunk & Zimmerman, 1997; Zimmerman & Schunk, 2001, as cited in Barnard, Paton, & Lan, 2008, p. 1). However, SRL may be even more important in online learning than in face-to-face
environments (Puzziferro, 2008). Kauffman, Zhao, and Yang (2011) reviewed research about learner regulation of their cognitive strategies within the process of constructing knowledge and concluded that “[t]hese models of knowledge construction…and self-regulation seem to have changed the way we look at learning from instructional materials” (p. 314). Especially in online environments, students need to engage in metacognitive control and cognitive strategy usage. In fact, Shea and Bidjerano (2010) concluded a literature review of web-based learning by observing that all of the studies approached the advantages of supporting “‘metacognitive’ learning strategies including self-reflection, self-explanation, and self-monitoring” (p. 1721). Thus, SRL is especially advantageous in the WBLE.

**Self-Regulated Learning**

Pintrich (2000) defines SRL as “an active, constructive process whereby students 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.” Most branches of SRL theory date back to the 1980s with Albert Bandura (1986) and his social-cognitive learning-based theory. The center of the theory states that learning is the result of personal, environmental, and behavioral factors in a process Bandura called reciprocal determinism (Schraw, Crippen, & Hartley, 2006). By the mid-1980s, Bandura (1986) suggested three SRL processes: self-observation, self-judgment, and self-reaction.

**SRL theories.**

SRL was conceptualized in the 1980s, and studies on it occurred frequently in the 1990s. It received an upsurge of theories and attention just before and at the turn of the 21st century
(Pintrich, 2000; Winne & Hadwin, 1998; Deci & Ryan, 2000; Zimmerman & Schunk, 2001) that cemented the theories and the relevance of SRL. Of the three main traditions of self-regulated learning (Sociocognitive [SRL], Information Processing Theory [IPT], and Student Approaches to Learning [SAL]), the Sociocognitive tradition is the theoretical foundation of the proposed research and in this study is considered to be synonymous with SRL.

Along with the surge of interest in SRL around the turn of the 21st century, there has been a focused attempt toward clarifying theoretical grounds for research and simplifying and finding common ground between theoretical orientations. In 2004, Pintrich linked the SAL and the SRL traditions by asserting that both agree that learners are active participants who construct knowledge and that individual learners’ self-regulation of cognition, motivation, and behavior are mediators within the context of the learning situation and individual characteristics. Thus, it is especially helpful when research has a strong theoretical background, but is also informed by and integrates other theoretical traditions. Although considering competing theories is important, “it is imperative that we adhere to a specific model which we can use to generate hypotheses, make assumptions regarding the role of specific processes, mechanisms, and constructs” (Azevedo, 2009, p. 91).
Pintrich and Zusho (2007) share a general model for self-regulated learning in the college classroom. While the “classroom” in this study is online, the model shown in Figure 1 provides an apt visual orientation to the basics of SRL. The model presents the pre-existing conditions on the left, SRL activity in the middle, and outcomes on the right. In addition, the model shows the iterative nature of SRL (from left to right and back again); the lines connecting elements represent metacognitive monitoring, and the movement between the components demonstrates metacognitive regulation.

The SRL activities shown in the model can include using learning strategies that encourage in-depth processing and deliberate planning when appropriate and simpler strategies when not. SRL is driven by feedback from cognitive processing, motivational processes, and external cues (Bednall & Kehoe, 2011, p. 206).

Figure 1. A General Model for Student Motivation and Self-Regulated Learning in the College Classroom (Pintrich & Zusho, 2007, p. 735)
**Phases.**

Phases are generally accepted as part of SRL (Bergamin, Bettoni, Zska, & Eggs, 2011). Zimmerman and Schunk (2001) proposed that SRL occurs in the following phases: forethought, performance, and self-reflection (Bembenutty & Karabenick, 2004, p. 43). Other traditions offer SRL models that contain similar phases (Winne & Hadwin, 1998; Pintrich, 2004; Zimmerman & Schunk, 2001). The study utilized Pintrich’s four phases.

Pintrich’s relevant phases, regulated areas (cognition, behavior, motivation/affect, and context), and specific activities by phase and area are shown on the next page. In this description, goals and subgoals are organized hierarchically into a strategic plan that learners use to perform tasks; the plan sets a standard that is used to monitor progress (Manlove, Lazonder, & de Jong, 2007, p. 143). This process is triggered by learners or their learning environment. Highly self-regulated learners monitor performance and comprehension to compare goals with acquired comprehension to determine whether adjustment is needed (Bernacki et al., 2011) as they execute their strategic plans.
Table 1. Phases and Areas of Self-Regulated Learning

<table>
<thead>
<tr>
<th>Phases and relevant scales</th>
<th>Area for regulation</th>
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<tbody>
<tr>
<td>Phase 1 Forethought, planning and activation</td>
<td>Cognition</td>
</tr>
<tr>
<td>Target goal setting</td>
<td>Time and effort planning</td>
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<tr>
<td>Prior content knowledge activation</td>
<td>Self-observation of behavior planning</td>
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<tr>
<td>Metacognitive knowledge activation</td>
<td>Interest value activation</td>
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<tr>
<td>Phase 2 Monitoring</td>
<td>Metacognitive awareness and monitoring of cognition</td>
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<tr>
<td>Selection and adaptation of cognitive strategies for learning, thinking</td>
<td>Increase/decrease effort</td>
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<tr>
<td></td>
<td>Persist, give up</td>
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<tr>
<td></td>
<td>Help-seeking behavior</td>
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<tr>
<td>Phase 4 Reaction and reflection</td>
<td>Cognitive judgments</td>
</tr>
<tr>
<td>Relevant MSLQ Scales</td>
<td>Effort regulation</td>
</tr>
<tr>
<td>Rehearsal</td>
<td>Help-seeking</td>
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<tr>
<td>Elaboration / organization</td>
<td>Time/study environment</td>
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<tr>
<td>Critical thinking</td>
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<td>Control beliefs</td>
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<td>Phases and relevant scales</td>
<td>Cognition</td>
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<td>Metacognition</td>
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Pintrich, 2004, p. 390

**SRL and Metacognition**

Metacognition is defined as thinking about thinking or cognitions about cognitions (Prins, Veenman, & Elshout, 2006). Moos and Azevedo (2008) assert that “Metacognition is the key to self-regulated learning” (p. 273). Thus, most models of SRL incorporate both self-regulation and metacognition (Dinsmore, Alexander, & Loughlin, 2008, p. 394). Metacognition emerged in the 1970s as a construction developed from Flavell’s writing on other metaconstructs (Dinsmore, Alexander, & Loughlin, 2008, p. 392). Similarly, metacognition is distinctively domain independent (Veenman, Wilhelm, & Beishuizen, 2004) or domain-general (Schraw, 1998), whereas cognitive skills are domain dependent.

The importance of metacognitive monitoring to SRL is illustrated by its inclusion in nearly every general theoretical approach to SRL (Zimmerman, 2001). As Winne (2001) states, “metacognitive monitoring is the pivot on which SRL turns because it creates opportunities to change tactics, to control how a task might be better dealt with” (p. 125). Greene, Bolick, and Robertson (2010) observe that “the metacognitive nature of SRL also allows for students to iterate back through the phases of learning as needed” (p. 232). Fox and Riconscente (2008) observe that many theorists see metacognition and self-regulation as “parallel and intertwining constructs that are clearly distinct yet mutually entailed both developmentally and in their functions in human thought and behavior. Neither subsumes nor subordinates the other” (p. 385).
Schraw and Dennison (1994) distinguished between two components of metacognition: knowledge and regulation. The first refers to declarative, procedural, and conditional knowledge. The second includes planning, information management, monitoring, debugging, and evaluation during learning. Regulation has also been conceptualized as metacognitive control or metacognitive monitoring (Pintrich et al., 2000), metacognitive skill (Bannert & Mengelkamp, 2008, p. 41), or sometimes simply calibration (Peschel, 2009). Bannert and Mengelkamp’s model of metacognitive activities during hypermedia learning resembles Pintrich’s SRL model (Table 1) with activity moving from learner and learning environment characteristics on the left through several monitoring-related processes. In this model, metacognitive monitoring leads to performance, recall, and comprehension (on the right), which shows a reciprocal and iterative relationship with learner characteristics.

Mecclellan and Soden (2012) explain the essential elements of metacognition as follows:

- Monitoring one’s thinking process
• Checking on progress toward appropriate goals
• Ensuring accuracy
• Balancing likely costs or benefits of investing time and mental effort

Specific examples of metacognition include: “being well informed about content when evaluating an argument, anticipating alternative implications of any one position when constructing an argument, or trialing methods in different conditions to see which is more fit-for-purpose” (Maclellan & Soden, 2012, p. 447).

In this proposed research, the focus lies on the second component of metacognition, i.e., the student’s metacognitive regulation during hypermedia learning (Bannert & Mengelkamp, 2008). Such regulation includes planning, information management, monitoring, debugging, and evaluation. Most researchers “agree that self-monitoring behaviors are among the most common metacognitive activities of highly effective learners” (Kauffman et al., 2008, p. 116-7).

The Problem: Learners Are Not Using SRL

Metacognitive monitoring leads to metacognitive regulation, which is central to SRL and its positive effect on grades. Metacognitive regulation is the mechanism that applies SRL cognitive and metacognitive strategies toward set goals. However, learners “don’t deploy key metacognitive monitoring activities” nor monitor “their progress toward goals during learning” (Azevedo & Cromley, 2004, p. 133). SRL and metacognition are not automatically acquired or activated even in the WBLE where they are so sorely needed.

Students may not have developed the requisite cognitive and motivational strategies or may lack the insight or motivation to use SRL and metacognition. In addition, if strategies are
unknown or the learners are novices, asking them to engage in unfamiliar arenas may cause high working loads (Bednall & Kehoe, 2011).

Intervention appears necessary, and research has proposed several possibilities. For example, Green, Bolick, and Robertson (2010) state “students benefit from scaffolds that foster SRL processing because they rarely effectively self-regulate on their own” (p. 232). Moreover, Azevedo, Moos, Greene, and Winters (2008) found that externally facilitated regulated learning is currently more effective in hypermedia environments than students’ natural, but inactivated, SRL.

**Prompts and Scaffolding**

SRL has been acknowledged as an important factor in learning, especially learning in the ill-structured, open-ended WBLE. However, without assistance, learners are not activating their use of SRL.

Numerous studies have shown that externally facilitated regulation that included training combined with scaffoldings, and in particular prompts, has been helpful to learners engaged in SRL. Scaffolding is providing assistance to students as they need it and then removing it, slowly fading, as student competence increases (Wood & O’Malley, 1996). Scaffolding has become a commonly used word for almost any educational activity (Van de Pol et al., 2010) but specifically refers to support that is contingent on learner characteristics that fades as responsibility is transferred from teacher to learner (Van de Pol et al., 2010, p. 275). Scaffolding is seen as one of the “facilitator strategies” that coincides with recent educational reforms toward “less structured, problem-based, project-based, and inquiry-oriented teaching approaches” (Lin et al., 2012, p. 437). Examples of scaffolds include feedback (on learner responses), providing of
hints (partial information), instructing (what to do or how something must be done and why), explaining (more detailed information), modeling (sharing examples of possible approaches and overarching conceptualizations), and asking questions (Van de Pol et al., 2010).

Molenaar, Boxtel, and Sleegers (2011) conclude that the function of metacognitive scaffolds is to improve learning outcomes, not train metacognitive knowledge or skillfulness. However, scaffolding has been found to support problem solving, but the results are less conclusive for domain knowledge acquired due to scaffolds (Bannert 2006, 2009; Azevedo et al., 2008). Most researchers understand scaffolding to have three purposes: scaffolding metacognitive activities, cognitive structuring, and scaffolding student understanding for learning specific concepts (Van de Pol et al., 2010). Generally, scaffolding is used both to improve and support SRL (Perry et al., 2008) and metacognitive awareness (Raes, Schellens, De Wever, & Vanderhoven, 2012).

Prompts are a subset of scaffolding that have been successful in all phases of SRL (Nückles et al., 2009, p. 261) and especially when combined with SRL training (Bannert & Reimann, 2012). Morris, Hadwin, Gress, and Miller (2010) define prompts as “measures to induce and stimulate cognitive, metacognitive, motivational, and/or cooperative activities during learning, which vary from hints, suggestions, reminders, sentence openers to questions” (p. 84). Bannert and Mengelkamp (2008) assert that “prompting students to reflect upon their own way of learning allow them to activate their repertoire of metacognitive knowledge and skills, which will further enhance hypermedia learning and transfer” (p. 46).

While prompts are a subset of scaffolding, many educators and researchers use the terms interchangeably (Molennar et al., 2011). Relevant research includes studies that characterize prompts as prompts or scaffolds. For the study, research studies are only included if they
reference the functionality of prompts. So despite the nomenclature used in research studies, the researcher refers to all scaffolding and prompts as simply prompts.

**Examples of prompts.**

In general, prompts can take many forms but are frequently formatted as questions that attempt to structure a learner’s approach to specific content being studied or instructions that support the use of problem-solving processes by the learner. For example, Ifenthaler (2011) presents a succinct categorization of prompts used in two of Bannert’s (2007, 2009) studies as follows:

- simple questions (e.g., “What was your first step when solving the problem?”)
- incomplete sentences (e.g., “To approach the solution to the problem step by step, I have to …”)
- explicit execution instructions (e.g., “First, draw the most important concepts and link them.”)
- pictures and graphics for a specific learning situation (Bannert, 2009; Ifenthaler, 2011, p. 38)

Prompts may also be more complicated, as with statements or instructions. An example of such a prompt is offered by Kauffman et al. (2011):

There was a lot of information covered on that web page. Now would be a good time to ask yourself if you have collected all the important information. If you believe you can answer the question below, even with your notes, then you are
probably ready to move on to the next section. Otherwise you may want to return to the Central Tendency and Dispersion page (p. 318).

**Prompt categories.**

Devolder et al. (2012) made the following distinctions:

- **Conceptual scaffolds** point learners to what to consider when a problem or task is already defined.
- **Procedural scaffolds** guide learners in using the features available in open-ended learning environments.
- **Metacognitive scaffolds** offer learners different ways to think about a problem, or different strategies that need to be considered.
- **Strategic scaffolds** steer learners toward how to approach tasks or problems (Hannafin et al., 1999).

Other prompt categorizations include contrasting generic vs. directed (Ifenthaler, 2012); problematizing vs. structuring (Molennar, 2011); cognitive, metacognitive, and reflective (Nückles et al., 2009); and knowledge integration vs. problem-solving prompts (Chen & Bradshaw, 2007).

Several research studies have compared different types of prompts and their relative effectiveness. Although prompt characteristics are important, research shows that frequently combining prompts produces the most successful results. The positive effect of multiple prompt types may be explained by Clark’s (2011) observation that SRL and metacognitive subprocesses are interlinked so that monitoring, reflection, and evaluating often occur simultaneously. Nückles
et al. (2009) found that “it was particularly effective to prompt all three essential sub-processes involved in self-regulated learning” (p. 268). The highest learning success occurred when students were prompted for organization and elaboration of the learning content, monitoring their own comprehension, and remedial strategy planning (Nückles et al., 2009). Similarly, Kauffman et al. (2008) found that learners receiving reflective prompts alone had less success than if they also received problem-solving prompts. They hypothesize that “providing students with an opportunity to reflect on their own work is an effective technique for improving problem solving and achievement, but only when accompanied by a clear understanding of the problem-solving process” (p. 133). Thus, using multiple prompt types is the most helpful way to employ prompts.

However, a few researchers found the exact opposite: “The scaffoldings of both knowledge integration prompts and problem solving prompts did not have the increased positive results over the single scaffolding as we would expect” (Chen & Bradshaw, 2007, p. 369).

Manlove et al. (2007) found that prompts (referred to as cues by Manlove) had a moderate but positive contribution to the tools presented to learners in their study and to note taking (p. 152).

Due to the lack of a theoretical framework, the researcher categorized the main dimensions of prompts as the following:

- whether prompts are designed for specific stages of SRL
- whether prompts are focused on the cognitive learning related to subject matter or metacognition (object-level)
- whether prompts are highly structured or more open-ended
- whether prompts include a requirement for the learner to provide a response (either as learner feedback about the prompt or as remedial action)
These distinctions are discussed and clarified below.

**Prompts and phases.**

An important distinction for prompting is timing. Prompts should be presented just as external support is needed by the learners. Prompts are usually presented before, during, and after learning episodes in order to focus a learner on phase-specific aspects of learning. For example, prompts presented before problem solving focus learners on determining an approach (Ifenthaler, 2011) and setting goals, while those presented during problem solving focus a learner on monitoring their problem-solving activities (Ifenthaler, 2011, p. 40).

The study follows Pintrich’s theoretical foundations, including the four phases theorized by Pintrich (2004). In a WBLE there can be a clear distinction between the start and end of a learning task or unit (since those are often activated by the teacher). However, the operational clarity of student monitoring and control is less clear. Student engagement with instructional materials is unregulated and random. Therefore, Pintrich’s monitoring and control phases are combined into the middle phase according to the three-phase tradition of Zimmerman (1990). These are shown below with comments about prompts specific to each phase:

- **Forethought:** At the beginning of study, both goal-setting prompts (product and process goals) and strategic prompts reflecting prior learning experiences are appropriate.
- **Monitoring and control:** Devolder et al. (2012) conclude that prompts are the most effective scaffolds, especially during control phases processes. Thus, most problem-solving and metacognitive prompts are presented during these phases.
- **Reaction and reflection:** Although reflection is interrelated to metacognitive monitoring and evaluating, perhaps occurring at other times during the learning units, prompts
initiating summative reflection and remediation are appropriate in the reaction and reflection stage.

**Iterative nature of reflection.**

Unique to the question of reflective prompts is the realization that prompts in general activate reflection and thus support metacognitive activities during all stages (Bannert & Mangelkamp, 2008). Learners’ reflective thinking stimulates their use of SRL prompts and the development of metacognitive insights (Kuiper & Pesut, 2004; Clark, 2012). Bose and Rengel (2009) assert that “self-reflection is the heart of self-regulation.” In addition, Biggs and Collis (1982) observe that “reflection is also one of the higher learning levels in several learning taxonomies” (Wu & Looi, 2012, p. 339). Therefore, reflection may be difficult to quantify and isolate and may be partially activated in all phases.

**Object-level.**

Prompts may be characterized by their object-level or by their goal (clarifying or complicating). Several researchers (Molenaar et al., 2011) characterize the object-level as cognition and cognitive acquisition of knowledge and skills as unique from the metalevel activities of metacognitive monitoring and control. Nückles et al. (2009) narrowed this definition further by researching organizing and elaboration prompts as cognitive prompts and comprehension monitoring as metacognitive prompts. Hoffman and Spatariu (2008) define metacognitive prompting (MP) as an externally generated stimulus that activates reflective cognition and evokes strategy use. This is distinctive from feedback in that the objective is evoking strategy use and stimulating and facilitating the problem-solving process, which in turn
enhances the learning outcome. However, MP does not directly enhance the learning product (p. 878).

Some researchers have been more explicit when explaining how the structure of the prompt relates to its function. Molenaar et al. (2011) distinguish structuring prompts from problematizing prompts. Structuring prompts simplify learning by reducing complexity, clarifying underlying components, and supporting planning and performance with specific examples (Molenaar et al., 2011, p. 787-8). Problematizing prompts increase complexity by “emphasizing certain aspects of the assignment and asking learners to clarify the underlying components and perform actions to plan and construct their own strategies” (Molenaar et al., 2011, p. 788). Hence, structuring prompts focus upon cognitive processes and content explanation while problematizing prompts stimulate metacognition.

Similarly, clarification is related to cognitive processes, while complication activates metacognition as long as it does not lead to overload. Prompts can be explicit or tacit (Hadwin & Winne, 2001), direct or indirect (Narciss et al., 2011), and directive or generic (Ifenthaler, 2011). In each of those cases, the first half of the pairs is more clarifying and confining and thus more likely to support facts and content transfer than metacognitive activities.

Structure.

Molenaar et al. (2011) refer to prompts as structuring to support cognitive processes through simplifying and clarifying. Ifenthaler (2011, 2012) addresses the way in which prompts are presented. Generic prompts ask learners “to stop and reflect about their current problem-solving activities,” while directed prompts include “an expert model of reflective thinking in the problem-solving process” (Ifenthaler, 2012, p. 38). Learners receiving generic prompts perform
better on domain-specific knowledge and gain understanding of structural and semantic issues related to the problem scenario, perhaps partly because their autonomy is maintained and they do not have to process new information in the directed prompts (Ifenthaler, 2012).

Though distinguishing between various functions and structures of prompts is helpful, most of the distinction in the classifications lies between cognitive and metacognitive prompting. Thus generic, less-structured, and more open-ended prompts facilitate metacognitive monitoring and may induce strategy use.

**Interactivity.**

In addition, prompts that require learner reaction, either cognitively or behaviorally, are more helpful than those that allow learner passivity. Several researchers reinforce the benefit of moving learners from passivity to active processing, particularly through prompts that regulate learner responses (Berthold & Renkle, 2010; Nückles, Hübner, & Renkl, 2009).

Nückles et al. (2009) used required writing learning protocols in conjunction with cognitive and metacognitive prompts to cultivate learners’ comprehension. Nokes, Hausmann, VanLehn, and Gershman (2011) distinguish between gap-filling justification and gap-filling step-focused prompts. Such self-explanation prompts have been used in multiple research aimed at activating deep processing of information to require learners to justify correct steps, reflect, explain by referencing principles in a glossary, and develop self-explanations (Nokes et al., 2011). The more effective prompts were more open-ended in asking for “justification” versus step-by-step explanations. The researchers posited that steps were an assumed method to explain the process. Thus, participants frequently implied steps in their responses, but were not confined by that requirement under the more open-ended justification prompts.
Students in Johnson’s (2011) study reviewed material only 5 times, even though they were prompted 35 times (p. 57-8). Similarly, Bannert and Reimann (2012) did an implementation check that indicated only a portion of the participants had complied with the instructions. Therefore, Bannert and Reimann (2012) recommend that “specific care has to be taken to ensure these instructional SRL-prompts are performed in the intended manner. Only then can effects on learning outcomes be established” (p. 206). Instructors and researchers may need to integrate prompts in courses in order to encourage participation.

**Disadvantages of prompts.**

Prompts have been found to be problematic in some scenarios. First, as discussed above, prompting can be overwhelming and restrictive because prompts structure the problem too much and interfere with the student’s own problem solving. Nückles et al. (2009) found that students do better with generic prompts (“Amend and improve your concept map if necessary”) in contrast to prompts that are directive (“Please complete the list item by item by completing each sentence on its own in your mind”). Bannert, Hildebrand, and Mengelkamp (2009) found cognitive overload occurred with prompting that was too directed. Of course, cognitive overload can also occur with too many prompts and prompts that are not understood by learners (Chen & Bradshaw, 2007) if such instructional support becomes excessive or when prompts require written responses (Papadopoulos et. al., 2011).

Secondly, tension exists between externally facilitated support and self-regulation. External supports eventually need to be withdrawn so they do not interfere with self-regulation. When individual prompts are used, determining how to fade is more difficult.
Despite these potential limitations, in the study, prompts are expected to improve both academic achievement and SRL and metacognitive activities by activating and supporting the metacognitive monitoring and reflective activities in a nonintrusive way.

Examples of the prompts to be used in this study are shown in Appendix A.

**Overload**

Cognitive load is automatically generated in free-form, open-ended, ill-structured WBLE. Wang, Peng, Cheng, and Zhou state that “while such a resource-abundant and self-regulated learning environment allows learners a great deal of freedom and flexibility in search for, selecting, and assembling information, learners may suffer from cognitive overload . . . when faced with massive information online” (2011, p. 28). In fact, cognitive overload and student disorientation are some of the main reasons why some students do not learn in WBLE (Greene, Bolick, & Robertson, 2010, p. 231).

Prompting of self-regulated learning behaviors and metacognitive monitoring has been found helpful in increasing learner ability to cope with information overload and lack of linearity. However, these three activities of regulating, monitoring, and receiving prompts can also increase information and new strategies that the learner needs to attend to. Any new activity, especially the meta-level observation activated by metacognitive prompts, can also be mentally taxing (Sweller, 1994). Even resultant helpful SRL activity can generate additional cognitive load. However, instructional design, scaffolds, and prompts can decrease cognitive load (Lajoie, 2005; Azevedo & Hadwin, 2005; Hannafin, Land, & Oliver, 1999; Danilenko, 2010).
Finally, although ultimately helpful, prompts can be problematic if they become overwhelming in number, new content, or new strategies. They can also interfere with learning if they are ill-timed or as they become unnecessary as learners increase their knowledge.

Consequently, while these metastrategies of SRL, metacognition, and prompting are all helpful, it is advantageous to consider ways to reduce the “risks” of SRL activation and metacognitive prompting. One potential answer may lie in another 21st-century technology adoption: video. Video delivery of prompts may provide the needed advantages while reducing possible additional overload.

**Video Podcasts**

A technology that has experienced a 21st-century revival is video—specifically video in the form of short, frequently teacher-produced, video podcasts. A profound communication shift has occurred that redefines 21st-century literacy as including “a set of abilities and skills where aural, visual, and digital literacy overlap” (New Media Consortium, 2005, p. 2). This multimodal expression occurs in part through the proliferation of user-created videos. Lectures for online and face-to-face classes are recorded and placed online, making them accessible any hour of the day. Small and comprehensive videos are being produced because they are an effective way to increase a teacher’s “presence” in online courses and as a way to provide just-in-time education. Researchers have started using screen capture videos to record think-aloud protocols (Azevedo & Moos, 2008) and as a retrospective feedback tool (Tung & Chin, 2011). Videos are used as part of an SRL/TELE/media Reference Course Model (Bergamin et al., 2011) in experiments comparing SRL usage with video and audio multimedia (Colombo & Antonietti, 2012) and as a
preferred method to present research instructions and subject matter in a consistent way (O’Hanlon & Diaz, 2010; Nückles et al., 2009; Berthold, Nückles, & Renkl, 2007).

Videos and video podcasts are useful in education primarily because they provide repetitive or supplemental information (Walls, Kucsera, Walker, & Acee, 2010). Educators are expounding the virtues of digital video technology for lectures and lecture introductions and conclusions (Holtzblatt & Tschakert, 2011) due to students’ appreciation for the complete availability of video podcasts and their positive changes in study habits and improved learning (Kay, 2012, p. 825).

Some of the educational advantages of video may reduce potential cognitive overload from prompts and SRL in WBLE. As observed by Kalyuga (2012), using dual-modality presentations (auditory rather than on-screen written explanations of a diagram) may reduce split-attention (p. 193) and redundancy (p. 194). In addition, dividing presentations into shorter, more manageable sections may reduce extraneous cognitive load (p. 196). The benefit of these video podcasts is two-fold: they provide both engagement and thus motivation and synchronized multimodal information that can be controlled and easily repeated by the learner.

The benefits of video podcasts over other forms of instruction may be related to the use of two channels: audio and visual. Walls et al. (2010) assert that “podcasting should improve student learning over other learning resources, such as textbooks, notes taken from class lectures, or even PowerPoint slides” (p. 372) because they have the ability to present audio and visual content simultaneously.

Moreover, Mayer’s (Mayer & Moreno, 2003) Cognitive Theory of Multimedia Learning builds on cognitive psychology ideas of two independent subcomponents, one visual and one verbal, in working memory. Mayer’s research indicates that learning is facilitated by
simultaneous and synchronized multimodal information more than by images and written text presented separately or not in close proximity. While Mayer’s theory highlights the issue of cognitive load, it also suggests that cognitive load can be reduced through specific presentations that combine verbal and visual components.

While videos have become more common in education, they have not yet been utilized for prompting. Researchers have highlighted two notes of caution when using video in educational research. Firstly, Bennett and Maniar (2007) contend that video lectures may support transfer of knowledge as facts but reduce the importance of knowledge construction because video lectures are complete, whereas the traditional online presentation has been incomplete PowerPoint slides that provide overviews and key points. Although complete video lectures may suffer from this limitation, shorter videos may inherently be designed to be less comprehensive and thus less complete. Shorter videos then may be more easily created in an open-ended manner and, in any case, more easily re-recorded. Similarly, Deimann and Keller (2006) observe that there are some inherent aspects of self-regulation in self-directed multimedia learning that may contribute to decreased motivation (p. 138).

Additionally, this new form of communication, with multimodal visual and auditory elements, incorporates “an immediacy which itself is a dimension of the new language” (New Media Consortium’s Global Imperative Report, 2005, p. 1). Videos, particularly in an online course, may increase the perception of teacher immediacy over written communication. This may have a confounding effect upon student-teacher interactions in prompting and externally related learning.
Summary

Although SRL and metacognitive monitoring is particularly appropriate in 21st-century WBLE learning environments, learners are not activating these skills consistently in an effective manner. This is true even when the learners receive prompts, a known and effective type of scaffolding. Cognitive overload—a potential inherent in SRL, metacognition, and WBLE—as well as prompting, may be part of the problem. Video has been used effectively for 21st-century learning through its ability to utilize both audio and visual channels simultaneously. Combining the known benefits of SRL and metacognitive monitoring with video prompting may reveal the most effective environment for supporting learners’ success.
Chapter 3: Methodology and Research Design

The study researched the effect of video metacognitive prompts on activating self-regulated learning (SRL) and metacognitive monitoring by learners in WBLE.

The proposed research was completed in a between-group, pretest-posttest quantitative Pilot Study and a repeated-measures, between-groups, pretest-posttest quantitative Final Study. Learners engaged in online learning through the WBLE at the University of Montana. They were given pre- and posttest measures for SRL and metacognition and prompted for the use of those two activities. The researcher gathered demographic data, including gender, age, and year in college, along with academic information such as prior subject knowledge, self-report cumulative GPA, and unit grades from the course.

Research Questions and Hypotheses

In the study, the researcher attempted to find answers to the following research questions:

1. What impact do video and text prompts have on SRL, metacognition, and their components?
2. What impact do video and text prompts have on academic success?
3. Do learners’ personal characteristics moderate the effects of the prompts?

The following hypotheses were offered:

- **H1**: Video prompts are not significantly different from text-based prompts in activating self-regulated learning.
- **H2**: Video prompts are not significantly different from text-based prompts in activating metacognitive monitoring.
• H3: Video prompts are not significantly different from text-based prompts in affecting academic success.

• H4: Learner MSLQ and MAI scores do not covary significantly with unit grades, computer comfort, age, gender, and prior knowledge of content.

Population and Sample

The population for this study was restricted to learners enrolled in an undergraduate Computer Science course fall 2013 (Pilot Study) and the same course plus a graduate Business course during spring 2014 (Final Study). The participants were recruited through their registration in these particular courses. The courses were offered online only in the MoodleRooms Learning Management System (LMS) built from open source Moodle software.

Ethics and Informed Consent

The studies prompted the learner participants’ overt awareness of their metacognitive monitoring and SRL practices. These practices have future and wide-reaching benefits for the learners. The only potential disadvantage to the participants was the potential for cognitive overload. However, the potential for this effect was mitigated, since SRL is a valuable skill in the online environment. In addition, the teachers were notified if any students indicated cognitive load issues in their responses. Likewise, the teacher was able to compare content performance in the two trials as compared to the rest of the course and could make any grade adjustments as necessary. A potential for measurement fatigue also existed. The use of a smaller between-trial measurement and the length of time allowed for the trials helped mitigate the effect of fatigue.

Because all data was gathered online through the standard LMS/MoodleRooms interface, students did not experience a need to adapt to additional environments. Although there was a
small possibility that technology was overwhelming to participants, the necessity for overcoming that barrier was related to the course, not the study.

Appropriate IRB permission was sought through the standard University of Montana IRB process with the documents included in Appendix A.

**Variables and Instrumentation**

These studies addressed the following independent, moderating, and dependent variables using the measures and instruments described below. All of the questionnaires were loaded into an IRB-approved software, Selectsurvey.

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Moderaing variables</th>
<th>Dependent variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRL prompts embedded in course unit content</td>
<td>Learner characteristics</td>
<td>Changes in learner SRL scores &amp; MAI regulation scores (MSLQ &amp; MAI)</td>
</tr>
<tr>
<td></td>
<td>Learner technological skill</td>
<td>Content comprehension measured by course grades</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Self-regulated learning activity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Metacognition activity</td>
</tr>
</tbody>
</table>

**Independent variable–video and written prompts.**

The independent variable was video versus written prompts embedded in the course unit content. Using examples from previous research, the researcher and the instructor(s) designed introductions to the generic metacognitive prompts delivered during the units, and a reflection prompt delivered at the end of each unit. The prompts were recorded as video podcasts. The content of the videos was transcribed verbatim for use as text prompts. All of these prompts,
whether video or written, were designed to require a response. Specific prompts and screenshots of how they appeared in the Moodle course are included in Appendix B.

**Moderating variables.**

Some variables may moderate the effect of the independent variable upon the dependent variables.

**Learner characteristics.**

Learner characteristics are important for SRL (Bannert & Reimann, 2012). SRL has been found to be linked to several learner characteristics such as SRL and prior domain knowledge (Azevedo & Moos, 2008) and gender (Askell-Williams, Skrzypiec, & Lawson, 2012, p. 412), although other research indicates that no significant gender differences exist (Yukselturk & Bulut, 2009).

The study gathered the following demographic data: year in college, age, gender, self-report GPA, whether the course was in their major, and level of comfort with the subject matter.

Due to previous research that links learner characteristics to SRL (Bannert & Reimann, 2012), a pre-experimental question of prior knowledge was given (Kauffman et al., 2011). Dependent upon specific course content, it consisted of the question: “How much do you know about [course content]?” The question was answered with a 5-point Likert-like scale from “I am a complete novice” to “I consider myself an expert.”

These data were gathered through an online demographic questionnaire during pretesting (shown in Appendix C).
Computer comfort.

Computer comfort was determined by a Likert-scale item that was administered along with the demographic data: “Please indicate your level of comfort with the technology used in this course (Moodle, web browsing, word processing).”

Dependent variables.

The researcher studied dependent variables with quantitative instruments. SRL is understood to be driven by metacognition. These related constructs are traditionally measured with the Motivated Strategies for Learning Questionnaire (MSLQ) and the Metacognitive Awareness Inventory (MAI).

Motivated Strategies for Learning Questionnaire (MSLQ).

The MSLQ is a 7-point Likert questionnaire divided into Motivation Scales & Learning Strategy Scales and subscales within those two major scales. The Motivation scales contain the Value, Expectancy, and Affective components. The study used the Value Component and the Expectancy components. The Affective component (Test Anxiety) was not used in either study. The two Learning Strategy scales used were Cognitive and Metacognitive Strategies, and Resource Management Strategies.

Scale and subscale results were calculated by summing the items, adjusting for any reversed items, and then averaging the scores. The instrument is modular so that subscales and scales can be used independently or together depending on the researcher’s goals (Pintrich, Smith, Garcia, & Mckeachie, 1993, p. 804).
Previously, this 7-point Likert measure has been used to test adult IT competency and self-directed learning (Shinkarara & Denson, 2007), to test gender differences in SRL in online courses (Yukselturk & Bulut, 2009), and to study mathematics anxiety as related to SRL strategies (Kesici & Erdogan, 2009). The MSLQ has been cited in 1,311 articles (Google Scholar). It has been translated from English into several additional languages, and those versions have also been validated (Lee, Zhang, & Yin, 2010; Akin, Cetin, & Abaci, 2007).

The MSLQ scales and subscales show significant correlations with final grades. The original study had a sample size of 380, so obtained correlations of .13 and above are significant at alpha levels of .05. Correlations from the study added to the validity by being in the expected direction (Pintrich et al., 1991, p. 811). All of the cognitive strategy and resource management scales were related in positive direction (rs ranging from .10 to .70). The motivational and learning strategies scales were correlated in the expected directions (p. 812). The MSLQ has relatively good reliability and internal consistency, the subscales and learning strategies embody a “coherent conceptual and empirically valid framework for assessing student motivation and use of learning strategies in the college classroom …. and the subscales seem to show promising predictive validity” (p. 812).

Pintrich et al. (1993) completed additional research on the MSLQ in order to present its internal consistency, reliability, and predictive validity. These researchers posit: “The MSLQ seems to represent a useful, reliable, and valid means for assessing college students’ motivation and use of learning strategies” (p. 812). In the study, the coefficient alphas are robust for scales that were used (see Appendix C).

Several researchers have further analyzed the MSLQ instrument. Taylor (2012) summarizes: “overall, results of reliability generalization studies for both the motivation and
learning strategies sections of the MSLQ demonstrate that the MSLQ can be used across a variety of different samples with reasonable confidence for obtaining generally reliable scores” (p. 135).

**Metacognitive Awareness Inventory (MAI).**

Schraw and Dennison (1994) designed the Metacognitive Awareness Inventory (MAI) with the following similar constructs: knowledge of cognition (declarative knowledge, procedural knowledge, conditional knowledge) and regulation of knowledge (planning, monitoring, evaluation, debugging strategies, and information management strategies). The subscales measured for this study included all of the regulation measures: planning, information management, monitoring, debugging, and evaluation.

While the MAI has been cited in 586 articles (Google Scholar) and used in numerous studies, even the original study was promising with reliable factors (alpha = .90) and sound intercorrelation (r = .54).

Numerous scales have been used to collect MAI data, including a numeric scale of 1-100, T/F, and both 5- and 7-point Likerts. One of the MAI authors, Gregory Schraw, recommended that the 5-point, Likert-type scale (ranging from always false [1] to always true [5]) be used.

**Post-trial Confidence and Satisfaction measurement**

Self-report satisfaction and distraction questions, using a 5-point Likert scale and metacognitive confidence questions, were included in this instrument (see Appendix F).

The metacognitive confidence questions ask learners to make confidence judgments about their performance. Such questions inherently invoke and measure self-monitoring
(Kauffman et al., 2008). Kauffman et al. (2008) observe that “[r]esults not only suggest confidence judgments are a good predictor of self-monitoring behavior, but also that self-monitoring is related positively to metacognitive knowledge and may be a more or less domain-general skill” (p. 117).

Learners were asked to evaluate their satisfaction with their performance, satisfaction with the prompts, level of focus versus distraction, grade expectations, and confidence in having met the necessary qualifications to receive that grade (see Appendix F). Metacognitive monitoring was based on learner self-evaluation.

**Combination and presentation of instruments.**

The demographics, MSLQ, and MAI instruments were combined and presented to the participants pre-experiment. Confidence & Satisfaction instruments were presented post-trial, and repeat MAI and MSLQ instruments were presented post-experiment. The individual questionnaires and questions for the pretest were combined in a single web-based instrument. Within the single instrument, specific questionnaires were listed in their original form. The items were included in this order for both groups:

<table>
<thead>
<tr>
<th>Pre-experiment</th>
<th>After first trial</th>
<th>Post-experiment (after second trial)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographics</td>
<td>Post-trial Confidence &amp; Satisfaction Measure</td>
<td>Post-trial Confidence &amp; Satisfaction Measure</td>
</tr>
<tr>
<td>MSLQ</td>
<td>MAI</td>
<td>MAI</td>
</tr>
<tr>
<td>MAI</td>
<td></td>
<td>MSLQ</td>
</tr>
</tbody>
</table>

All prompts, instruments, and activities were administered and completed online.
Procedures

The researcher created prompts in a Moodleroom shell that met the prompt requirements discussed in the text. The text of the prompts and the particular Moodle function utilized are shown in Appendix B. The researcher created online surveys that replicate the instruments used in this study. They are shown in Appendices C, D, E, and F as the individual instruments. As mentioned above, they were combined as needed for specific administration at the beginning of the research, after the first trial, and at the conclusion of the research.

The researcher conducted the following:

1. Submitted IRB checklist, Online Survey Statement of Confidentiality, and Consent Form to the IRB (see Appendix A).
2. Met with the professor to
   a. explain the prompts and
   b. how they were delivered within the course,
   c. determine any adjustments to prompts, timing, or procedures based on course content or structure,
   d. determine the length of two trials that could span at least one content unit, include only complete content units, and conclude with a summative course assignment
   e. finalize
      i. the introductory text to inform the students about the study,
      ii. determine when and how the study should be included, and
      iii. inform the IRB of the changes. The proposed text was:

This semester a doctoral graduate student was conducting research in both sections of this course on self-regulated learning strategies. During two
course learning units, you are/were prompted to consider aspects of your own learning. These prompts are built into this course’s Moodle shell and require a response from you. Please respond to these prompts within 48 hours of seeing them (you will also receive an e-mail in case you have not logged in during the appropriate time. As with much research, you are/were asked to fill out questionnaires at the beginning and end of class and a short questionnaire about and immediately following the two learning units. The researcher and I appreciate your cooperation. We both believe that your learning and study skills can be augmented by your participation. You can ask me questions about how this affects the course content. You can ask the researcher, janet.sedgley@umontana.edu, questions about her research if you wish. She has taught online and face-to-face classes at UM and Missoula College and has worked in Information Technology at UM for 26 years. She has tried to make this experience as “user-friendly” for you as possible.

3. Discussed with the professor the introductory sentence or two that accompanied each of the prompts and created the prompts in the courses’ Moodle shell.
   a. Assisted professor, if needed, in creating the prompt videos.
   b. Created text prompts by transcribing the videos using the exact same wording minus any verbal ums or filler words.
   c. Set prompts to be delivered:
      i. Daily during a summer course with a final reflective prompt or
ii. at regular intervals during a regular semester course with a final reflective prompt

4. Placed a link to the pretrial combined questionnaire in the course (as determined by the professor). This questionnaire included the demographic questionnaire, the MSLQ, and the MAI (as shown in Appendix C-F).

5. Monitored the process and collected the data from this questionnaire.

6. Started the first trial at the beginning of the selected course unit by delivering prompts for all participants (sequenced as determined by the length of units/trials) throughout the content unit.
   a. Monitored class activities to make sure that the prompts were being delivered as determined.
   b. Sent reminders to students who were not completing the prompts.
   c. At the start of the subsequent unit (assumedly the day after the previous unit’s summative assessment was due), placed a link to the Post-Trial Confidence & Satisfaction Measure.
   d. Downloaded the data from that online questionnaire immediately after it is closed.

7. Allowed at least one content unit to occur without prompting.

8. Started the second trial at the beginning of a course unit by delivering prompts to all participants during the unit.
   a. Monitored class activities to make sure the prompts were being delivered as determined.
   b. Sent reminders to students who were not completing the prompts.
c. At the start of the subsequent unit (assumedly the day after the previous unit’s summative assessment was due), placed a link in Moodle to the Post-Trial Confidence & Satisfaction Measure.

d. Downloaded the data from that online questionnaire immediately after it is closed.

9. Placed a link to the post-experiment combined questionnaire in the course (as determined by the professor). This questionnaire included only the MSLQ and the MAI.

   a. Requested that the professor include a participant reminder after several days indicating that the questionnaire must be completed before they could turn in the summative assessment for the current, post-experiment unit.

   b. Collected the data from this combined instrument.

10. Collected the prompt responses from the Moodle prompts and stored them in a database.

11. Thanked the class members and professor.

12. Analyzed the data.

**Study Design**

Both studies used the same instruments. Additionally, the MAI and MSLQ were reduced to 2 or 3 questions per item for the Final Study. The instruments and timing are summarized below, followed by both designs.

1. Pretest: MSLQ, MAI and demographic instrument.

2. Trials: Written or video prompts.

3. Post-trial: The smaller Satisfaction & Confidence instrument (Appendix F: Confidence on page 131) was used after learning units.
4. MSLQ and MAI.

**Pilot study.**

The design for the Pilot Study is shown below. Additional details are available in Appendix G.

<table>
<thead>
<tr>
<th>Participants</th>
<th>Pre-experimental measures</th>
<th>Treatment: Prompts (4)</th>
<th>Post-measure</th>
<th>Treatment: Prompts (2)</th>
<th>Post-measure</th>
<th>Treatment: Prompts</th>
<th>Post-measure</th>
<th>Post-experimental measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section 1</td>
<td>0</td>
<td>X</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Section 2</td>
<td>0</td>
<td>0</td>
<td>X</td>
<td>0</td>
<td>X</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

MSLQ – 81 7-point Likert
MAI – 52 5-point Likert
Demographics: year in college, age, gender, self-report GPA, major
Level of comfort with subject matter - 100 point Likert

<table>
<thead>
<tr>
<th>Participants</th>
<th>Pre-experimental measures</th>
<th>Before treatment</th>
<th>Treatment: Text Prompts (2)</th>
<th>Post-measure</th>
<th>Treatment: Video Prompts (2)</th>
<th>Post-measure</th>
<th>After treatment</th>
<th>Post-experimental measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section 1</td>
<td>0</td>
<td>X</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Section 2</td>
<td>0</td>
<td>0</td>
<td>X</td>
<td>0</td>
<td>X</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

MSLQ – 47 7-point Likert
MAI – 35 5-point Likert
Demographics: year in college, age, gender, self-report GPA, major
Level of comfort with subject matter – 3 points

**Final study.**

The design for the Pilot Study is shown below.
<table>
<thead>
<tr>
<th>Participants</th>
<th>Pre-experimental measures</th>
<th>Before treatment</th>
<th>Treatment: Text Prompts (2)</th>
<th>Post-measure</th>
<th>Treatment: Video Prompts (2)</th>
<th>Post-measure</th>
<th>After treatment</th>
<th>Post-experimental measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSCI172</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMIS541</td>
<td>Level of computer comfort – 5 points</td>
<td></td>
<td>Assignment</td>
<td></td>
<td>Assignment</td>
<td></td>
<td>Exam 2</td>
<td></td>
</tr>
</tbody>
</table>

Prompts

Prompts consisted of several parts. First, the content of the prompt included the selected metacognitive prompts as indicated in Appendix G. In addition, the teacher created a one- to several-sentence introduction to the prompts that varied slightly from prompt to prompt. Both of these components were part of the final prompt video or text. Each prompt/video was recorded first, and the text was transcribed verbatim from that recording.

The prompt responses were collected in Moodle feedback elements. Since feedback elements are not able to display videos, the prompts were presented in two steps: a page display that showed a video and contained a link to the appropriate feedback. For video prompts, the second element (the feedback element) provided a response window with the caption: “Please answer the question asked in the video.”

Text prompts had a page-based display first, with a link that simply said, “Please answer this question.” The link opened the feedback element for text-based prompts and displayed the verbatim text of the associated video as the caption for the response window.

Screenshots of prompt examples in Moodle are shown in Appendix G.
Analysis

Descriptive statistics (means, distributions, and standard deviation), tests of statistical significance, and tests of group differences were completed on the data. The data in this study were largely Likert-scale data with a neutral middle category or interval data. Additionally, primarily parametric tests were used (as suggested by a member of the Statistics and Applied Mathematics CORE (SAMC) at the Department of Mathematical Sciences, University of Montana, in a phone conversation January 23, 2013). Bivariate statistical tests (t-tests) were also used.

Occasionally participants completed survey responses more than once and with varying responses on items such as level of comfort with computers. When that occurred the two responses were averaged. This approach occasionally resulted in unusual decimal answers for Likert items.
Chapter 4: Findings and Analysis

The purpose of this research was to add to the current information about the effectiveness of prompting for metacognitive analysis and self-regulated learning (SRL) in an online learning environment. In particular, the researcher investigated the difference in effectiveness of text-based versus video prompts, and the effect of prompts on participant satisfaction with academic performance and distraction. The researcher also used the subscales of the Metacognitive Strategies for Learning Questionnaire (MSLQ) (Pintrich et al., 1991) and the Metacognitive Awareness Inventory (MAI) (Schraw & Dennison, 1994).

Research Design

Participants completed a pilot test during the fall of 2013 with the final study occurring in spring 2014.

Pilot Test

During fall 2013, the researcher conducted a pilot study on three sections of an online undergraduate course at the University of Montana. The total population of the class was 75, and 73 students completed demographic and consent forms. Initially, the students were asked for their participation in exchange for extra credit. However, after a lower than expected response, the instructor announced a raffle to increase participation. Despite the raffle, a statistically significant number of participants was not achieved; only 17 participants completed most of the Pilot Study. The three course sections were divided into two groups. Section 1 received video prompting, section 2 received text prompts, and section 3 was divided between the two treatments.
Pilot design.

Before and after the study, participants were required to fill out an adapted version of the MAI and the MSLQ. These instruments were used in their original forms using all questions.

The study consisted of trials during three units of the course. Units were released on Monday and the concluding unit activity was due 10 days later, on Wednesday of the following unit. Before and after the study, participants were required to fill out the MAI and the MSLQ. After each trial, participants were asked to complete the Post-Trial Confidence and Satisfaction Measure.

Table 2. Pilot Design

<table>
<thead>
<tr>
<th>Week</th>
<th>Testing</th>
<th>Activity</th>
</tr>
</thead>
</table>
| 1-4  | Consent Form  
Demographic Form  
Full MSLQ  
Full MAI | 4 prompts released during a 9-day period (assignments due 10 days after the start of each week) |
| 6    |  
Post-trial Confidence & Satisfaction Measure |  |
| 9    | Post-trial Confidence & Satisfaction Measure (repeated) | 2 prompts released during the 9-day “assignment” period |
| 13   | Post-trial Confidence & Satisfaction Measure (repeated) | 1 prompt released during the 9-day “assignment” period |
| 14-16| MSLQ  
MAI |  |
|      | End of semester |  |
Pilot: Demographics.

Demographics are given below for the Pilot Study and include both the participants who completed most of the measures and questions and those who did not. While 17 participants completed all but one or two questions of the MAI and MSLQ questionnaires, some participants did not answer demographic questions. Thus, the total number of responses reported in this section may not be consistent.

Prompts.

Participants from three course sections contributed to the Pilot Study. The first two sections were assigned to text or video prompts respectively, while the third section split between these two conditions to make equal numbers assigned to each condition. That initial assignment was affected by participants who withdrew from the class. The final participation numbers are as follows: 24 percent of the participants who completed the study received only video prompts, while 76 percent received only text prompts. Prompts received by those who did not complete the study were more evenly distributed, with 58 percent and 42 percent receiving videos prompts and text prompts respectively.

Table 3. Pilot Study - Video vs. Text Prompts

<table>
<thead>
<tr>
<th>Category</th>
<th>Completed Frequency</th>
<th>Completed Percent</th>
<th>Did not complete Frequency</th>
<th>Did not complete Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Video</td>
<td>4</td>
<td>24%</td>
<td>26</td>
<td>58%</td>
</tr>
<tr>
<td>Text</td>
<td>13</td>
<td>76%</td>
<td>19</td>
<td>42%</td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td></td>
<td>45</td>
<td></td>
</tr>
</tbody>
</table>
Figure 3. Pilot Study - Video vs. Text Prompts

*Year in school.*

Most of the participants who completed the Pilot Study were sophomores or juniors. Freshmen were the next largest demographic. This is not an unexpected distribution for a 100-level undergraduate course. The skew toward sophomore and junior level students instead of freshman and sophomore is likely due to the technological nature of the course.

When the Pilot Study started, the breakdown by class status was as follows:

Table 4. Pilot Study - Year in School

<table>
<thead>
<tr>
<th></th>
<th>Completed</th>
<th>Did not complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshman</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Sophomore</td>
<td>16</td>
<td>5</td>
</tr>
<tr>
<td>Junior</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>Senior</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>5th year</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Graduate</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>
Figure 4. Pilot Study - Year in School Comparison

Demographics.

The average age of these 72 respondents was 22.75 years old (with 1 respondent skipping this question). Fifty-four percent (39 participants) were female, and 46% (33) were male (and 1 respondent skipped the question).

The average age of participants who completed the study was 22.68, with 8 females (53%) and 7 males (47%).

<table>
<thead>
<tr>
<th></th>
<th>Participants who completed study</th>
<th>Participants who did not complete study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average age</td>
<td>22.68</td>
<td>22.539</td>
</tr>
<tr>
<td>Female</td>
<td>8</td>
<td>17</td>
</tr>
<tr>
<td>Male</td>
<td>7</td>
<td>21</td>
</tr>
</tbody>
</table>

Figure 5. Pilot Study Demographic Comparison

The average self-report GPA was 3.487 for those who completed the Pilot Study, and 3.11 for those who did not complete the study.
Participants entered information into the Demographic Questionnaire as to whether the Pilot Study course satisfied a major or minor requirement or was within the participant’s major or minor field. Table 3 demonstrates that an overwhelming percentage of the participants (100%, 74%) were required to take this course.

Table 5. Pilot Study Course of Study Details

<table>
<thead>
<tr>
<th></th>
<th>Participants who completed study</th>
<th>Participants who did not complete study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major requirement</td>
<td>15</td>
<td>37</td>
</tr>
<tr>
<td>Minor requirement</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Within major field</td>
<td>8</td>
<td>23</td>
</tr>
<tr>
<td>Within minor field</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>
Figure 7. Pilot Study - Course of Study

**Subject matter familiarity.**

Data was collected during the Pilot Study in response to the request: “Please indicate your level of experience with the subject matter before the course started.” As shown in the table below almost half of the participants (49%) considered themselves midway between novice and expert, with a relatively standard distribution curve evident on this measure. A distribution closer to novice is expected for a 100-level course. However, if technology is becoming a foundational skill similar previously to reading and writing, and the Pilot Study course was a non-major Computer Science course, this level of experience with the subject matter is not surprising.

Table 6. Pilot Study Experience with Subject Matter

<table>
<thead>
<tr>
<th>Level of expertise (Novice = 1; Expert = 5)</th>
<th>Participants who completed study</th>
<th>Participants who did not complete study</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>7%</td>
</tr>
<tr>
<td>1.5</td>
<td>1</td>
<td>7%</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>14%</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>11%</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>13%</td>
</tr>
</tbody>
</table>
Participants who completed study | Participants who did not complete study
---|---
2.5 | 7% | 3% | 1 | 19 | 50%
3 | 40% | 50% | 6 | 19 | 50%
3.5 | 7% | 0 | 1 | 0 | 0
4 | 13% | 24% | 2 | 9 | 24%
5 | 7% | 0 | 1 | 0 | 0

Table: Level of expertise (Novice = 1; Expert = 5)

---

**Figure 8. Pilot Study - Experience with Subject Matter**

*Comfort with technology.*

Participants also indicated their level of comfort with the technology used in the course such as the learning management system, the publisher’s website and homework system, and the technology used in producing course content. They chose 1 (below average), 2 (average), or (above average). Sixty-two (62%) of the participants indicated an average level of comfort with technology as shown in the table below.
Table 7. Pilot Study Comfort with Technology

<table>
<thead>
<tr>
<th>Level of comfort</th>
<th>Participants who completed study</th>
<th>Participants who didn’t complete study</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>18%</td>
<td>8%</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>41%</td>
<td>68%</td>
</tr>
<tr>
<td>2.5</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>6%</td>
<td>3%</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>24%</td>
<td>21%</td>
</tr>
</tbody>
</table>

Figure 9. Pilot Study - Technology Comfort Level

**Pilot: Qualitative results – Confidence and Satisfaction measure.**

After each prompt treatment, participants completed a Confidence and Satisfaction questionnaire containing the following questions:

- How satisfied are you with your current performance?
- How satisfied were you with the reminders/questions that you received?
- Please indicate what was truest for you during the last learning unit.
- Please indicate the grade you expect to receive in this course.
- Please indicate how confident you are that you will receive this grade.
Less than half of the participants who completed the study finished the Confidence and Satisfaction measures (8 out of 17). Therefore, the numbers were too low to analyze. Additionally, these measures weren’t critical in the Pilot Study for analyzing results relevant to the null hypotheses.

**Pilot: Quantitative results – MSLQ & MAI.**

The researcher ran quantitative analyses (paired-sample t-tests) on the data from the pre- and post-tests of participants who completed the demographic and pre- and post-study questionnaires in both the text and video groups. In the pilot study, of the 17 participants, two didn’t complete the first MAI, a third didn’t complete the first MSLQ and a fourth individual complete the second MSLQ. In all these cases, other participants’ final MAI and MSLQ scores were averaged and used. The results are shown in Table 8 with cells left blank if the differences were not significant. As shown, none of the main measures reached significance. Even if they had approached significance, such results would not be conclusive because of the small sample size.

Table 8. Pilot Study - Paired Sample T-Test Results

<table>
<thead>
<tr>
<th>Measures</th>
<th>Pre-test mean</th>
<th>Post-test mean</th>
<th>Direction</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAI Knowledge</td>
<td>34.607</td>
<td>35.294</td>
<td>↑</td>
<td>NS</td>
</tr>
<tr>
<td>MAI Regulation</td>
<td>124.132</td>
<td>126.5</td>
<td>↑</td>
<td>NS</td>
</tr>
<tr>
<td>MSLQ Value</td>
<td>69.835</td>
<td>69.43</td>
<td>↓</td>
<td>NS</td>
</tr>
<tr>
<td>MSLQ Expectancy</td>
<td>63.09</td>
<td>59.957</td>
<td>↓</td>
<td>NS</td>
</tr>
<tr>
<td>MSLQ Strategies</td>
<td>91.629</td>
<td>94.389</td>
<td>↑</td>
<td>NS</td>
</tr>
<tr>
<td>MSLQ Resource Management</td>
<td>55.348</td>
<td>55.755</td>
<td>↑</td>
<td>NS</td>
</tr>
</tbody>
</table>
Pilot: Participants who completed compared to those who did not.

The average age of the 17 participants who completed the study was 23.55 years old, with 53.3% (11 participants) being female and 45% (9) being male. The average GPA was 3.4715, and the level of experience with the subject matter was 3 on a scale of 1-5. On the average technology comfort rating (3-point scale), four participants rated themselves as having below average comfort with technology, 10 as average, and six as above average.

In comparison, the average age of those who did not complete the study was 22.539 years old, with 25% females and 75% males. The average GPA was 3.4715, and the level of experience with the subject matter was 3 on a scale of 1-5. These statistics are relatively consistent between the two populations.

Of particular note is the participants’ year in school, self-report GPA, and final grades. The participants who completed the study had been in school on the average of one semester longer than their classmates who did not complete the study. They also reported slightly more than one-fourth of a point higher GPAs (.38) and achieved higher grades in the class (two letter grades).

Table 9. Pilot Study - Comparing Those Who Completed With Those Who Did Not

<table>
<thead>
<tr>
<th></th>
<th>Participants who completed the study</th>
<th>Participants who did not complete the study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year in school</td>
<td>2.93</td>
<td>2.55</td>
</tr>
<tr>
<td>Average age</td>
<td>22.68</td>
<td>22.539</td>
</tr>
<tr>
<td>GPA (self-report)</td>
<td>3.487</td>
<td>3.11</td>
</tr>
<tr>
<td>Subject matter expertise</td>
<td>2.1</td>
<td>2.197</td>
</tr>
<tr>
<td>Computer</td>
<td>2.9</td>
<td>2.882</td>
</tr>
</tbody>
</table>
**Final Study**

Research began in spring 2014 with two sections of the same undergraduate Computer Science course and instructor that had been used in the pilot study. Originally, these two sections were full with the standard 25 participants for online courses. Several weeks later, the total number of students dropped to 40. Due to concerns about the lack of final participation that happened in the pilot study, the researcher added an online section of graduate students: BMIS541 – Systems and Operations.

**Study design.**

The final study consisted of within-group design with all participants receiving text prompts during the first trial and video prompts during the second trial. As was conducted with the pilot study, trials followed unit structure of the course. The MSLQ and MAI instruments were used in this study to measure general changes due to prompting, while the Confidence and Satisfaction measure was used to evaluate differences between participants’ reactions to text versus video prompts.

In the undergraduate course, the units were released on Monday and the concluding unit activity was due 10 days later, on Wednesday of the following unit. The graduate course had similarly discrete units but without the requisite end-of-unit activity. Instead, students were tested three times during the semester.
Participants were required to fill out the MAI and the MSLQ pre- and post-study. Because of the lack of response during the pilot study, both instruments were modified to two questions per factor. The questions included in the modified instrument are shown in Appendix C and D. Of the participants completing the study, 12 were graduate students and eight were undergraduate students.

The researcher selected the trial units based on a number of timing factors not present in the Pilot study. A time lag existed because of the need to have the second class complete the pre-study questionnaires (Consent Form, Demographics, MSLQ, and MAI). If the original schedule had been followed, these could have been completed by week 9; however, Week 10 was spring break, which meant that the unit activated for week 9 was a weekend shorter than most units. Moreover, participants would have been distracted by the close proximity of spring break, possibly causing the effect of prompting to be reduced. The prompts were originally set to be released at the start of Week 11 but were again delayed when the professor for the graduate course extended an exam due date into the middle of that week. Again, the researcher concluded that the effectiveness of prompts would be reduced if they were released just before or on the day an exam was due (Tuesday / Wednesday) or immediately after a major assignment.

Table 10. Final Study Design

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Undergraduate</th>
<th>Graduate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-4</td>
<td>Consent Form &amp; Demographic Form</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Full MSLQ</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Full MAI</td>
<td></td>
</tr>
<tr>
<td>Friday (week 8)</td>
<td></td>
<td>Consent Form &amp; Demographic Form</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Full MSLQ</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Full MAI</td>
</tr>
<tr>
<td>Week 10</td>
<td>Spring Break</td>
<td></td>
</tr>
<tr>
<td>Week 11</td>
<td></td>
<td>Test 2</td>
</tr>
</tbody>
</table>
Weeks | Undergraduate | Graduate
---|---|---
Week 12 | 2 text prompts released during a 9-day period (assignments due 10 days after the start of each week) |  
Week 13 | Confidence & Satisfaction Measure Questions 1-5 |  
Week 12 Quiz |  
Week 14 | 2 video prompts released during the 9-day “assignment” period |  
Week 15 | Confidence & Satisfaction Measure (repeated) |  
Week 14 Quiz |  
Week 15-16 | MSLQ MAI |  
Week 16 | Finals Week | Test 3  
End of Semester |  

**Final Study: Descriptive.**

The researcher analyzed the data based on means, percentages, and frequency distributions as appropriate. These analyses are reported for the demographics, technology comfort, subject matter experience, MSLQ, MAI, and Confidence and Satisfaction measures. Some participants answered surveys twice. When multiple sets of data with varying answers appeared, an average answer was calculated. Thus, the data may be reported as a decimal.

**Year in school.**

Table 11 shows the Final Study’s breakdown by participants’ year in school, with a mean of 4.38 years in school. Most participants were graduate students (50%), with an almost equal split between sophomores or juniors as the next largest demographic (15% each). These numbers meet expectations due to the combination of a graduate and undergraduate course. The close split
between sophomores and juniors replicates the demographics observed during the Pilot Study. A more even distribution exists among the participants who did not complete the Final Study.

Table 11. Final Study – Year in School Frequencies

<table>
<thead>
<tr>
<th>Year in school</th>
<th>Participants who completed the Final Study</th>
<th>Participants who did not complete the Final Study</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percent</td>
</tr>
<tr>
<td>Freshman</td>
<td>2</td>
<td>10%</td>
</tr>
<tr>
<td>Sophomore</td>
<td>3</td>
<td>15%</td>
</tr>
<tr>
<td>Junior</td>
<td>3</td>
<td>15%</td>
</tr>
<tr>
<td>Senior</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>5th year</td>
<td>1</td>
<td>10%</td>
</tr>
<tr>
<td>Graduate</td>
<td>11</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

Figure 10. Final Study - Year in School Frequencies

GPA.

For the Final Study population who completed the course, the minimum self-report GPA was 1, and the maximum 4, with a mean of 3.255. The mean GPA for those not completing the study was 3.0389.


**Gender.**

When the study began, the participants were 62% male and 38% female with an average age of 28.6. Conversely, the gender distribution among the participants who completed the Final Study approximates a normal population distribution, with 55% females and 45% males.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Participants who completed Final Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>11</td>
</tr>
<tr>
<td>Male</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>55%</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>45%</td>
<td></td>
</tr>
</tbody>
</table>

Figure 11. Final Study - completed by Gender

**Course of study.**

All students in the Final Study appear to have taken the courses included in the Final Study to satisfy major or minor requirements (Table 12). These results replicated those of the Pilot Study.
Table 12. Final Study - Course of Study

<table>
<thead>
<tr>
<th>Course status</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major requirement</td>
<td>95%</td>
</tr>
<tr>
<td>Minor requirement</td>
<td>15%</td>
</tr>
<tr>
<td>Major field</td>
<td>8%</td>
</tr>
<tr>
<td>Minor field</td>
<td>15%</td>
</tr>
</tbody>
</table>

Figure 12. Final Study - Course of Study

Subject matter.

The demographic questionnaire asked: “Please indicate your level of experience with the subject matter before the course started.” Although a 5-point Likert scale was used, no participants selected the 5-expert rating, so the answers ranged from 1 to 4, with a mean of 2.4. This outcome is to be expected from students taking a course on the subject.

The spread of prior subject matter familiarity for the Final Study is more evenly distributed than for the Pilot Study. The skewed distribution in the Pilot Study may be due to the fact that all of the participants were participating in a technology-based course. In the Final
Study, 60% of the participants who completed the study were in less technology-intensive courses. The Final Study distribution may reflect a more normal distribution.

Table 13. Final Study – Subject Matter Familiarity

<table>
<thead>
<tr>
<th>Subject Matter Familiarity</th>
<th>Completed</th>
<th></th>
<th>Not Completed</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percent</td>
<td>Frequency</td>
<td>Percent</td>
</tr>
<tr>
<td>5 - Expert</td>
<td>0</td>
<td>0%</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>21%</td>
<td>2</td>
<td>7%</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>32%</td>
<td>9</td>
<td>33%</td>
</tr>
<tr>
<td>2.5</td>
<td>0</td>
<td>0%</td>
<td>3</td>
<td>11%</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>21%</td>
<td>6</td>
<td>22%</td>
</tr>
<tr>
<td>1 - Novice</td>
<td>5</td>
<td>26%</td>
<td>6</td>
<td>22%</td>
</tr>
<tr>
<td>Missing?</td>
<td>19</td>
<td>100%</td>
<td>27</td>
<td>100%</td>
</tr>
</tbody>
</table>

Figure 13. Final Study - Subject Matter Familiarity
Participants indicated their level of comfort with the technology used in this course (Moodle, MyITLab, Microsoft Office, etc.). When students participate in an online course, their level of comfort with technology can be an entrance or a barrier to the course content. The participants who completed the study ranged from 1.67 to 3.00 on a 3-point Likert of comfort with technology (with 3 representing high levels of comfort). Their mean was 2.6085, with a standard deviation of .51060.

Table 14. Final Study - Technical Comfort Levels

<table>
<thead>
<tr>
<th>Comfort with technology</th>
<th>Participants who completed the Final Study</th>
<th>Participants who did not complete the Final Study</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percent</td>
</tr>
<tr>
<td>Above Average (3)</td>
<td>12</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>2.5</td>
<td>5%</td>
</tr>
<tr>
<td>Average (2)</td>
<td>6</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td>1.67</td>
<td>5%</td>
</tr>
<tr>
<td>Below Average (1)</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>
Final Study: MSLQ / MAI measures.

The MSLQ and MAI instruments were completed before and after the Final Study. They were not administered between the Text Prompt trial and the Video Prompt trial. Thus, the results reported in this section must be interpreted in relationship to the administration of prompts themselves (not whether they were text or video).

Paired sample t-tests were completed on change during the study of the 5 MSLQ and the 2 MAI main components. Three of the measures achieved significant change (MAI Knowledge, MAI Regulation and MSLQ Expectancy). In addition, Resource Management (MSLQ) achieved near significance at .057. Moreover, the direction of the change of the elements is worth observing with some component scores increasing and some decreasing.

Figure 14. Final Study - Technical Comfort Levels
Table 15. Final Study MSLQ/MAI T-Tests

<table>
<thead>
<tr>
<th></th>
<th>Final</th>
<th></th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-test mean</td>
<td>Post-test mean</td>
<td></td>
</tr>
<tr>
<td>MAI Knowledge</td>
<td>38.350</td>
<td>33.092</td>
<td>↓ .000</td>
</tr>
<tr>
<td>MAI Regulation</td>
<td>50.108</td>
<td>66.6</td>
<td>↑ .000</td>
</tr>
<tr>
<td>MSLQ Value</td>
<td>40.250</td>
<td>40.281</td>
<td>↑ NS</td>
</tr>
<tr>
<td>MSLQ Expectancy</td>
<td>36.6</td>
<td>34.132</td>
<td>↓ .024</td>
</tr>
<tr>
<td>MSLQ Strategies</td>
<td>68.025</td>
<td>66.088</td>
<td>↓ NS</td>
</tr>
<tr>
<td>MSLQ Resource</td>
<td>42.733</td>
<td>45.72</td>
<td>↑ .057</td>
</tr>
</tbody>
</table>

**Final Study: Post-trial Confidence and Satisfaction measure.**

Participants completed the Confidence and Satisfaction Measure after each of the two prompt trials. Significant differences between scores on these measures would indicate an effect related to the intervening prompts and be the basis for accepting or rejecting null hypothesis 1 and 2. All of these measures exhibited significant differences between participants receiving text or video prompts.

Four measures did not reach significant differences after text versus after video prompt trials. One measure approached significance—the expected course grade. The questions included in the Confidence and Satisfaction questionnaire were:

1. How satisfied are you with your current performance? (CS1)
2. How satisfied were you with the reminders/questions that you received? (CS2)
3. Please indicate what truest (level of distraction vs. focus) was for you during the last learning unit (CS3).
4. Please indicate the grade you expect to receive in this course (CS4).
5. Please indicate how confident you are that you will receive this grade (CS5).
Table 16: Final Study Confidence and Satisfaction T-Tests

<table>
<thead>
<tr>
<th></th>
<th>Text</th>
<th>Video</th>
<th>Direction</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS1</td>
<td>Satisfaction with performance</td>
<td>3.55</td>
<td>3.5710</td>
<td>↑</td>
</tr>
<tr>
<td>CS2</td>
<td>Satisfaction with prompts</td>
<td>3.5</td>
<td>3.4658</td>
<td>↓</td>
</tr>
<tr>
<td>CS3</td>
<td>Distracted vs. focused</td>
<td>3.35</td>
<td>3.20</td>
<td>↓</td>
</tr>
<tr>
<td>CS4</td>
<td>Expected grade</td>
<td>91.65</td>
<td>90.395</td>
<td>↓</td>
</tr>
<tr>
<td>CS5</td>
<td>Confidence in prediction</td>
<td>86.23</td>
<td>85.053</td>
<td>↓</td>
</tr>
</tbody>
</table>

Although not significantly, video prompts appear to improve participants’ satisfaction with their performance but reduce their satisfaction with the prompt themselves and lower participants’ expected grade and confidence in their prediction of that grade.

The confidence and satisfaction data was analyzed by MANOVA with the five post-trial confidence and satisfaction measure and the final grade as dependent variables, video vs. text prompts as the independent variable, and a number of variables as covariates. Findings revealed only nonsignificant associations for the CS1 variable (Satisfaction with Performance). CS2 (Satisfaction with Prompts) achieved significance for initial MSLQ Value, initial MSLQ Strategies, initial MSLQ Resource Management and final MSLQ Strategies. Therefore, participants’ satisfaction with prompts covaried along with their initial value MSLQ Value scores (intrinsic and extrinsic goal orientation and task value); use of MSLQ (Strategies) cognitive and metacognitive strategies; and initial Resource Management orientation. Distraction vs. focus shows significance with MSLQ final Strategy use. Thus, a focused participant was more likely to use cognitive and metacognitive strategies (score high on the
MSLQ Strategy measure). Participants’ expected course grade, their confidence in that expectation, and the course grade earned all covaried significantly with their initial MSLQ Value, Expectancy scores (control beliefs about learning and Self-efficacy for learning and performance), and their initial Resource Management. The expectations of course grade also covaried significantly with MAI Metacognitive Regulation scores (both initial and final) and confidence in expectations covaried with initial MSLQ Strategy. Final grade covaried significantly with initial and final MSLQ Value and MSLQ Expectancy; initial MSLQ Resource use and final MSLQ Strategies; and final MAI Metacognitive Knowledge and Regulation.

Significant interactions are listed in the table below.

Table 17. Final Study Post-Trial Confidence & Satisfaction MANOVA Results

<table>
<thead>
<tr>
<th>Initial measures</th>
<th>CS2</th>
<th>CS3</th>
<th>CS4</th>
<th>CS5</th>
<th>Final Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satisfaction with prompts</td>
<td>.03</td>
<td>.018</td>
<td>.047</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>Distracted vs. focus</td>
<td>.001</td>
<td>.054</td>
<td>.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected course grade</td>
<td>.056</td>
<td>.057</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Confidence in expectation</td>
<td>.016</td>
<td>.012</td>
<td>.014</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>MSLQ Value</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MSLQ Expectancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MSLQ Strategies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MSLQ Resource Management</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAI Metacognitive Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAI Metacognitive Regulation</td>
<td></td>
<td></td>
<td>.021</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Final measures</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MSLQ Value</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MSLQ Expectancy</td>
<td></td>
<td></td>
<td>.015</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CS2</td>
<td>CS3</td>
<td>CS4</td>
<td>CS5</td>
<td>Final Grade</td>
</tr>
<tr>
<td>----------------</td>
<td>----------------------</td>
<td>----------------------</td>
<td>----------------------</td>
<td>----------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Satisfaction with prompts</td>
<td>S.004</td>
<td>Distracted vs. focus</td>
<td>Expected course grade</td>
<td>Confidence in expectation</td>
<td>.000</td>
</tr>
<tr>
<td>MSLQ Strategies</td>
<td>.004</td>
<td>.03</td>
<td></td>
<td></td>
<td>.000</td>
</tr>
<tr>
<td>MAI Metacognitive Knowledge</td>
<td></td>
<td></td>
<td>.020</td>
<td></td>
<td>.032</td>
</tr>
<tr>
<td>MAI Metacognitive Regulation</td>
<td></td>
<td></td>
<td></td>
<td>.020</td>
<td>.032</td>
</tr>
</tbody>
</table>

**Final Study: Correlations.**

Final Study factors were also checked for correlations using Pearson Correlation Coefficients. The correlation results are shown in Appendix H. MSLQ and MAI measures are indicated as either pre-test (1) or post-test (2). Confidence and Satisfaction measures are either post text trial (1) or post video trial (2).

Correlations of items within questionnaires highlight the relevance of the items within the questionnaire to each other but will not be discussed further.

**Demographics.**

Correlations between demographic variables revealed a significant correlations between three variables: Year in School, Age and GPA. A correlation between Age and Year in school is expected. The correlation between those two variables and GPA is notable and discussed further below.
**MAI and MSLQ Questionnaires.**

As the chart in Appendix H demonstrates, MSLQ Strategies displayed some of the most consistent correlations with MAI Regulation and Knowledge. This is true for the pre- and post-test values of all three measures. In addition, post-test MSLQ Values had significant correlations with post-test MAI Knowledge and post-test MAI Regulation. These findings provide support for the interrelatedness of the MSLQ and MAI instruments.

There were no significant correlations between any of the MSLQ or MAI and Gender, Year in school, or GPA. Post-test MAI Metacognitive Knowledge did correlate significantly (.02) with age. That significant correlation and the correlation noted above between Age and GPA reflects discussion in Chapter 5 about the increased tendency of older students to use self-regulated learning.

**Confidence and Satisfaction Questionnaire.**

The Confidence and Satisfaction questions revealed multiple significant correlations. The results for the Text prompt trial include:

1. Satisfaction with Performance during the text prompt trial (CS1) correlated significantly with MSLQ Resource Management (.017) during the same trial.
2. Text prompt trial Satisfaction with Prompts (CS2) correlated significantly with MAI Regulation during the same trial.
3. Text prompt trial Focus (CS3) correlated significantly with GPA
4. Grade Expectations (CS4) after the text prompt trial correlated significantly with pre-test MSLQ Strategies
5. Text prompt trial Confidence in Grade Prediction (CS5) correlated significantly with pre-test MSLQ Resource Management.

Thus, if participants were satisfied with their performance after the text prompt trial, they were also likely to have higher MSLQ Resource Management scores. Participants who were satisfied with the text prompts were also more likely to score higher on MAI regulation during that trial. Participant focus at the end of text prompt trial was related to their GPA. Participants were more likely to have higher grade expectations if they had higher pre-test MSLQ strategies scores while higher confidence in their ability to predict their grade was matched with higher pre-test MSLQ Resource Management.

In other words, participants who started this study with high MSLQ Resource Management scores, were more likely to feel satisfied with their performance and have higher confidence in their ability to predict their grades. Participants who scored high on MAI Regulation at the start of the study, were more likely to be satisfied with the text prompts and participants who had higher MSLQ strategy scores had higher grade expectations. Participants with higher self-report GPAs were more highly to have higher focus at the end of the text prompt trial.

The results for the Video prompt trial are shown below:

6. All Video prompt trial Confidence and Satisfaction measures correlations significantly with all post-test MSLQ components: Values, Expectancy, Strategies and Resource Management.

7. Video prompt trial Focus (CS2-3) correlates significantly with pre-test MSLQ Values.
8. Video prompt trial Grade Expectations (CS2-4) correlates significantly with pre-test MAI Knowledge.

9. Video prompt trial Confidence in Grades (CS2-5) correlates significantly with Gender.

Participants who had higher satisfaction with performance and prompts, focused attention, a higher grade prediction and higher confidence in that prediction after the Video prompt trial were likely to also have higher MSLQ Values, Expectancy, Strategies and Resource Management scores at the end of the study. Participants with higher pre-test MSLQ Values and MAI Knowledge were more likely to have better Focus and higher Grade Expectations at the conclusion of the Video prompt trial. Finally, girls were more likely to have higher confidence in their ability to predict their grade at the conclusion of the Video prompt trial.

Results Summary

The results presented in this chapter, and summarized in the final table below, are used to test the null hypotheses and to support the summary, discussion and conclusions in Chapter 5. The inconsistent final numbers in the Pilot Study are due to participants not answering all questions.

Table 18. Pilot and Final Study Demographics Summary

<table>
<thead>
<tr>
<th></th>
<th>Pilot Study Completers</th>
<th>Pilot Study Non Completers</th>
<th>Final Study Completers</th>
<th>Final Study Non completers</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-17</td>
<td>15-17</td>
<td>45-50</td>
<td>20</td>
<td>13</td>
</tr>
<tr>
<td>Video / Text</td>
<td>4/17 19%</td>
<td>26/19 58%</td>
<td>20/20</td>
<td>13/13</td>
</tr>
<tr>
<td>UC-CS vs. Grad-Business</td>
<td></td>
<td></td>
<td>7/13</td>
<td>8/5</td>
</tr>
<tr>
<td>Freshman</td>
<td>15%</td>
<td>5%</td>
<td>15%</td>
<td></td>
</tr>
<tr>
<td>Year in School</td>
<td>Sophomore</td>
<td>Junior</td>
<td>Senior</td>
<td>5th year</td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------</td>
<td>--------</td>
<td>--------</td>
<td>----------</td>
</tr>
<tr>
<td>Sophomore</td>
<td>36%</td>
<td>34%</td>
<td>7%</td>
<td>1%</td>
</tr>
<tr>
<td>Junior</td>
<td>20%</td>
<td>15%</td>
<td>0%</td>
<td>5%</td>
</tr>
<tr>
<td>Senior</td>
<td>15%</td>
<td>15%</td>
<td>15%</td>
<td>15%</td>
</tr>
<tr>
<td>5th year</td>
<td>15%</td>
<td>15%</td>
<td>15%</td>
<td>15%</td>
</tr>
<tr>
<td>Graduate</td>
<td>7%</td>
<td>15%</td>
<td>15%</td>
<td>15%</td>
</tr>
<tr>
<td>Missing</td>
<td>2%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year in school</td>
<td>2.93</td>
<td>2.55</td>
<td>4.38</td>
<td>3.44</td>
</tr>
<tr>
<td>Average age</td>
<td>22.68</td>
<td>22.539</td>
<td>28.6</td>
<td>25.11</td>
</tr>
<tr>
<td>GPA (self-report)</td>
<td>3.487</td>
<td>3.11</td>
<td>3.255</td>
<td>3.0389</td>
</tr>
<tr>
<td>Subject matter expertise</td>
<td>2.1</td>
<td>2.197</td>
<td>2.35</td>
<td>2.39</td>
</tr>
<tr>
<td>Computer</td>
<td>2.9</td>
<td>2.882</td>
<td>2.6085</td>
<td>2.259</td>
</tr>
<tr>
<td>Male</td>
<td>46.7%</td>
<td>75%</td>
<td>45%</td>
<td>77%</td>
</tr>
<tr>
<td>Female</td>
<td>55%</td>
<td>23%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Final grade</td>
<td>93.03029</td>
<td>72.11476</td>
<td>91.7060</td>
<td>65.3504</td>
</tr>
</tbody>
</table>
Chapter 5: Discussion and Conclusions

The purpose of this chapter is to summarize and evaluate the findings. The following sections summarize findings from the Pilot and Final Study, present implications from the Pilot Study and the Final Study, place this study in the stream of existing research, and suggest recommendations for practical purposes and further research.

This study was designed to test the following hypotheses:

- H1: Video prompts are not significantly different from text-based prompts in activating self-regulated learning (SRL).
- H2: Video prompts are not significantly different from text-based prompts in activating metacognitive monitoring.
- H3: Video prompts are not significantly different from text-based prompts in affecting academic success.
- H4: Learner MSLQ and MAI scores do not covary significantly with unit grades, computer comfort, age, gender, and prior knowledge of content.

Synopsis of Study

During the Pilot Study, participants from three sections of an online undergraduate Computer Science class were divided into two groups with each group receiving different treatments: text-based versus video-based prompts. The prompts were administered in three trials with 4, 2, and 1 prompt respectively in the Pilot Study. Any difference between video and text prompts were shown by pre- and post-tests with the MSLQ and MAI. The results were analyzed and presented in Chapter 5; however, since only 17 participants completed the Pilot Study, the
results are not sufficient enough to indicate the significance of text-based versus video-based
prompts on students’ academic success, SRL, or metacognitive monitoring.

The Final Study included participants from two sections of an online undergraduate
Computer Science class and one section of an online graduate Business course. The Final Study
design was a repeated-measures design with all participants receiving first a trial of two text
prompts followed by a trial with two video prompts.

Summary

Prompts make a difference.

Both studies measured the effect of prompts on self-regulated learning and metacognitive
monitoring. The researcher performed pre and post t-tests on the Pilot and Final Study’s MSLQ
and MAI measures. In the Final Study, t-tests were also performed on the Post-Trial measures of
Confidence & Satisfaction. Too few Satisfaction & Confidence answers were collected during
the Pilot Study (6) to make a t-test worth completing.

The Pilot Study t-tests yielded no significant results for the MAI and the MSLQ.
However, the Final Study demonstrated significant changes in MAI Knowledge (p ≤.001) and
Regulation (p ≤.001), MSLQ Expectancy (p ≤ .05) and closely approached significance for
MSLQ Resource Management (.057). These are discussed below. MAI Regulation, MSLQ
Expectancy and MSLQ Resource Management changed in the same direction in both the Pilot
and the Final Study. However, in the Pilot Study MAI Knowledge and MSLQ Strategies scores
increased between pre- and post-tests while they dropped in the Final Study and MSLQ Value
dropped in the Pilot Study but increased in the Final Study.}
Table 19. Major Measures T-Tests

<table>
<thead>
<tr>
<th></th>
<th>Pilot</th>
<th>Final</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Pre-test mean</td>
<td>Post-test mean</td>
</tr>
<tr>
<td>MAI Knowledge</td>
<td>34.607</td>
<td>35.294</td>
</tr>
<tr>
<td>MAI Regulation</td>
<td>124.132</td>
<td>126.5</td>
</tr>
<tr>
<td>MSLQ Value</td>
<td>69.835</td>
<td>69.43</td>
</tr>
<tr>
<td>MSLQ Expectancy</td>
<td>63.09</td>
<td>59.957</td>
</tr>
<tr>
<td>MSLQ Strategies</td>
<td>91.629</td>
<td>94.389</td>
</tr>
<tr>
<td>MSLQ Resource Management</td>
<td>55.348</td>
<td>55.755</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Text Video trial</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post Video trial</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfaction with performance</td>
<td>3.55</td>
<td>3.5710</td>
</tr>
<tr>
<td>Satisfaction with prompts</td>
<td>3.5</td>
<td>3.4658</td>
</tr>
<tr>
<td>Distracted vs. focused</td>
<td>3.35</td>
<td>3.20</td>
</tr>
<tr>
<td>Expected grade</td>
<td>91.65</td>
<td>90.395</td>
</tr>
<tr>
<td>Confidence in prediction</td>
<td>86.23</td>
<td>85.053</td>
</tr>
</tbody>
</table>

No significant difference between video and text prompts.

This pair of studies did not directly support the value of video prompts versus text prompts for activating SRL and metacognitive monitoring.
• H1: Video prompts are not significantly different from text-based prompts in activating self-regulated learning.

• H2: Video prompts are not significantly different from text-based prompts in activating metacognitive monitoring.

Measurement of significant differences in text-based versus video-based prompts varied between the two studies. In the Pilot Study, the pre and post MSLQ and MAI measures were run again the two groups who received different treatments of text versus video prompts. In the Final Study, the post MSLQ and MAI measures were completed after the participants had received both treatments.

The main MSLQ and MAI measures during the Pilot Study generated no significant results. Even if these measures had been significant, the significance of these results would have been reduced by the small number of participants who completed the study.

The design of the Final Study required all participants to receive a trial of text-prompts followed by a trial of video prompts. Thus, the pre- and post-test MSLQ as well as the MAI scores reported above represent significant difference due to receiving prompts with no distinction on kind of prompts. Results indicate that receiving prompts had a significant effect upon reducing MAI Knowledge and MSLQ Expectancy and increasing MAI Regulation. MSLQ Resource Management was also almost significantly affected in a positive direction. The fact that the two regulatory / management variables are both affected in a positive direction provide redundant findings. It is noteworthy that MAI Knowledge and MSLQ Expectancy drop with the additional exposure of a second trial.
The Confidence and Satisfaction Measures, which the researcher administered between the two trials, were analyzed to show differences after the text prompts as compared to the video prompt.

The Post-Trial Confidence and Satisfaction measures of the Final Study yielded no significant main effects related to the presence of video versus text prompts. Statistical significance was approached (.066) only on Expected Final Grade. Participants had a lower expected final grade after the video prompt trial than after the text prompt trial. Interpretation of this almost significant result may be more dependent upon the timing of the video trial, which occurred two weeks before Finals, than upon the difference between text and video prompting.

The findings indicate that Null Hypothesis 1 and 2 should not be rejected.

**Academic success and video vs. text prompts**

- **H3**: Video prompts are not significantly different from text-based prompts in affecting academic success.

Academic success has been defined and measured in many different ways. For these studies, the final grade in the course was intended to be used as the main measure of academic success as compared to the MSLQ and MAI measures of the Pilot Study and the post-trial Confidence and Satisfaction measures of the Final Study.

For the Pilot Study, the lack of sufficient total number of participants completing the study may be part of the reason why no significant results were found between groups receiving video instead of text prompts. Similarly, no significant main effects between video and text prompts occurred in the Final Study measures (Table 19). In the Final Study, the final grade was...
significantly related (as tested with Pearson’s Correlation Coefficient) to several MSLQ and one MAI component. However, these cannot be linked directly to video versus text-based prompts.

Thus, the findings were inconclusive. No conclusions can be made about Null Hypothesis 3. However, the discussion of these results should again include the realization that those completing this study were perhaps already a group of self-selected, self-regulated learners.

- **H4**: Learner MSLQ and MAI scores do not covary significantly with unit grades, computer comfort, age, gender, and prior knowledge of content.

As reported in Chapter 4, section “Final Study: Correlations,” participants’ MSLQ and MAI scores do covary significantly with final grades and age. Thus, Null Hypothesis 4 is partially rejected.

**Discussion**

**Significance of statistical tests.**

Video prompts had not been used before in any previous studies of SRL. For this study, the researcher wrote null hypotheses 1 and 2 to include possibilities in both directions. Therefore, it could be conjectured but not well known whether video prompts had the same benefit to learners as in-class videos. The varying directionality of the t-tests supports this caution. If directional hypotheses are substituted for the non-directional hypotheses, the significance of a 1-tail test is more conclusive. For example, if “better” or “worse” is substituted for “different” in the hypothesis, t-tests are testing for only one end of a difference. Testing such a hypothesis represents a 1-tail t-test and requires half the significance of a 2-tailed test. For example, video prompts are not significantly better or worse than text-based prompts in activating self-regulated learning. If the null hypothesis said the “video prompts are not significantly better than text-
based prompts,” we would expect to reject this hypothesis by seeing significant increases in the means between the pre- and post-tests.

The researcher asserts that study results need to be interpreted in light of findings about final grades displayed in Table 18. Pilot and Final Study Demographics Summary on page 84.

When the final grades are compared between those who completed this study and those who didn’t, at least a 2 grade spread is observed. Participants who completed the study were awarded extra credits points but only enough to change grade levels by 1 grade. (Participants were considered to have completed the study if they missed answering only one or two of the questions that were asked in the all of the questionnaires during the study.) Thus, participants in this study may have self-selected into self-regulated learners who chose to complete whatever was required for the course (including this study) and less self-regulated learners who may have started, but not completed, the extra credit option that was this study. Unexpectedly, from the table below, we would summarize that prompts had an equally negative effect and positive effect on MSLQ and MAI measures. Half of the measures decreased and half increased. The Post-Trial Confidence and Satisfaction measures (the only indication in the Final Study of the effect of video versus text prompt) were more conclusively negative.

In the Pilot Study, both MAI Knowledge and Regulation, as measured by the MAI instrument, rose. MSLQ Expectancy and Value decreased after receiving prompts, while Strategies and Resource Management increased. That might appear to be a confusing result; however, it may be hypothesized that Expectancy and Value are more powerful at the start of a learning project than at the end, and that Strategies and Management are activated more as students move through learning. Satisfaction with performance and a decrease in distractedness rose as the participants continued through the semester, while satisfaction with prompts, final
grade prediction and confidence in that prediction fell. Wigfield, Tonks and Klauda (2009) assert that “students' expectancies for success and beliefs about ability are among the strongest psychological predictors of performance” (p. 47). Similarly, Mac Iver, Stipek & Daniels link within-semester changes to students’ ability-perception with some students raising and some lowering their efforts. Berger and Karabenick (2011) found a reduction in effort as the semester progressed along with a move toward more shallow learning strategies such as rehearsal. Since this was true even though the students’ value of the subject matter was strong, the researchers conclude “results of the role of cost is especially important given the dearth of information available to date (Wigfield & Cambria, 2010), and should spur additional efforts to study its effects on the use of learning strategies” (p. 424). These observations, and the results from the current study, highlight the need for understanding the complex relationship between expectancy, value and effort (as strategies and management) over time and the directionality of the effects.

Some of the results of the current study may be related to the final measures occurring so close to the end of the semester. In addition, a considerable problem with the Pilot and Final Studies was the lack of significant participation. This led to a lack of significant findings. Although the study shows a general support for the effectiveness of prompts, the distinction between video and text prompts was not clear. In particular, the benefit of video prompts over text prompts is not well supported by the findings.
Lack of responsiveness.

One overriding challenge of this study was the lack of student participation. The Pilot Study in fall 2013 started with an initial pool of 75 students but finished with 17 students. This happened despite several enticements, including extra credit and a raffle.

In the Final Study, the initial group of potential participants was raised from two sections to three sections by including a section of online graduate students, for a total of 20 participants. Also, in an effort to encourage participation, the researcher reduced both the number of questions and the amount of activities participants were required to complete. Finally, the researcher had the intention to include the study as one of the standard class activities, with assigned points that made the activity equal to other unit activities. However, the course instructor used a common syllabus for all sections of the course (both online and face-to-face) so all students could see the “extra points” available for the online course, which is the category that the study fell into on the syllabus. When students contacted the researcher during the semester, they always referred to this study as the extra credit activity. This unwanted effect is discussed further in the Conclusions section.

Self-selection.

The valid results from this study were primarily collected from individuals who tend to be self-regulated learners. During the Pilot Study, only 23.3% of the participants finalized. Seventy-three participants filled out the consent and demographic questionnaires. Only 17 participants completed the entire process—although even some of them did not complete the
between-trial measures. In the Final Study, 58 participants filled out the consent and demographic questionnaires, with only 20 (34.5%) finishing the entire process.

Therefore, the participants examined in both studies were a self-selected group with less variation than normal. Therefore, the study measured the unique group of participants who completed the process rather than the entire participant population. The participants’ choice to complete an extra credit activity, and the ability to do so, in itself may be an example of self-regulated learning. Similarly, students who were already struggling may have been demonstrating self-regulated learning when they stopped completing measures for this study. They may have seen this study as competing with their course work. This is only a hypothesized assumption but may indicate a direction for future research.

If the assumption can be made that completing extra credit is an act of self-regulated learning, then the participants do not reflect a normal distribution. Study results may be skewed because they contain a self-selecting group of SRL participants. This assumption is supported when examining the demographics of the participants who completed the study compared to those who did not because those who completed had a higher self-report GPA and final grade.

**Possibility for cognitive overload.**

The concept of cognitive overload was introduced in Chapter 1 during a discussion of how self-regulated learning is especially common in ill-structured environments. Self-regulated learning is particularly useful in such environments, for example, online learning environments. However, there is an inherent danger of tipping the balance from an environment potentially fraught with possibility and richness to one of overwhelming confusion. Both the Pilot Study and the Final Study may have reached this tipping point for different reasons.
During the Pilot Study, several factors may have caused participants to feel overwhelmed and confused, thus affecting the results: 1) problems with the course textbook and software, and 2) an instructor teaching an online course for the first time. In addition, the amount of responses required from the participants was larger than in the Final Study. Thus Pilot Study participants may have experienced the number of prompts and the additional prompting from the researcher as irritating interruptions.

Disruptions during the Final Study included trial weeks sandwiched between Spring Break and Finals Week and, for the undergraduate class, a long time lag between filling out post-test instruments and participating in the actual study. These issues are highlighted in Table 20. Pilot and Final Study Timing on page 97.

**Excessive prompting.**

During the Pilot Study, the researcher postponed trials in order to achieve a sufficient number of participants. In addition, the researcher sent several messages enticing students to participate. Students who filled out the forms correctly from the start received at least four messages, while students who did not fill out their forms may have received up to six messages before the study commenced. These messages were emailed generated in the learning management system, Moodle, and delivered as individual emails to the participants selected to receive the message. The researcher began to sense that continued supplication was starting to have deleterious effects on students’ willingness to participate in the study.

Moreover, the first prompt trial involved four prompts received on Tuesday, Thursday, Saturday, and Monday. The researcher had planned three trials that followed the same protocol but recognized that this number of prompts could be seen as harassing rather than encouraging.
The final factor in a potential case of over prompting was that the prompts were delivered both in the online course system and in e-mail. These dual notifications were intended to provide ease of response for participants. However, the cumulative effects of these factors may have created cognitive or prompting overload. This negative effect has not been noted in other studies, but few other prompting studies have been completed in an online environment.

Initially, it seemed that the structural course issues would encourage participation for the extra credits points. However, the drop-in, intermittent participation may demonstrate a negative reaction to overload created by excessive prompting.

**Timing issues.**

Timing issues plagued the Final Study, as discussed in Chapter 4. These issues are highlighted in Table 20, and can be characterized as follows:

- Eight to ten weeks lag time between completing pre-test measures and the actual study (undergraduate students in the Computer Science course)
- Trial weeks occurring next to testing distractions (graduate students in the Business course)
- A final trial week that occurred the week before course finals.

These timing issues could have led to distractions and provided additional sources of cognitive overload. Inversely, some of the participants may have dropped out of the study as an act of self-regulated learning and metacognitive monitoring because they recognized that the distractions and additional cognitive overload was not beneficial to their progress in the course.

Table 20. Pilot and Final Study Timing

<table>
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<tr>
<th></th>
<th>Pilot Study – Fall semester</th>
<th>Final Study – Spring semester</th>
</tr>
</thead>
</table>


<table>
<thead>
<tr>
<th>Weeks</th>
<th>Undergraduate CS course</th>
<th>Undergraduate CS course</th>
<th>Graduate Business course</th>
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<td>1-4</td>
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<td>Consent, Demographics, Pre- and Post-tests</td>
<td>Consent, Demographics, Pre- and Post-tests</td>
</tr>
<tr>
<td>6</td>
<td>Trial 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td>Consent, Demographics, Pre- and Post-tests</td>
</tr>
<tr>
<td>9</td>
<td>Trial 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>Spring Break</td>
<td>Spring Break</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>Trial 1</td>
<td>Trial 1</td>
</tr>
<tr>
<td>13</td>
<td>Trial 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Thanksgiving break</td>
<td>Trial 2</td>
<td>Trial 2</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>Finals week</td>
<td>Finals week</td>
</tr>
<tr>
<td>16</td>
<td>Finals week</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Conclusions**

The researcher chose to study the online environment because it is ill-structured and therefore ideal for examining self-regulated learning. Furthermore, web-based learning environments (WBLE) have been seen as especially conducive to learning challenging and complex topics and facilitating problem solving. The researcher suggested video prompts as a way to reduce cognitive overload while prompting SRL.

The current research replicates some of the findings of other studies. Outside of the original parameters of this study, previous studies highlighted the extreme attribution that occurs in online environments and for any extra assignments, even those touted to help improve learning outcomes. For example, Johnson (2011) also had low responses. Of the 35 prompts in the learning materials, participants only followed the prompt recommendation five times, or 14% of the time. One of the conclusions of that study was that “[t]he addition of instructions within the learning content may increase extraneous cognitive load and reduce available cognitive resources for the learning task” (p. 58).
In addition, this pair of findings uncovered some tendencies that suggest additional research:

- It appears that video prompts reduced participants’ tendencies to complete the study; however, the numbers are extremely small to fully support this tendency. The findings cannot be replicated in the Final Study because all participants received both sets of prompts (a text prompt trial followed by a video prompt trial).
- Neither comfort with computers nor prior subject matter appeared influential in this study regarding interaction with type of prompt, MSLQ or MAI scores.
- Participants who completed the study received a course grade two letter grades higher than those who did not complete the study.
- Male participants were less likely to finish the study than female participants.
- Final grades covaried with initial MSLQ Value, Expectancy, and Resource Management; final MSLQ Value, Expectancy, and Strategies; and final MAI Metacognitive knowledge and Regulation (Final Study).
- Significant differences were achieved among MAI / MSLQ measures only during the Final Study. However, interesting directional results also appeared for these measures. One SRL component score dropped over the course of the study for both the Pilot and Final Study, MSLQ Expectancy while others rose: MAI Regulation, and MSLQ Resource Management. Two other measures exhibit different behavior between the Pilot and the Final Studies: MAI Knowledge, MSLQ Value. Although not significant participants’ satisfaction with their performance increased from text-prompt trials to video-prompt trials in the Final Study. Their satisfaction with the prompts, focus, predicted final grade, and
confidence in that prediction were all reduced (but not significantly) during the same time.

As noted before, some of the differences between the Pilot and the Final Study may be due to the additional prompts and trial in the Pilot Study, the proximity of the Final Study’s video trial to finals week and the presence of graduate students in the Final Study. It may also be possible that students were self-regulating their learning and reducing the complexity of their environments by dropping participation in the study. However, if this were true, the difference in academic success would not be so noticeably apparent between those who did complete the prompt study and those who did not.

Results with fewer significant differences than expected were possibly found because the participants who completed the study were similar in their academic focus and ability to succeed and, as a more homogenous group, exhibited fewer differences. A study design that compared a prompted course with the participants’ prior year grades, other grades received that semester, and future grades would better isolate the effect of prompts through comparison with grades received in courses without prompts.

**A problematic continuum.**

Metacognition is not easy nor can it ever become completely automatic if it is to be effective. Thus it will always require mental effort or load. Additional mental effort is required even if students have the requisite cognitive and motivational strategies—which may not be true (Bednall & Kehoe, 2011).

Moreover, online education is known for its convenience. When convenience is an aim, other factors may covary, such as participants already being busy or overloaded or instructors
avoiding time-based events to maintain the adjustable hours provided by online courses. These factors may contribute to students experiencing a course as more chaotic. The lack of synchronicity may reduce the human interactions directly responsive to an individual student’s questions or concerns (Farwell, 2011) and also increase student stress.

The elements of self-regulated learning, metacognition and an online learning environment describe the basis for a balancing act along a teaching-learning continuum of teacher-led versus student-led learning environments; well-structured versus ill-structured learning environments; and constricted and well-explained compared to freeform, nonlinear and open-ended problems. These complex dimensions require monitoring and modulation. Providing well balanced opportunities for student metacognitive activation and learning self-regulation is more difficult if the system is set up for the use of students at whatever time they chose to engage. Creating such a course will most likely require significant metacognitive considerations from the course designers and teachers themselves.

**Naturalistic settings.**

These studies were completed in a naturalistic setting where controlling external variables is difficult. Publishers do not have products ready in time, grading systems or software can fail, and students can struggle with a variety of aspects of the online environment. These factors can raise cognitive load. Much of the previous research on metacognition and self-regulated learning was completed in a more controlled environment where external factors could be limited and cognitive load managed deliberately. Attribution was also not a factor in testing environments. However, the naturalistic setting of these two studies may add ecological validity to the findings.
Prompts covary with success.

Although many limiting factors constrained the statistical and practical conclusions available from this set of studies, results provided general support for self-regulated learning and metacognitive monitoring and the judicious use of prompts. The current research supports the covariance of prompting with academic success, while conclusive evidence for the benefit of video over text prompts has not yet been achieved.

Implications.

One of the implications of this study is clear: students continue to struggle to complete online courses. This is especially true if the students are college freshmen or sophomores and male. This finding has broader educational repercussions. Participants are not consistently doing well with the ill-structured environments that replicate 21st century life. In an environment where it is predicted that individuals may have multiple careers, information will continue to explode and lifelong learning will be common; therefore, educators need to address how to scaffold learners into consistent and successful interactions with these environments and their concomitant need for self-regulated learning.

One of the responses has been to make course content deliberate and reduce complexity. However, while deliberateness is advisable, inappropriate simplicity may be the opposite of what is needed. Bjork’s desirable difficulties concept (Sungkhasette, Freidman & Castel, 2011) suggests both that individuals may not be aware of the benefits of desirable difficulties during learning and may also over predict their learning if it is achieved in a simplified environment. Ill-structured environments may have produced some of the issues with the present study,
causing students who were well self-regulated to complete the study and those who were not to drop the study, which served as an indication of how they would do in the course. Perhaps naturalistic environments and overload are part of the problem.

**Findings.**

The significance of this study includes the following findings related to the use of prompts:

- MAI knowledge decreased significantly over the course of the Final Study, while MAI Regulation increased significantly.
- MSLQ Expectancy significantly dropped over the course of the Final Study (MSLQ Strategies also dropped, but not significantly), while Resource Management approached a significant increase.
- MAI Knowledge rose (non-significantly) during the pilot study but dropped significantly during the final study, while MSLQ Value and Cognitive & Metacognitive Strategies reflected opposite directionality (but not significantly) between the Pilot and Final Study.

Findings related to the difference between text and video prompts included the following:

- Satisfaction with performance rose but not significantly from text to video prompting.
- Satisfaction with prompts, expected grade, and confidence in grades prediction all dropped but without reaching significance from text to video prompting.
- Distraction dropped but didn’t reach significance between text and video prompt-based trials.

Table 21. Pilot and Final Study Difference (Directionality and Significance indicated)

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Pilot</th>
<th>Final</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metric</td>
<td>Change Symbol</td>
<td>Significance</td>
</tr>
<tr>
<td>-----------------------------------------------------</td>
<td>---------------</td>
<td>--------------</td>
</tr>
<tr>
<td><strong>MAI Knowledge</strong></td>
<td>↑</td>
<td>↓ *</td>
</tr>
<tr>
<td>Declarative, procedural and conditional knowledge</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MAI Regulation</strong></td>
<td>↑</td>
<td>↑ *</td>
</tr>
<tr>
<td>Planning, information management strategies,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>comprehension monitoring, debugging strategies and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>evaluation</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MSLQ Value</strong></td>
<td>↓</td>
<td>↑</td>
</tr>
<tr>
<td>Intrinsic &amp; extrinsic goal orientation and task value</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MSLQ Expectancy</strong></td>
<td>↓</td>
<td>↓ *</td>
</tr>
<tr>
<td>Control beliefs about learning and self-efficacy for learning</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MSLQ Cognitive and Metacognitive Strategies</strong></td>
<td>↑</td>
<td>↓</td>
</tr>
<tr>
<td>Rehearsal, elaboration, organization, critical thinking,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>metacognitive self-regulation</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MSLQ Resource Management</strong></td>
<td>↑</td>
<td>↑ +</td>
</tr>
<tr>
<td>Time and study environment, effort regulation, peer learning and help seeking</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Satisfaction with Performance</strong></td>
<td></td>
<td>↑</td>
</tr>
<tr>
<td><strong>Satisfaction with Prompts</strong></td>
<td></td>
<td>↓</td>
</tr>
<tr>
<td><strong>Distracted vs. Focused</strong></td>
<td></td>
<td>↓</td>
</tr>
<tr>
<td><strong>Expected Grade</strong></td>
<td></td>
<td>↓</td>
</tr>
<tr>
<td><strong>Confidence in Prediction</strong></td>
<td></td>
<td>↓</td>
</tr>
</tbody>
</table>

* = significance; + = approaching significance

**Differences between the Pilot and Final Study.**

MAI Knowledge rose but did not reach significance during the Pilot Study but dropped significantly during the Final Study. MSLQ Value, as well as Cognitive & Metacognitive Strategies, changed non-significantly in opposite directions.

Several of the differences between the Pilot and Final Studies may be due to the nature of class composition, with 60 percent of the Final Study being graduate students in a graduate course compared to the Pilot Study class composite with no graduate students in a lower-level undergraduate course. The differences between age and year in school were significant when the Pilot Study and the Final Study were compared. The differences were both significant to $p < 0.05$
levels. Studies have consistently shown that age and year in school has an effect on students’ self-regulated learning and metacognition. Young and Fry’s (2012) study supports this explanation, highlighting Schraw’s suggestions that “adult students may differ not so much in their metacognitive knowledge skills but in their metacognitive regulation skills” and that “metacognitive knowledge may develop independently of metacognitive regulation” (as quoted in Young & Fry, 2012, p. 3).

These significant differences between age and level of college experience in the two current studies may be reflected in the effects of the prompts. For example, MAI Knowledge and MSLQ strategy use levels rose (but to an insignificant level) among the largely undergraduate participants of the pilot, while they dropped (significantly for MAI Knowledge and insignificantly for MSLQ strategies) for the Final Study population comprised of 60 percent graduate students. This may be explained by the fact that students in their second and third year of college study are encountering the concepts implicit in the questionnaires and the prompts for the first time and may be experiencing increases in their metacognitive awareness and use.

MSLQ Value also dropped for the Pilot but rose for the Final study (although both to insignificant levels). Though most participants in both studies were taking classes in their majors, graduate students may experience an increase in goal orientations and task values (MSLQ Value) as they move through a semester due to more imminent final goal completion (graduation), while sophomores and juniors may have a slightly more “removed” sense of completion. Graduate students, by the nature of their decision to pursue an advanced degree, may be considered more serious and focused. Both of these characteristics could explain the rise in the Final Study.
Significant differences in the Final Study due to prompts.

MAI Knowledge and MSLQ Expectancy dropped, while MAI Regulation and MSLQ Resource Management rose. The change was significant in both cases. When discussing these changes, two points should be taken into consideration:

- The differences in these constructs are related to the use of prompts in general rather than to the contrast of video to text prompts.
- The composition of these constructs is important when discussing the final study findings. They are outlined in Appendix C and D.

Stage-based nature of SRL.
Some of the significant findings can be seen as revealing the stage-based, cyclical nature of self-regulated learning with metacognition. As the main study progressed, MAI Knowledge and MSLQ Expectancy (use of or knowledge of) dropped. Conversely, MAI Regulation and MSLQ Resource Management rose. These results are not dependent upon the kind of prompts, just that prompts had been used.

Most metacognitive monitoring and self-regulated learning theories include the idea of stages. Pintrich’s model of the Phases and stages of SRL label Phase 1 as forethought, planning, and activation. Stage 2 includes monitoring, and stage 3 control. The changes are also indicative of a move from the Forethought phase with self-motivation, self-efficacy and task value to the Performance Control phase, which includes self-control, metacognitive monitoring, and strategy use. (Refer to the model in Chapter 2.)

Pintrich’s models show efficacy and control beliefs as part of the motivation processes (Pintrich & Zusho, 2007; Pintrich, 2004, p. 33). As that model demonstrates, the control phase for Motivation is selection of management, motivational and affective strategies.
The current study’s rise in regulation at posttest is replicated by De Backer, Van Keer and Valcker’s (2012) study. The stage-based nature of SRL and metacognition can explain this significant change.

These phases fit well with activating knowledge during initial stages of engagement in a task and then dropping the focus on that knowledge and moving deeper into Regulation as a task or class continues. Similarly, with Expectancy as more of a latent and preparation quality, it makes sense that this MSLQ component would drop as a course of study progressed. Conversely, it is equally logical that Resource Management would rise as an academic course progressed and SRL stages progressed.

Further support for this idea comes from Bagheri, Yamini, and Riazi (2009), who found that motivation decreased significantly from pre- to post-tests and “the number of the total resource management strategies exceeded that of cognitive and meta-cognitive, control and regulation strategies” (p. 26). Given that expectancy and motivation are similar, these findings replicate the current study’s results. Preparation declined while the number of strategies used rose, as did Resource Management. This suggestion is further supported by Isaacson and Fujita (2006) who observed that “… students who are expert learners have more than an arsenal of study strategies and the ability to regulate academic resources, they also know when they have mastered, or not mastered, the required academic tasks” (p. 39).

*Timing and stress affect SRL.*

In the current study, the significant drop in MAI Knowledge and MSLQ Expectancy, combined with the rise in MAI Regulation and MSLQ Resource Management, may also represent the effects of timing and stress on the participants. The timing of prompts related to the
school term may also represent the effect of stress. As the amount of learning rises, it may feel as though one’s efforts are less and less relevant compared to the growing amount of information and the cumulative semester performance. For example, Schwabe and Wolf (2012) found changes in types of MAI knowledge and learning strategies used as stress increased. Senko and Hulleman (2013) similarly found that students’ judgments about goals and their mastery-approach versus performance-approach orientations were highly amendable to cues in the situation.

**Differences in the Final Study due to video versus text prompts.**

In the Final Study, none of the differences between video and text prompts are significant. Satisfaction with performance rose but was non-significant from the text prompt trial to the video prompt trial, while satisfaction with prompts, distractedness, expected grade, and confidence in that prediction all dropped. The decrease in distractedness represents a positive move from distractedness to focus.

**Satisfaction with performance rose.**

Although not significant, the between trial measure “satisfaction with performance” is higher after video prompt trials than after text prompts. The interaction of satisfaction with performance and self-regulated learning is complex, as shown in competing findings. Madonna and Philpot’s (2013) results do not support a relationship between self-efficacy and academic or student satisfaction. Nevertheless, Madonna and Philpot’s results do support evidence for a relationship between self-efficacy, perceived control, self-regulation, and effort. These finding may parallel the current study’s finding in the relationship between self-regulated behaviors and
satisfaction with performance, as compared to academic or student satisfaction. Students in the current study dropped expectancy, which contains the constructs of self-efficacy and control beliefs about learning. However, they increased their regulation (effort and self-regulation in Madonna and Philpot’s study) and especially experienced increased satisfaction when encountering video prompts.

Madonna and Philpot use a scale adapted by Flores (2007) to determine academic satisfaction related to “areas of personal and social development, intellectual skills, and practical or vocational competence” (p. 165). In the current study, the scale used to measure student satisfaction focused on student satisfaction with online learning. It should be noted that the Madonna and Philpot definitions are different from “how satisfied are you with your performance,” which appeared in this study’s Post-trial Confidence and Satisfaction measure.

Vrieling, Bastiaens, and Stijnen (2012) concluded that student teachers benefitted from SRL opportunities and felt more confident after engaging in SRL. Conversely, Kuo, Walker, Belland, and Schroder (2010) found that self-regulated learning was not important in student satisfaction in online learning environments; rather, learner-instructor interaction, internet self-efficacy, and learner-content interactions were good predictors of student satisfaction. Internet self-efficacy may be similar to Computer Comfort in the current study but the other measures in Kuo et al. (2010) were not replicated.

**Distraction and satisfaction with prompts dropped.**

The proximity of the video trial to semester end may provide some explanation for the drop in distractedness between text and video prompts. As noted earlier in this dissertation, a disadvantage of prompts is overload. It is not surprising then that, as distraction decreased,
participants reported less satisfaction with prompts. When there is less need to be reminded to work, prompts may have caused a source of distraction.

The timing of the video trial may also override assumed benefits (as hypothesized earlier) of multimodal video prompts, representing increased learner-instructor or learner-content interaction—especially in online environments—as related to Kuo et al.’s (2010) findings.

*Expected grade and confidence in that prediction.*

The expected grade is the only Confidence and Satisfaction measure that approached significance between the text and the video prompt trials in the Final Study. Stress and the time of the semester may explain some of the drop in expected grade and confidence as participants moved from text-based prompts to video prompts. The video prompt trial occurred the week before finals week, and participant responses about that second trial may have been overshadowed by their judgments about the semester in general. Because of the minimal responses to these post-trial questions in the Pilot Study, there is insufficient data to use for comparison.

Performance prediction and confidence are areas of growing interest in self-regulated learning and metacognitive discussions. Schraw (1994) links actual test performance with metacognitive knowledge as measured by judgments of test performance made before testing. Isaacson and Fujita’s (2006) research highlights the connection between ability to predict test scores and academic achievement (p. 41) but also reveals that students whose self-efficacy is consistently higher than the mean tend to have lower scores than those whose self-efficacy is less than the mean. They conclude that “students who use the feedback they receive from taking a test to adjust their self-efficacy are more likely to do better on tests across the semester” (p. 47-
Their finding may provide an alternative positive interpretation for the drop in expected grade and confidence in that prediction experienced in the Final Study. Perhaps the drop indicated either a realistic measure of current standing or achievement, or a proactive overly negative drop in assessment in order to prepare for continued learning.

The interaction between self-monitoring, self-efficacy in self-regulated learning, and metacognitive monitoring provides a rich area of future research. Gutierrez and Schraw (2014) suggest that calibration accuracy is an adaptive skill that can be increased with instruction and practice. Azevedo et al. discuss about the micro-levels of confidence: Feeling of Knowing (FOK), Judgment of Learning (JOL), Monitoring Use of Strategies (MUS), Self-test (ST), Monitoring Progress Toward Goals (MPTG), Time Monitoring (TM), and Content Evaluation (CE). Buratti and Allwood (2012) assert that regulating the realism of confidence can be considered a form of meta-metacognition in which second-order confidence judgments are used to evaluate the accuracy of the first-order confidence judgments. While the current study touched upon these areas, further research is recommended.

**Recommendations for further research.**

The recommendations for further research that emerged from this study include the following:

- Perform a longer study with sufficient participants for a control group and groups who receive video versus text prompts.
- Use prompting activities that are completely integrated into the course so they require no extra effort to activate and are timed to the completion of course activities.
• Complete research in a stabilized course or in several courses during the same semester so the influence of environmental factors can be reduced.

• Compare the complexity of prompts within the text versus video modes. For example, research the differences between prompt length, number of prompts presented per unit, and whether the prompts require a response or not.

• Start prompt activity from the beginning of the course.

Moreover, online-only courses are beginning to be replaced by blended courses. Whatever the impetus for this, prompting in a blended course will require additional research.

**Recommendations for theory and practical learning.**

From these studies emerge the following recommendations for teaching and learning.

Instructors must continue to work with undergraduates—specifically lowerclassmen—to determine what will hook them into sustained interaction with the learning in their courses. This seems particularly apropos for male students.

Technology provides great connectivity, storage, and presentation possibilities, as well as adaptive interactions. Teachers need to manage these potentially rich online and blended class spaces to achieve a beneficial balance of ill-structured problems and desirable difficulties, in addition to an organizing structure and “noise-filtering” options. Instructors need to provide an environment conducive to the training and prompting of metacognitive monitoring and self-regulated learning and scaffolding from teacher-led to student-led learning that will support the lifelong learning required in the 21st century.

Teaching has always been about scaffolding a teacher’s knowledge in order to transfer it to students, while also prompting students to interact with the information and make it their own.
Prompting students toward success is never more crucial than now with the increase of online courses, where direct teacher-students interactions are reduced, and in a 21st-century world where information grows exponentially.
References


*International review of research in open and distance learning, 9*(2), 7.


doi:10.1016/j.jaccedu.2011.10.003

Hooker, J. F. (2010, January 1). Teacher immediacy research, instructional delivery method, topic relevance, and cognitive and affective learning: An experimental investigation. West Lafayette, IN: Purdue University.


Kaufmann, P. B., & Mohan, J. (2009). Video use and higher education: Options for the future, Copyright Clearance Center/Intelligent Television/New York University. 10.08.10.


Appendix A: IRB

IRB Checklist
THE UNIVERSITY OF MONTANA-MISSOULA
Institutional Review Board (IRB)
for the Use of Human Subjects in Research

ONLINE SURVEY
(SurveyMonkey, Select Survey, Qualtrics, etc.)

Statement of Confidentiality

When developing the online survey instrument for my project, “Video prompts for self-regulated learning: Metacognition and reflection activity,” my signature below certifies that:

1) I will design my online survey so that the front page of the instrument includes the project description, a risk/benefit statement, and contact information for questions. Participants will not be forced to respond to a question before being able to move on to the next question. Participation was clearly voluntary and subjects’ consent was implied by their proceeding into the survey; and,

2) If my survey is anonymous,
   a. I will provide the URL link to the survey via a hand-out, or in the body of an email, but will not send it electronically through a feature of the survey software; and
   b. I will not include any potentially identifiable technical data (e.g., IP address) in my collection configuration. If, however, I am unable to deselect and technical data are captured by default, I, as the instrument designer, will destroy it immediately. As a result, I was the only one (of my research team, if applicable) to see these data, and it will not be used it in any way.

The highest form of online security available utilizes secure sockets layer (SSL) and ensures data are transmitted in an encrypted fashion. Select Survey does not use SSL, and for some survey software (e.g., SurveyMonkey), this security is available only via purchase.

The survey software I am using is _______ Select Survey_______

It utilizes SSL: _____ Yes _____ No
Signature of Principal Investigator  Date

I AM AWARE that electronic submission of this form from my University email account constitutes my signature.
Appendix B: Prompts for Study

Goals

Product goals was included as unit goals by the instructor. Process goals was indicated by the following introductory statement used for both trials/units.

This semester a doctoral student was conducting research in both sections of this course on self-regulated learning strategies. During two course learning units, you was prompted to consider aspects of your own learning, such as watching how your study and comprehension is going, expanding upon what you are learning, and using critical thinking. These prompts are built into this course’s Moodle shell and require a response from you. When you receive the prompt reminder in email, please click on the provided link. You was placed in the course. Please respond to these prompts that same day (summer)/within 48 hours of seeing them (fall). You will also receive an email in case you haven’t logged during the appropiate time. A final reflective prompt will occur just as the unit is finishing. You will need to respond to this prompt in order to submit your unit assignment. As with much research, you was asked to fill out questionnaires at the beginning and end of class and a short questionnaire about and immediately following the two learning units. The researcher and I appreciate your cooperation. We both believe that your learning and study skills can be augmented by your participation. You can ask me questions about how this affects the course content. You can ask the researcher, janet.sedgley@umontana.edu, questions about her research if you wish. She has taught online and face-to-face classes at UM and Missoula College and
has worked in Information Technology at UM for 26 years. She has tried to make this experience as “user-friendly” for you as possible.

**Prompts**

**Phase 1: Forethought, planning and activation**
- Product goals: part of unit content, determined by instructor
- Process goals: The students will receive this message when the course opens:

“This semester a doctoral student was conducting research in both sections of this course on self-regulated learning strategies. During two course learning units, you were prompted to consider aspects of your own learning. These prompts are built into this course’s Moodle shell and require a response from you. Please respond to these prompts that same day (summer)/within 48 hours of seeing them (fall). You will also receive an email in case you haven’t logged during the appropriate time. As with much research, you were asked to fill out questionnaires at the beginning and end of class and a short questionnaire about and immediately following the two learning units. The researcher and I appreciate your cooperation. We both believe that your learning and study skills can be augmented by your participation. You can ask me questions about how this affects the course content. You can ask the researcher, janet.sedgley@umontana.edu, questions about her research if you wish. She has taught online and face-to-face classes at UM and Missoula College and has worked in Information Technology at UM for 26 years. She has tried to make this experience as “user-friendly” for you as possible.”

- Phase 2 Monitoring & Phase 3 Control
○ Monitoring (MAI): Please consider which main points have you already understand well and which you have not understood yet. Enter your response in the area provided. (adapted from Nückles, Hübner, & Renkl, 2009, p. 260).

○ Metacognitive self-regulation (MSLQ)
  - Please respond in the area provided to this question: What do you do when reading and studying for this course? (General Strategies)
  - What do you do when you become confused or uncertain about what you are learning? Please respond in the area provided. (Clarification Strategies) (designed for current study from MSLQ items)

○ Critical thinking (MSLQ):
  - Please respond in the area provided to this question: What do you do when you find yourself questioning things from this course if a theory, interpretation, assertion, or conclusion is presented? (designed for current study from MSLQ items)

---

1 From three MSLQ Metacognitive Self-regulation items also used for General Strategies for Learning (GSL): (1) When reading for this course, I make up questions to help focus my reading; (2) If course materials are difficult to understand, I change the way I read the material; and (3) I ask myself questions to make sure I understand the material I have been studying in this class.

2 From three MSLQ Metacognitive Self-regulation items also used for Clarification Strategies for Learning (CSL): (1) When I become confused about something I’m reading for this class, I go back and try to figure it out; (2) When studying for this course I try to determine which concepts I don’t understand well; and (3) When I get confused taking notes in class, I make sure I sort it out afterwards.

3 From three MSLQ Critical Thinking items: I often find myself questioning things I hear or read in this course to decide if I find them convincing; when a theory, interpretation, or conclusion is present in a class or in the readings, I try to decide if there is good supporting evidence; and whenever I read or hear an assertion or conclusion in this class, I think about possible alternatives.
- Please consider this question: Do you treat course material as a starting point and try to develop your own ideas about it? Please respond in the area provided. (designed for current study from MSLQ items)

- Phase 4 Reaction and reflection
  - Did I approach my goals? Can I remember, explain, and apply what I learned?
    (Bannert & Reismann, 2012, p. 200)
  - Check your understanding at the end of learning. Mention your goals and task.
    (Bannert & Reismann, 2012, p. 200)
  - Recap the most important parts in your own words and create a diagram or a list of content. (Bannert & Reismann, 2012, p. 200)
  - Use the next 15 minutes for reflection. Reflect critically on the course and outcome of your problem-solving process. (Ifenthaler, 2012, p. 43)

Although the prompts should be integrated in the course content, they should also be distinctive from other course activities – aka as prompts. Thus standard elements, such as forums, was avoided for use as prompts due to their generalized use as discussion arenas. Other elements, such as quizzes, was avoided because they cannot include videos. The selected format for the prompts was a combination of a:

- Moodle web page that can host a video (or replicate that step without the video for the written prompt condition) and a link to the
- subsequent input form.

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4 From one MSLQ Critical Thinking items: I treat the course material as a starting point and try to develop my own ideas about it.
Design of the Prompts

The researcher assisted the teacher in creating the videos, which was transcribed word-for-word and used as the written prompts. The teacher was responsible for the 1-4 introductory
The reflection prompt followed the same design of the metacognitive prompts. The reflective prompt was completed before the final assignment for the unit was released (as shown in Figure 4). After it is completed, the students saw the following screen:
Appendix C: Motivated Strategies for Learning Questionnaire (MSLQ)

Information included below is condensed from the Motivated Strategies for Learning Questionnaire Manual,

Composition and Term Definition

The MSLQ is composed of the following scales, components, and items:

Motivation Scales:

**Value Components:**
- Intrinsic goal (IG)
- Extrinsic goal (EG)
- Task Value (TV)

**Expectancy Components:**
- Control Beliefs (CB)
- Self-efficacy (SE)

Affective Components:
- Test Anxiety (TA)

**Learning Strategy Scales**
- Cognitive & Metacognitive Strategies
  - Rehearsal (R)
  - Elaboration (E)
  - Organization (O)
  - Critical thinking (CT)
  - Metacognitive Self-Regulation (MSR)

**Resource Management Strategies**
- Time & Study Management (TSM)
- Effort Regulation (ER)
- Peer Learning (PL)
- Help Seeking (HS)

The bolded items are the focus of this study.

Value Component - Intrinsic Goal Orientation: Goal orientation refers to the student’s perception of the reasons why she is engaging in a learning task. On the MSLQ, goal orientation refers to a student’s general goals or orientation to the course as a whole. Intrinsic goal orientation concerns the degree to which the student perceives herself to be participating in a task for reasons such as challenge, curiosity, and mastery. Having an intrinsic goal orientation toward an academic task indicates that the student’s participation in the task is an end all to itself, rather than participation being a means to an end.
Value Component – Extrinsic Goal Orientation: Extrinsic goal orientation complements intrinsic goal orientation and concerns the degree to which the student perceives herself to be participating in a task for reasons such as grades, rewards, performance, evaluation by others, and competition. When one is high in extrinsic goal orientation, engaging in a learning task is the means to an end. The main concern the student has is related to issues that are not directly related to participating in the task itself (such as grades, rewards, comparing one’s performance to that of others). Again, this refers to the general orientation to the course as a whole.

Expectancy Component – Control of Learning Beliefs: Control of learning refers to students’ beliefs that their efforts to learn will result in positive outcomes. It concerns the belief that outcomes are contingent on one’s own effort, in contrast to external factors such as the teacher. If students believe that their efforts to study make a difference in their learning, they should be more likely to study more strategically and effectively. That is, if the student feels she can control her academic performance, she is more likely to put forth what is needed strategically to effect the desired changes.

Expectancy Component – Self-Efficacy for Learning and Performance: The items comprising this scale assess two aspects of expectancy: expectancy for success and self-efficacy. Expectancy for success refers to performance expectations, and relates specifically to task performance. Self-efficacy is a self-appraisal of one’s ability to master a task. Self-efficacy includes judgments about one’s ability to accomplish a task as well as one’s confidence in one’s skills to perform that task.

Cognitive and Metacognitive Strategies - Elaboration: Elaboration strategies help students store information into long-term memory by building internal connections between items to be learned. Elaboration strategies include paraphrasing, summarizing, creating analogies, and generative note-taking. These help the learner integrate and connect new information with prior knowledge.

Cognitive and Metacognitive Strategies - Organization: Organization strategies help the learner select appropriate information and also construct connections among the information to be learned. Examples of organizing strategies are clustering, outlining, and selecting the main idea in reading passages. Organizing is an active, effortful endeavor, and results in the learner being closely involved in the task. This should result in better performance.

Cognitive and Metacognitive Strategies - Critical Thinking: Critical thinking refers to the degree in which students report applying previous knowledge to new situations in order to solve problems, reach decisions, or make critical evaluations with respect to standards of excellence.

Cognitive and Metacognitive Strategies - Metacognitive Self-Regulation: Metacognition refers to the awareness, knowledge, and control of cognition. We have focused on the control and self-regulation aspects of metacognition on the MSLQ, not the knowledge aspect. There are three general processes that make up metacognitive self-regulatory activities:
planning, monitoring, and regulating. Planning activities such as goal setting and task analysis help to activate, or prime, relevant aspects of prior knowledge that make organizing and comprehending the material easier. Monitoring activities include tracking of one’s attention as one reads and self-testing and questioning: these assist the learner in understanding the material and integrating it with prior knowledge. Regulating refers to the fine-tuning and continuous adjustment of one’s cognitive activities. Regulating activities are assumed to improve performance by assisting learners in checking and correcting their behavior as they proceed on a task.

Table 22. Correlations Among MSLQ Subscales (Pintrich, Smith, Garcia, & McKeachie, 1993)

<table>
<thead>
<tr>
<th></th>
<th>Intr</th>
<th>Extr</th>
<th>Tskv</th>
<th>Cont</th>
<th>Slfef</th>
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<tr>
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<td>Tskv</td>
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<td>Tanx</td>
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<tr>
<td>Hsk</td>
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<td>.00</td>
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</tbody>
</table>
Figure 2. Measurement model for cognitive strategy scales (standardized solution). Goodness of fit indices for this model are as follows: GFI = .78; AGFI = .75; $\chi^2/df = 2.26$; RMR = .08.

Figure 16. MSLQ Goodness of Fit Indices (Pintrich, Smith, Garcia, & McKeachie, 1993)
Descriptive Statistics, Internal Reliability Coefficients, and Correlations with Final Course Grade for Motivation and Learning Strategy Scales

<table>
<thead>
<tr>
<th>Scale</th>
<th>M (SD)</th>
<th>Coefficient Alpha</th>
<th>r with Final Course Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Motivation Scales</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intrinsic Goal Orientation</td>
<td>5.03 (1.09)</td>
<td>.74</td>
<td>.25</td>
</tr>
<tr>
<td>Extrinsic Goal Orientation</td>
<td>5.03 (1.23)</td>
<td>.62</td>
<td>.02</td>
</tr>
<tr>
<td>Task Value</td>
<td>5.54 (1.25)</td>
<td>.90</td>
<td>.22</td>
</tr>
<tr>
<td>Control of Learning Beliefs</td>
<td>5.74 (.98)</td>
<td>.68</td>
<td>.13</td>
</tr>
<tr>
<td>Self-Efficacy for Learning and Performance</td>
<td>5.47 (1.14)</td>
<td>.93</td>
<td>.41</td>
</tr>
<tr>
<td>Test Anxiety</td>
<td>3.63 (1.50)</td>
<td>.80</td>
<td>-.27</td>
</tr>
<tr>
<td><strong>Learning Strategy Scales</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rehearsal</td>
<td>4.53 (1.35)</td>
<td>.69</td>
<td>.05</td>
</tr>
<tr>
<td>Elaboration</td>
<td>4.91 (1.08)</td>
<td>.75</td>
<td>.22</td>
</tr>
<tr>
<td>Organization</td>
<td>4.14 (1.33)</td>
<td>.64</td>
<td>.17</td>
</tr>
<tr>
<td>Critical Thinking</td>
<td>4.16 (1.28)</td>
<td>.80</td>
<td>.15</td>
</tr>
<tr>
<td>Metacognitive Self-Regulation</td>
<td>4.54 (.90)</td>
<td>.79</td>
<td>.30</td>
</tr>
<tr>
<td><strong>Time and Study Environment Management</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Effort Regulation</td>
<td>5.25 (1.10)</td>
<td>.69</td>
<td>.32</td>
</tr>
<tr>
<td>Peer Learning</td>
<td>2.89 (1.53)</td>
<td>.76</td>
<td>-.06</td>
</tr>
<tr>
<td>Help-Seeking</td>
<td>3.84 (1.23)</td>
<td>.52</td>
<td>.02</td>
</tr>
</tbody>
</table>

Figure 17. MLSQ Reliability (Pintrich, Smith, Garcia, & McKeachie, 1993)

**MSLQ Instrument**


Part A. Motivation

The following questions ask about your motivation for and attitudes about this class. 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, find the number between 1 and 7 that best describes you.
1. Please indicate which is true for you.

<table>
<thead>
<tr>
<th>1 - not at all true of me</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7 - very true of me</th>
</tr>
</thead>
<tbody>
<tr>
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<td>0</td>
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<td>0</td>
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</tr>
</tbody>
</table>

1. In a class like this, I prefer course material that really challenges me so I can learn new things.
2. If I study in appropriate ways, then I was able to learn the material (in this course.)
3. When I take a test I think about how poorly I am doing compared with other students.
4. I think I was able to use what I learn in this course in other courses.
5. I believe I will receive an excellent grade in this class.

<table>
<thead>
<tr>
<th>1 - not at all true of me</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7 - very true of me</th>
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</table>

6. I am certain I can understand the most difficult material present in the readings (for this course).
7. Getting a good grade in this class is the most satisfying

<table>
<thead>
<tr>
<th>1 - not at all true of me</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7 - very true of me</th>
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<td>0</td>
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</tbody>
</table>
thing for me right now.
8. When I take a test I think about items on the other parts of the test I can't answer.
9. It is my own fault if I don't learn the material (in this course).
10. It is important for me to learn the course material in this class.

1 - not at all true of me  2  3  4  5  6  7 - very true of me

3 Please indicate which is true for you.

11. The most important thing for me right now is improving my overall grade point average, so my main concern in this class is getting a good grade.
12. I'm confident I can understand the basic concepts taught (in this course).

1 - not at all true of me  2  3  4  5  6  7 - very true of me
13. If I can, I want to get better grades in this class than most of the other students.

14. When I take tests I think of the consequences of failing.

15. I'm confident I can understand the most complex material presented by the instructor (in this course).

<table>
<thead>
<tr>
<th>1 - not at all true of me</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<th>6</th>
<th>7 - very true of me</th>
</tr>
</thead>
</table>

4 Please indicate which is true for you.

16. In a class like this, I prefer course material that arouses my curiosity, even if it is difficult to learn.

17. I am very interested in the content area of this course.

18. If I try hard enough, then I will understand (the course material).

19. I have an uneasy, upset
20. I’m confident I can do an excellent job on the assignments and tests in this course.  

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<tr>
<th>1 - not at all true of me</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7 - very true of me</th>
</tr>
</thead>
</table>

21. I expect to do well in this class.
22. The most satisfying thing for me in this course is trying to understand the content as thoroughly as possible.
23. I think the course material in this class is useful for me to learn.
24. When I have the opportunity in this class, I choose course assignments that I can learn from even if they don’t guarantee a good grade.
25. If I don’t understand (the course material),
it is because I didn't try hard enough.

<table>
<thead>
<tr>
<th>1 - not at all true of me</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7 - very true of me</th>
</tr>
</thead>
</table>

6 Please indicate which is true for you.

26. I like the subject matter of this course.
   - [ ] 1
   - [ ] 2
   - [ ] 3
   - [ ] 4
   - [ ] 5
   - [ ] 6
   - [ ] 7

27. Understanding the subject matter of this course is very important to me.
   - [ ] 1
   - [ ] 2
   - [ ] 3
   - [ ] 4
   - [ ] 5
   - [ ] 6
   - [ ] 7

28. I feel my heart beating fast when I take an exam.
   - [ ] 1
   - [ ] 2
   - [ ] 3
   - [ ] 4
   - [ ] 5
   - [ ] 6
   - [ ] 7

29. I'm certain I can master the skills being taught (in this class).
   - [ ] 1
   - [ ] 2
   - [ ] 3
   - [ ] 4
   - [ ] 5
   - [ ] 6
   - [ ] 7

30. I want to do well in this class because it is important to show my ability to my family, friends, employer, or others.
   - [ ] 1
   - [ ] 2
   - [ ] 3
   - [ ] 4
   - [ ] 5
   - [ ] 6
   - [ ] 7

31. Considering the difficulty of this course, the teacher and my skills, I think I will do well in this class.
   - [ ] 1
   - [ ] 2
   - [ ] 3
   - [ ] 4
   - [ ] 5
   - [ ] 6
   - [ ] 7
Part B.
Learning Strategies

The following questions ask about your learning strategies and study skills for this class. Again, there are no right or wrong answers. Answer the questions about how you study in this class as accurately as possible. Use the same scale to answer the remaining 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, find the number between 1 and 7 that best describes you.

7 Please indicate which is true for you.

<table>
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<th>1 - not at all true of me</th>
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<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7 - very true of me</th>
</tr>
</thead>
<tbody>
<tr>
<td>32. When I study the readings for this course, I outline the material to help me organize my thoughts.</td>
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<tr>
<td>33. During class time I often miss important points because I'm thinking of other things. (Reversed)</td>
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<td>34. When studying for this course, I often try to explain the material to a classmate or a friend.</td>
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<td>35. I usually study in a place where I can</td>
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</table>
concentrate on my course work.

36. When reading for this course, I make up questions to help focus my reading.

1 - not at all true of me  2  3  4  5  6  7 - very true of me

8 Please indicate which is true for you.

37. I often feel so lazy or bored when I study for this class that I quit before I finish what I planned to do (reversed).

38. I often find myself questioning things I hear or read in this course to decide if I find them convincing.

39. When I study for this class, I practice saying the material to myself over and over.

40. Even if I have trouble learning the material in this class, I try to do the work on my own, without help.
from anyone.
(reversed)

9 Please indicate which is true for you.

<table>
<thead>
<tr>
<th></th>
<th>1 - not at all true of me</th>
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<th>4</th>
<th>5</th>
<th>6</th>
<th>7 - very true of me</th>
</tr>
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<tbody>
<tr>
<td>41. When I become confused about something I'm reading for this class, I go back and try to figure it out.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
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<td>○</td>
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</tr>
<tr>
<td>42. When I study for this course, I go through the readings and my class notes and try to find the most important ideas.</td>
<td>○</td>
<td>○</td>
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<td>○</td>
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<tr>
<td>43. I make good use of my study time for this course.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
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<tr>
<td>44. If course materials are difficult to understand, I change the way I read the material.</td>
<td>○</td>
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<tr>
<td>45. I try to work with other students from this class to complete the course assignments.</td>
<td>○</td>
<td>○</td>
<td>○</td>
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</tbody>
</table>
10 Please indicate which is true for you.

<table>
<thead>
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<th>1 - not at all true of me</th>
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<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7 - very true of me</th>
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</thead>
<tbody>
<tr>
<td>46. When studying for this class, I read my class notes and the course readings over and over again.</td>
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<tr>
<td>47. When a theory, interpretation, or conclusion is present in class or in the readings, I try to decide if there is good supporting evidence.</td>
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<td>48. I work hard to do well in this class even if I don’t like what we are doing.</td>
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<td>49. I make simple charts, diagrams, or tables to help me organize course material.</td>
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</tr>
<tr>
<td>50. When studying for this course, I often set aside time to discuss the course material with a group of students from the class.</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
11. Please indicate which is true for you.

<table>
<thead>
<tr>
<th></th>
<th>1 - not at all true of me</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7 - very true of me</th>
</tr>
</thead>
<tbody>
<tr>
<td>51. I treat the course material as a starting point and try to develop my own ideas about it.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>52. I find it hard to stick to a study schedule (reversed).</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>53. When I study for this class, I pull together information from different sources, such as lectures, readings, and discussions.</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>54. Before I study new material thoroughly, I often skim it to see how it is organized.</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>55. I ask myself questions to make sure I understand the material I have been studying in this class.</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
12 Please indicate which is true for you.

<table>
<thead>
<tr>
<th>Item</th>
<th>1 - not at all true of me</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7 - very true of me</th>
</tr>
</thead>
<tbody>
<tr>
<td>56. I try to change the way I study in order to fit the course requirements and the instructor's teaching style.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>57. I often find that I have been reading for class but don't know what it was all about (reversed).</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>58. I ask the instructor to clarify concepts I don't understand well.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>59. I memorize key words to remind me of important concepts in this class.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>60. When course work is difficult, I give up or only study the easy parts (reversed).</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

13 Please indicate which is true for you.

<table>
<thead>
<tr>
<th>Item</th>
<th>1 - not at all true of me</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7 - very true of me</th>
</tr>
</thead>
<tbody>
<tr>
<td>61. I try to think through a</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
topic and decide what I am supposed to learn from it rather than just reading it over when studying.

62. I try to relate ideas in this subject to those in other courses whenever possible.

63. When I study for this course, I go over my class notes and make an outline of important concepts.

64. When reading for this class, I try to relate the material to what I already know.

65. I have a regular place set aside for studying.

1 - not at all true of me  2  3  4  5  6  7 - very true of me

14 Please indicate which is true for you.

66. I try to play around with

1 - not at all true of me  2  3  4  5  6  7 - very true of me
ideas of my own related to what I am learning in this course.

67. When I study for this course, I write brief summaries of the main ideas from the readings and the concepts from the lectures.

68. When I can't understand the material in this course, I ask another student in this class for help.

69. I try to understand the material in this class by making connections between the readings and the concepts from the lectures.

70. I make sure I keep up with the weekly readings and assignments for this course.

1 - not at all true of me   2   3   4   5   6   7 - very true of me

15 Please indicate which is true for you.
116

71. Whenever I read or hear an assertion or conclusion in this class, I think about possible alternatives.

72. I make lists of important terms for this course and memorize the lists.

73. I attend class regularly.

74. Even when course materials are dull and uninteresting, I manage to keep working until I finish.

75. I try to identify students in this class whom I can ask for help if necessary.

76. When studying for this course I try to determine which concepts I don't understand well.

Please indicate which is true for you.
77. I often find that I don't spend very much time on this course because of other activities (reversed).

78. When I study for this class, I set goals for myself in order to direct my activities in each study period.

79. If I get confused taking notes in class, I make sure I sort it out afterwards.

80. I rarely find time to review my notes or readings before an exam (reversed).

81. I try to apply ideas from course readings in other class activities such as lecture and discussion.

1 - not at all true of me  2  3  4  5  6  7 - very true of me

**MSLQ Scoring**

Value Component: Means 0-1.0
• Intrinsic Goal Orientation: 1, 16, 22, 24; 4 items; 4-2428 points
• Extrinsic Goal Orientation: 7, 11, 13, 30; 4 items; 4-28 points

Expectancy Component: 12-84
• Control Beliefs about Learning: 2, 9, 18, 25; 4-28 points
• Self-Efficacy for Learning and Performance: 5, 6, 12, 15, 20, 21, 29, 31; 8-56 points

Cognitive and Metacognitive Strategies
• Elaboration: 53, 62, 64, 67, 69, 81
• Organization: 32, 42, 49, 63
• Critical thinking: 38, 47, 51, 66, 71
• Metacognitive Self-Regulation: 33 R, 36, 44, 54, 55, 56, 57 R, 61, 76, 78, 79

55 with the Value, Expectancy subscales of the Motivation Scales and the Cognitive & Metacognitive Strategies scales

<p>| Motivated Strategies for Learning Questionnaire (MLSQ) (Pintrich, Smith, Garcia, &amp; McKeachie, 1991)–with changes proposed by Lo, Dunn, Mulvenon, &amp; Sutcliffe (2012) to change the Metacognitive Self-regulation and Effort Regulation subscales into two new subscales: General Strategies for Learning and Clarification Strategies for Learning. |
|---|---|---|
| 1. | Changes proposed by Lo, Dunn, Mulvenon, &amp; Sutcliffe (2012) | Metacognitive Self-Regulation | During class time I often miss important points because I'm thinking of other things. (Reversed) |
| 2. | General Strategies for Learning (GSL) – 1 | | When reading for this course, I make up questions to help focus my reading. |
| 3. | Clarification Strategies for Learning (CSL) – 1 | | When I become confused about something I'm reading for this class, I go back and try to figure it out. |
| 4. | General Strategies for Learning (GSL) – 2 | | If course materials are difficult to understand, I change the way I read the material. |
| Deleted | | | Before I study new material thoroughly, I often skim it to see how it is organized. |</p>
<table>
<thead>
<tr>
<th></th>
<th>General Strategies for Learning (GSL) – 4</th>
<th>Deleted</th>
<th>Deleted</th>
<th>Clarification Strategies for Learning (CSL) – 2</th>
<th>Deleted</th>
<th>Clarification Strategies for Learning (CSL) – 3</th>
<th>General Strategies for Learning (GSL) – 3</th>
<th>General Strategies for Learning (GSL) – 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>I ask myself questions to make sure I understand the material I have been studying in this class.</td>
<td>I try to change the way I study in order to fit the course requirements and the instructor's teaching style.</td>
<td>I often find that I have been reading for class but don't know what it was all about (reversed).</td>
<td>I try to think through a topic and decide what I am supposed to learn from it rather than just reading it over when studying.</td>
<td>When studying for this course I try to determine which concepts I don't understand well.</td>
<td>When I study for this class, I set goals for myself in order to direct my activities in each study period.</td>
<td>If I get confused taking notes in class, I make sure I sort it out afterwards.</td>
<td>Even when course materials are dull and uninteresting, I manage to keep working until I finish. (#74)</td>
</tr>
<tr>
<td>6</td>
<td>Effort Regulation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
Appendix D: Metacognitive Assessment Inventory


METACOGNITIVE SCALES

KNOWLEDGE OF COGNITION

1. Declarative knowledge: knowledge about learning and one's cognitive skills and abilities
2. Procedural knowledge: knowledge about how to use strategies
3. Conditional knowledge: knowledge about when and why to use strategies

REGULATION OF COGNITION

1. Planning: planning, goal setting, and allocating resources
   a) Organizing: implementing strategies and heuristics that help one manage information
   b) Information management: organizing, elaborating, summarizing, and selectively focusing on important information
2. Monitoring: online assessment of one's learning or strategy use
3. Debugging: strategies used to correct performance errors or assumptions about the task or strategy use
4. Evaluation: post-hoc analysis of performance and strategy effectiveness
Instrument: Metacognitive Assessment Inventory

We would like you to respond to the questions in this questionnaire by indicating how true or false each statement is about you. If a statement is always true, choose the number 5. Your responses are scored anonymously, so please answer as truthfully as you can.

1. Please select the answer that is truest for you to the right of each item.

<table>
<thead>
<tr>
<th></th>
<th>1 - always false</th>
<th>2 - sometimes false</th>
<th>3 - neutral</th>
<th>4 - sometimes true</th>
<th>5 - always true</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I ask myself periodically if I am meeting my goals.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☒</td>
</tr>
<tr>
<td>2. I consider several alternatives to a problem before I answer.</td>
<td>☐</td>
<td>☐</td>
<td>☒</td>
<td>☐</td>
<td>☒</td>
</tr>
<tr>
<td>3. I try to use strategies that have worked in the past.</td>
<td>☐</td>
<td>☐</td>
<td>☒</td>
<td>☐</td>
<td>☒</td>
</tr>
<tr>
<td>4. I pace myself while learning in order to have enough time.</td>
<td>☐</td>
<td>☐</td>
<td>☒</td>
<td>☐</td>
<td>☒</td>
</tr>
<tr>
<td>5. I understand my intellectual strengths and weaknesses.</td>
<td>☐</td>
<td>☐</td>
<td>☒</td>
<td>☐</td>
<td>☒</td>
</tr>
<tr>
<td>6. I think about what I really need to learn before I begin a task.</td>
<td>☐</td>
<td>☐</td>
<td>☒</td>
<td>☐</td>
<td>☒</td>
</tr>
</tbody>
</table>
2. Please select the answer that is truest for you to the right of each item.

<table>
<thead>
<tr>
<th>Item</th>
<th>1 - always false</th>
<th>2 - sometimes false</th>
<th>3 - neutral</th>
<th>4 - sometimes true</th>
<th>5 - always true</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. I know how well I did once I finish a test.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>8. I set specific goals before I begin a task.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>9. I slow down when I encounter important information.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>10. I know what kind of information is most important to learn.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>11. I ask myself if I have considered all options when solving a problem.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

3. Please select the answer that is truest for you to the right of each item.

<table>
<thead>
<tr>
<th>Item</th>
<th>1 - always false</th>
<th>2 - sometimes false</th>
<th>3 - neutral</th>
<th>4 - sometimes true</th>
<th>5 - always true</th>
</tr>
</thead>
<tbody>
<tr>
<td>12. I am good at organizing information.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>13. I consciously focus my attention on important information.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
14. I have a specific purpose for each strategy I use.
15. I learn best when I know something about the topic.
16. I know what the teacher expects me to learn.
17. I am good at remembering information.

1 - always false  
2 - sometimes false  
3 - neutral  
4 - sometimes true  
5 - always true

4. Please select the answer that is truest for you to the right of each item.

18. I use different learning strategies depending on the situation.
19. I ask myself if there was an easier way to do things after I finish a task.
20. I have control over how well I learn.
21. I periodically review to help me understand important relationships.
22. I ask myself questions about
the material before I begin.

1 - always false  2 - sometimes false  3 - neutral  4 - sometimes true  5 - always true

5. Please select the answer that is truest for you to the right of each item.

23. I think of several ways to solve a problem and choose the best one.
   1 - always false  2 - sometimes false  3 - neutral  4 - sometimes true  5 - always true

   1 - always false  2 - sometimes false  3 - neutral  4 - sometimes true  5 - always true

25. I ask others for help when I don't understand something.
   1 - always false  2 - sometimes false  3 - neutral  4 - sometimes true  5 - always true

26. I can motivate myself to learn when I need to.
   1 - always false  2 - sometimes false  3 - neutral  4 - sometimes true  5 - always true

27. I am aware of what strategies I use when I study.
   1 - always false  2 - sometimes false  3 - neutral  4 - sometimes true  5 - always true

6. Please select the answer that is truest for you to the right of each item.

28. I find myself analyzing the usefulness of strategies while I study.
   1 - always false  2 - sometimes false  3 - neutral  4 - sometimes true  5 - always true
30. I focus on the meaning and significance of new information.

31. I create my own examples to make information more meaningful.

32. I am a good judge of how well I understand something.

33. I find myself using helpful learning strategies automatically.

34. I find myself pausing regularly to check my comprehension.

1 - always false  2 - sometimes false  3 - neutral  4 - sometimes true  5 - always true

7. Please select the answer that is truest for you to the right of each item.

36. I ask myself how well I accomplished my goals once I'm finished.

37. I draw pictures or diagrams to help me understand while learning.

38. I ask myself if I have considered all options after I solve a problem.

1 - always false  2 - sometimes false  3 - neutral  4 - sometimes true  5 - always true
39. I try to translate new information into my own words.  
40. I change strategies when I fail to understand. 

<table>
<thead>
<tr>
<th></th>
<th>1 - always false</th>
<th>2 - sometimes false</th>
<th>3 - neutral</th>
<th>4 - sometimes true</th>
<th>5 - always true</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8. Please select the answer that is truest for you to the right of each item.

41. I use the organizational structure of the text to help me learn.  
42. I read instructions carefully before I begin a task.  
43. I ask myself if what I'm reading is related to what I already know.  
44. I reevaluate my assumptions when I get confused.
45. I organize my time to best accomplish my goals.

<table>
<thead>
<tr>
<th></th>
<th>1 - always false</th>
<th>2 - sometimes false</th>
<th>3 - neutral</th>
<th>4 - sometimes true</th>
<th>5 - always true</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

9. Please select the answer that is truest for you to the right of each item.
<table>
<thead>
<tr>
<th>Question</th>
<th>1 - always false</th>
<th>2 - sometimes false</th>
<th>3 - neutral</th>
<th>4 - sometimes true</th>
<th>5 - always true</th>
</tr>
</thead>
<tbody>
<tr>
<td>46. I learn more when I am interested in the topic.</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>47. I try to break studying down into smaller steps</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>48. I focus on overall meaning rather than specifics.</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>49. I ask myself questions about how well I am doing while I am learning something new.</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>50. I ask myself if I learned as much as I could have once I finished a task.</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>51. I stop and go back over new information that is not clear.</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>52. I stop and reread when I get confused.</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

Questions by Category: Scoring

(1 Always false – 5 Always true)
Knowledge:

- DK. Items  5, 10, 12, 16, 17, 20, 32, 46  (8 items; 8-40 points)
- PK. Items  3, 14, 27, 33  (4 items; 4-20 points)
- CK. Items  15, 18, 26, 29, 35  (5 items; 5-25 points)

Regulation:

- PLAN. Items  4, 6, 8, 22, 23, 42, 45  (7 items; 7-35 points)
- STRAT. Items  9, 13, 30, 31, 37, 39, 41, 43, 47, 48  (10 items; 10-50 points)
- MONITOR. Items  1, 2, 11, 21, 28, 34, 49  (7 items; 7-35 points)
- DEBUG. Items  25, 40, 44, 51, 52  (5 items; 5-25 points)
- EVALUATE. Items  7, 19, 24, 36, 38, 50  (6 items; 6-30 points)
Appendix E: Demographics
Demographic Information: This information is gathered anonymously. Please select the most truthful and correct answer.

1. What is your college status?
   - [ ] Freshman
   - [ ] Sophomore
   - [ ] Junior
   - [ ] Senior
   - [ ] Fifth year undergraduate
   - [ ] First or second year graduate
   - [ ] Third year or higher graduate
   - [ ] Other, please specify

2. Please enter your age. The value must be between 15 and 100, inclusive.

3. Are you female?
   - [ ] Yes
   - [ ] No

4. Please indicate your GPA. (If you don’t know what it is, make an educated guess.)
   The value must be between 0 and 4.0, inclusive.

5. Please indicate whether this course:

<table>
<thead>
<tr>
<th>Agree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>satisfies a major requirement</td>
<td>[ ]</td>
</tr>
<tr>
<td>satisfies a minor requirement</td>
<td>[ ]</td>
</tr>
<tr>
<td>is within your major field</td>
<td>[ ]</td>
</tr>
<tr>
<td>is within your minor field</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

6. Please indicate your level of experience with the subject matter before the course started.
   - [ ] 1 - Novice
   - [ ] 2
   - [ ] 3
   - [ ] 4
   - [ ] 5 - Expert

7. Please indicate your level of comfort with the technology used in this course (Moodle, web browsing, word processing)
   - [ ] Below Average
   - [ ] Average
   - [ ] Above Average
Appendix F: Confidence and Satisfaction


1. Please indicate the answer that was truest for you during the just-completed unit for each of the categories below:

<table>
<thead>
<tr>
<th>How satisfied are you with your current performance?</th>
<th>Extremely dissatisfied</th>
<th>Dissatisfied</th>
<th>Neutral</th>
<th>Satisfied</th>
<th>Extremely satisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How satisfied were you with the reminders that you received?</th>
<th>Extremely dissatisfied</th>
<th>Dissatisfied</th>
<th>Neutral</th>
<th>Satisfied</th>
<th>Extremely satisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Please indicate what was truest for you during the last learning unit.

☐ Very focused
☐ Focused
☐ Neither
☐ Distracted
☐ Very distracted

3. Please indicate the grade you expect to receive in this course. Please answer with a number from 1 to 100. The value must be between 1 and 100, inclusive.

4. Please indicate how confident you are that you will receive this grade. Please answer with a number from 1 to 100, 1 being not at all confident and 100 being completely confident. The value must be between 1 and 100, inclusive.

☐

5. Do you think you have performed a flawless process thus far or have you made any mistakes? Write about your successes and your mistakes.

Done  Save  Cancel
What have you experienced in terms of the prompts that you’ve received? What influenced or affected your experiences of prompting and your use of self-regulated learning and monitoring (metacognition) (Creswell, 2007, p. 61)
# Appendix G: Research Design

Table 23. Time-Related Research Design Details

<table>
<thead>
<tr>
<th>During these weeks</th>
<th>These activities will occur</th>
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<td>Presemester</td>
<td>Course modification and prompt preparation.</td>
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<td>Week 1</td>
<td>Pretesting with demographics and quantitative questionnaires (MSLQ, OSLQ, &amp; MAI)</td>
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<td>Week 2</td>
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<td>Week 3</td>
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<td>Week 4</td>
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<td>Week 5</td>
<td>Monday: Unit goal and process goal reminders</td>
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<td>Week 6</td>
<td>Prompt sequencing as listed above for 1- and 2-week units.</td>
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<td>Prompt responses gathered: (1) analyzed with phenomenological qualitative methods; (2) quantified into the categories of the MSLQ, OSLQ, and MAI questionnaires.</td>
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<td>Just before the end of the trial/unit: Reflective prompt responses gathered: (1) studied through phenomenological qualitative methods; (2) quantified as length, complexity, and number of main ideas; (3) quantified into the categories of # of matches with MSLQ, OSLQ, and MAI qualities.</td>
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<td>At the end of the trial/unit: Unit test or assignment (presented after completion of reflective prompt)</td>
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<td>Immediately following trial/unit: Confidence and satisfaction measures</td>
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<td>Week 12-13</td>
<td>Post-experiment: Final questionnaires (MSLQ, MAI, &amp; OSLQ) done immediately after the second unit/trial and no later than week 13.</td>
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<td>Week 14</td>
<td>All study activity complete except for researcher trace data counts and final data analysis.</td>
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Appendix H: Final Study: Correlation results

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