Instructional Design Interventions for Supporting Self-Regulated Learning: Enhancing Academic Outcomes in Postsecondary E-Learning Environments

Frances A. Rowe
Director of Instructional Design and Technology Support
Quinnipiac University Online
Quinnipiac University
Hamden, CT 06518 USA
frances.rowe@quinnipiac.edu

Jennifer A. Rafferty
Associate Director of Instructional Design
Quinnipiac University Online
Quinnipiac University
Hamden, CT 06518 USA
jennifer.rafferty@quinnipiac.edu

Abstract

Theories and models about self-regulated learning are important to educators attempting to understand why some learners succeed and others have difficulty in academic settings. Understanding self-regulation in e-learning environments is critical because there is much agreement in the literature that e-learning requires a higher degree of self-regulation than face-to-face learning. Furthermore, empirical studies of the effects of self-regulated learning intervention on learning outcomes of students in e-learning environments indicate that support for self-regulated learning fosters significantly higher academic outcomes. In this paper, the authors will focus on: (1) what educators should know about the different types of self-regulated learning interventions that have been studied; and (2) how educators might apply self-regulated learning interventions to the design of e-learning environments in order to support self-regulated learning processes.

Keywords: social cognitive theory, metacognition, cognition, motivation, learning outcomes, academic achievement, self-regulation, constructivism, higher education, online learning, virtual classroom, blended learning, distance learning

Introduction to Self-Regulated Learning

Self-regulation is a process that keeps people focused on monitoring their task completion progress and assists with multiple areas of human functioning, such as management of a chronic illness, athletic training, or learning in academic settings (Bandura, 1991; Caprara et al., 2008). Zimmerman (2000) defines self-regulation as "self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals" (p. 14). Educational researchers in particular have found that students who self-regulate their learning activities perform better than students who do not self-regulate their learning, irrespective of their course of study (Chen, 2002; Pintrich & Degroot, 1990; Pintrich, Wolters, & Baxter, 2000; Zimmerman, Bandura, & Martinez-Pons, 1992).

Self-regulated learning (SRL) is a process that involves students' intentional efforts to manage and direct complex learning activities toward the successful completion of academic goals (Zimmerman & Schunk, 2001). Zimmerman (1989) referred to SRL as the degree to which students are able to become active participants in the process of monitoring their own learning. Pintrich (2000) describes SRL as an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behavior in the services of those goals. Some key self-regulatory processes that affect learning outcomes include goal setting and time management, self-monitoring and reflection, modification of learning strategies, regulation of feedback, help seeking, and resource oriented learning (Bandura, 1991; Pintrich, 2000; Zimmerman & Schunk, 2001; Zimmerman, 1989).

Models and theories of SRL emerged in the 1980s in an effort to describe the attributes of academically successful students (Bandura, 1986; Kuhl, 1984; Pintrich, 2000; Zimmerman, 1989). Zimmerman and Schunk (2001) reviewed various models and theoretical perspectives of SRL, including operant, information processing, and social cognitive. All of these models tend to agree that SRL has cognitive, metacognitive, and motivational components, but theorists differ on which components to emphasize and which are more likely to improve learning outcomes. While operant theorists emphasize the role of external reinforcement in the SRL process, information processing theorists stress the role of memory, tactics, and knowledge. From the social cognitive perspective, SRL is a multidimensional construct that involves interactions between cognitive strategy use, metacognition, and motivation (Bandura, 1986; Kauffman, 2004; Pintrich & De Groot, 1990; Zimmerman, 1989).

Components of SRL

SRL's cognitive component refers to any learning strategies used to accomplish a given task and includes activities that support students' active manipulation of academic content (Kauffman, 2004; Zimmerman, 1989). SRL's metacognitive component involves the knowledge and self-awareness students have to self-monitor their understanding and cognitive processes (Kauffman, 2004; Whipp & Chiarelli, 2004). Metacognitive strategies refer to the skills that help students regulate their cognitive processes (Kauffman, 2008). Almost all SRL models presume that motivation is a key factor of academic success (Pintrich & DeGroot, 1990; Zimmerman, Bandura, & Martinez-Pons, 1992; Zimmerman & Schunk, 2001). Motivation, or the will to learn, involves students' confidence in their abilities to organize tasks and make judgments in executing the necessary course of action to achieve explicit types of outcomes (Kauffman, 2004).

Stages and Processes of SRL in Social Cognitive Theory

Social cognitive theory and research have contributed significantly to our understanding of how SRL, its components, and its processes are developed (Bandura, 1986; Pintrich, 2000; Zimmerman, 2000). Table 1 from Pintrich (2000) illustrates the social cognitive perspective of SRL. In this table, the self-regulatory processes are organized according to four stages: (a) planning and goal setting; (b) self-monitoring; (c) controlling; and (d) reflecting. Within each of these stages, self-regulation processes are structured into four areas: (a) cognition; (b) motivation; (c) behavior; and (d) context. Pintrich's illustration represents a comprehensive sequence that learners progress through as a task is being carried out. The stages produce various interactions among the different SRL processes as described below and as shown in Table 1.

The self-regulating processes begin in the planning stage with essential activities such as goal setting and activation of prior knowledge of the domain. The cognitive area recognizes the resources and strategies that are helpful in addressing the task. Metacognitive awareness recognizes the difficulty of the task and identifies the knowledge and skills needed for addressing the task. Motivational beliefs, such as efficacy for completing the task or value given to the task, influence learner behavior toward the task, such as planning time and effort and the activation of perceptions regarding the task and the contextual area.

Within the self-monitoring stage, learners become aware of their own state of cognition and motivation and use of time and effort, as well as conditions of the task and the context. Processes in this stage include self-observation of comprehension and competency, as well increased awareness of the goals that will subsequently direct behaviors and understanding of how performance will be evaluated.

The activities in the controlling stage embody the selection and utilization of cognitive, metacognitive, and motivational strategies, as well as those strategies related to regulation of diverse academic tasks such as atmosphere and structure of the task.

The final stage of reflecting includes evaluations that learners make regarding execution of the task. Processes in this stage include comparison of the executed task to previously established criteria that were determined by the learner and/or provided by the instructor, internal and external feedback about the results of the task, consequences for the results, behavior to be followed, as well as overall assessments about the task.

Table 1

Stages and Processes of SRL

Stages	Cognition	Motivation	Behavior	Context
Planning and goal setting	Setting target goals	Accepting responsibility for goals	Planning for time, effort, and self-observation	Perceiving the context of the task
	Activating prior knowledge of the domain	Judging confidence for completing the task		
	Recognizing the difficulty of the task	Perceiving the difficulty of the task		
	Identifying knowledge and skills needed for completing the task	Generating interest in the task		
Self-monitoring	Checking for comprehension	Being aware of motivation and interest	Being aware of effort and need to seek help	Checking for changes in the task and context conditions
Controlling	Selecting and adapting strategies for making meaning	Selecting and adapting strategies for controlling motivation and interest	Increasing and decreasing effort	Restructuring the task
			Persevering or giving up	Changing or leaving the context
			Seeking help	
Reflecting	Making judgments about understanding	Having reactions	Analyzing feedback	Assessing the task within the context
		Making acknowledgements		

Note. Stages and processes of self-regulated learning. Adapted from "The role of goal orientation in self-regulated learning". *Handbook of self-regulation* (p. 454), by P. R. Pintrich, 2000, San Diego, CA: Academic Press. Copyright 2000 by Academic Press.

Empirical Studies of SRL Interventions in Post-secondary E-learning Environments

Following is an in-depth review of the different SRL interventions that have been found to enhance learning outcomes in adult e-learning environments. Frequently studied SRL interventions include providing training and prompting students to follow SRL strategies and processes. Prompting is an instructional method for guiding and supporting students to perform a specific activity as part of a learning situation. Essentially, prompts instruct students to stop and reflect on their own thoughts or consider the efficiency of their own learning strategies. Training, by contrast, provides explicit instruction in the components of SRL such as cognition, metacognition, and motivation.

Within this paper, e-learning will serve as an umbrella term that encompasses all forms of computer and web-based learning environments such as interactive and hypermedia, computer-assisted, distance, virtual, web-enhanced, hybrid, blended, and online.

The more recent, empirical studies from post-secondary literature will be referred to in this paper, and rather than review the implications for e-learning environments without SRL intervention, the discussion will focus on: (a) what educators should know about the different types of SRL interventions that have been studied, and (b) how educators might apply SRL interventions to the design of e-learning environments in order to support SRL processes. In all of the studies, the SRL interventions were treated as the independent variable, and the academic outcomes were treated as the dependent variable.

For example, Bannert, Hildebrand, and Mengelkamp (2008) analyzed the learning outcomes of university students in an educational media course who either did or did not receive computer-assisted training on why metacognitive activities are useful and when to apply them. After the training, students completed a learning task that required them to study theories of using multimedia in learning environments and be able to teach these concepts to other students. During the learning task, students in the intervention group were given a diagram visualizing all of the metacognitive activities from the training to serve as a prompt. Immediately after learning, students' academic performance was measured on three different levels by means of recall, knowledge, and transfer to tasks. Students in the intervention group scored significantly higher than the students in the control group on all three levels, especially in transfer to tasks.

Bixler (2008) investigated the effects of reflective question prompts on students' problem-solving processes in a college level online course in information technology. The online learning environment was provided through a learning management system (LMS). The assigned problem was to create a website for a group of band members. Instead of providing students with instructions on how to complete the problem, the online learning screens in the LMS consisted of questions that prompted students to think about the problem and write down their thoughts in a web-based note-taking tool. A typical screen in the LMS displayed the following question prompts:

1. How do I define the problem?
2. What are the parts of the problem?
3. Am I on the right track and how do I know?
4. What information is already provided?
5. What information do I need to generate?

Academic outcomes were measured on four different levels of problem solving by means of: (a) representing the problem; (b) developing solutions; (c) making justifications; and (d) monitoring and evaluation. The results of this study showed that students who worked with reflective question prompts significantly outperformed students who did not work with reflective question prompts in all four levels of problem solving.

Chang (2007) examined the effects of self-monitoring on the learning outcomes of college students in a freshman level, online, English language course. Students in the intervention group were provided with a web-based, self-monitoring prompt, while students in the control group were not. After logging in to the online course, students in the intervention group were prompted to record the starting time, the place they studied, and the person(s) with whom they studied. Students were also asked to predict their score for the post-lesson quiz and adjust time spent on lesson materials in order to improve their score. The self-monitoring prompt was designed to help students better manage their time, evaluate their own learning, and make adaptions as needed in order to improve academic performance. Chang found that the self-monitoring prompts had a significant effect on learning outcomes.

Hu (2007) compared the performance of students who did and did not receive online training about SRL strategies. The participants in this study were undergraduate students in a web-enhanced, college success course. Prior to the intervention, a modified version of the Motivated Strategies Learning

Questionnaire (MSLQ) was used as a pretest to determine students' existing levels of motivation and experience with learning strategies. At the end of the intervention period, the same instrument and questions were used as a post-test to measure students' motivation and reported use of strategies. During learning, students received an online tutorial on the basic concepts of SRL and how to use them in a web-enhanced environment. The tutorial instructed students to plan for completion of assignments, evaluate outcomes, and choose SRL strategies. In this study, Hu found that the students who received the SRL intervention performed significantly higher on the assignments and final exam than the students who did not receive the intervention.

Kauffman (2008) randomly assigned students in an undergraduate case-based, psychology course to one of four conditions in a web-based module: (a) an intervention group that received a metacognitive prompt, designed to focus learner attention on problem identification, and a reflection prompt, designed to elicit learner confidence in their identification of the problem, along with opportunities to make revisions to their answer; (b) an intervention group with metacognitive prompts only; (c) an intervention group with reflection prompts only; or (d) a control group that did not receive any metacognitive or reflection prompts. Overall, Kauffman found that students who received metacognitive prompts were better problem solvers and wrote higher quality responses than students who did not. Likewise, students who received reflection prompts were also better performers, but only when they received metacognitive prompts.

Kauffman, Zhao, and Yang (2011) investigated conditions under which note-taking methods and self-monitoring prompts were most effective for facilitating information collection and achievement in an undergraduate level, web-enhanced course in educational psychology. Students took notes using matrix, outline, or conventional methods in a web-based form. The main page of the form provided a brief introduction to the topic and instructed students to take notes from the linked web-based tutorials in preparation for a series of tests on statistical procedures. In each of the three note-taking methods, there was a self-monitoring group and a no self-monitoring group. The self-monitoring groups received prompts that encouraged them to monitor their progress. The prompts were inserted at the end of the web-based tutorial and just prior to the test questions. In the prompts, students were provided with a sample test question and asked if they wanted to move forward to the test or return to the web-based tutorials. Students could also review their notes. The results of this study revealed five main effects: (a) matrix note takers collected more notes than outline note takers, who collected more notes than conventional note takers; (b) students who received self-monitoring prompts collected more notes than students who did not receive self-monitoring prompts; (c) the presence of self-monitoring prompts increased note taking in conventional note takers more than it did in matrix note takers; (d) students who used the matrix note taking tool scored significantly higher on the test than students who used the outline or conventional note taking tools; and (e) students who received the self-monitoring prompts significantly outperformed students on the test than students who did not receive the self-monitoring prompts.

Saito and Miwa (2007) examined the effects of self-reflection prompts on learning outcomes of university students in a freshman level, web-enhanced course in information fluency. Students in the intervention group were prompted to complete reflective exercises as part of their Internet searching process while students in the control group were not. The design of the intervention included a search-process feedback system with two types of reflection: (a) a schematic visualization of the search process and (b) question prompts designed to help students reflect on their own search processes presented by the system. For example, students were asked what kinds of keywords were used and how these keywords were combined, how many results of search pages were browsed per search and how many links per page were clicked. The results of this study indicated that the students who engaged in reflective exercises as part of their Internet searching process significantly outperformed students who did not.

Santhanam, Sasidharan, and Webster (2008) randomly assigned students in an undergraduate business course in Web design to one of four conditions during an online module: (a) an intervention group that received pre-training and midpoint scripts designed to encourage students to follow SRL strategies; (b) an intervention group with SRL pre-training scripts only; (c) an intervention group with SRL midpoint scripts only; or (d) a control group that did not receive any SRL information. Student learning outcomes were measured by a declarative knowledge test and a hands-on performance task.

Santhanam et al. found a significant difference in learning achievement for the group that received pre-training and midpoint scripts with SRL information.

Schober, Spiel, Reimann, and Wagner (2008) evaluated the effects of online modules designed to prompt university students in a psychology course to learn more effectively by completing different tasks. The modules were based in SRL principles and structured according to the phases of activation, action, and reflection from Zimmerman (2000). Upon logging in to a module, students in the intervention group were provided with a description of the module and a question that activated prior knowledge of the subject. Students in the control group did not receive the online modules. Goals specifying the learning objectives of the module were provided followed by any projects that needed to be accomplished. A project deliverable checklist was provided for the group project. The instructor, group members, and peer groups gave group specific feedback about the project deliverables. Self-tests allowed students to individually monitor their understanding of the concepts during the module. The module culminated with students reflecting on their ability to plan, organize, and complete projects individually and in groups. Academic achievement was measured on three different levels by means of recall, comprehension, and production. Students in the intervention group achieved better results in completing more complex "comprehension" and productive "production" items.

Shen, Lee, & Tsai (2007) randomly assigned college freshmen in a web-enabled computer software applications course to one of four groups: (a) SRL with problem-based learning; (b) SRL only; (c) problem-based learning only; or (d) no SRL or problem-based learning. The SRL groups received a two-hour training on how to manage study time and self-regulate their learning. Content of the SRL training was on the following four processes: (a) self-evaluation and monitoring; (b) goal setting and strategy planning; (c) strategy implementation; and (d) monitoring the outcome of the strategy. Students were taught how to apply these four processes to become more self-regulated learners. Additionally, students were required to record their learning behavior on a weekly basis. The problem-based learning (PBL) group received an authentic problem situation along with a web-based multimedia application that helped students construct their own models for problem solving. Student learning outcomes were measured by their skills in using the application software to create graphs and tables with accuracy and artistry. Overall, Shen, et al. (2007) found that the students who received the SRL intervention performed significantly better than students who did not. Likewise, students who received the PBL intervention were also better performers, especially when they received it in combination with the SRL intervention.

Tsai, Shen, and Tsai (2011) explored the effects of providing students with SRL training and web-enabled prompts in a college level, blended course in database management. Delivered in the classroom, the SRL training discussed how students could manage study time and regulate their learning by implementing four SRL processes: (a) self-evaluation and monitoring; (b) goal setting and strategy planning; (c) strategy implementation; and (d) monitoring of the outcome strategy. Students recorded the data of their learning behaviors in the course website. In the assessment section of the course website, assignment link prompts instructed students to submit by certain due dates and then became unavailable when the time was up. To measure the learning outcomes, students were required to solve simulated problems by designing and building a database for a customer. The results of this study revealed that students' skills in using database management software were significantly higher when they received SRL training and SRL web-enabled prompts.

Researchers seem to agree that embedding SRL prompts within the course design has a positive effect on student learning. These empirical studies of SRL interventions strongly suggest that there are benefits for students' academic success when SRL prompts or training are incorporated into the design of e-learning environments. Instructional design, therefore, can play a key role in supporting and expanding the use of SRL interventions in this context. An important practical implication of these studies is that self-regulation could be incorporated into already established standards and models for e-learning course design.

Recommendations and Conclusions

While it may seem challenging to apply SRL interventions to the design of

e-learning environments, there are multiple prompting and training strategies that can be employed toward achieving this goal. Both pedagogical interventions as well as the design of learning activities and course content can take advantage of a vast array of software and tools that are readily available through a LMS. It is important to acknowledge when considering these recommendations, however, that attention should be placed on the learning objectives and pedagogical goals and not the tool, as a number of other technologies can be configured to accomplish the same task. Following are specific examples of tools and instructional design interventions, along with practical advice for encouraging and supporting SRL.

First, online discussion boards, journals, and Wikis are all tools that can be used to activate the SRL processes of planning, self-monitoring, and reflection. The Wiki feature provides a collaborative area where learners can be prompted to: (a) define a problem; (b) generate possible solutions; (c) make arguments for solutions; (d) take next steps and consider steps an expert would take; (e) identify what information is needed to solve the problem; (f) view examples that are related to the problem; and (g) share points of view with peers about how to approach the problem.

Electronic journals, typically used for student to instructor communication, can be employed to elicit reflection about difficulties that students encounter or strategies that facilitate learning. For example, students might be asked:

1. What did I learn in this module?

2. How did I learn the material?

3. How confident am I about my knowledge of this module?

4. What was challenging for me in learning the material?

5. What strategies helped me learn the material?

6. What changes will I make in my approaches to studying for the upcoming module?

Comparably, a discussion board can be used at the onset of a course to trigger the SRL processes of planning and goal setting. Students can be prompted to engage in a dialogue about their goals and expectations, study strategies, and learning styles. An inventory such as the Visual, Aural, Read/Write, Kinesthetic (VARK) questionnaire, will help students identify their learning preferences before they share this information in the discussion board. Once students have shared their own profile, they can be prompted to interact with their peers to compare study strategies and summarize learning style trends for the class.

Second, the design of learning activities and course content can play a major role in stimulating SRL processes. The syllabus, for example, should provide a detailed road-map for the student who navigates through course content and deliverables in an e-learning environment. Setting the stage for students, the syllabus relays important details about course requirements, deadlines, and academic policies. Careful thought should be given to the way in which this information is presented and how students can better retain it. For example, to reinforce the organization and timing of assignment due dates, a syllabus can include a graphic prompt that illustrates patterns in course assignment due dates. Table 2 illustrates how a two-week module could be depicted to learners in a course syllabus. Instructors can call upon this visual aid when creating a syllabus overview presentation.

Table 2

Module Requirements

2 Week Module	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Week 1	Syllabus quiz	Metacognitive self-assessment (familiarity with course concepts)		Comprehension check	Blog post		Paper
Week 2	Response to blog posts				Module quiz		Partner activity

To make the most of this kind of graphic, an instructor can visually display the table at the onset of a course in a voice over presentation that covers syllabus content. The instructor's narration and computer screen can be recorded using a screen capture tool or some other multimedia presentation application. For further reinforcement, learners can be evaluated for their understanding of course syllabus by incorporating an assessment with multiple choice and true false questions. Figure 1 illustrates examples of questions from a "syllabus scavenger hunt," which can be deployed using the test feature of a LMS. Students can then be prompted to check and evaluate their own test results. Test settings to consider include: (a) the availability of the assessment such as time limit and date range; (b) number of attempts; and (c) feedback options. These kinds of pedagogical interventions and learning activities on course policies and assignment deadlines will encourage the SRL processes of planning and goal setting before students have been immersed in the discipline-specific content of the course.

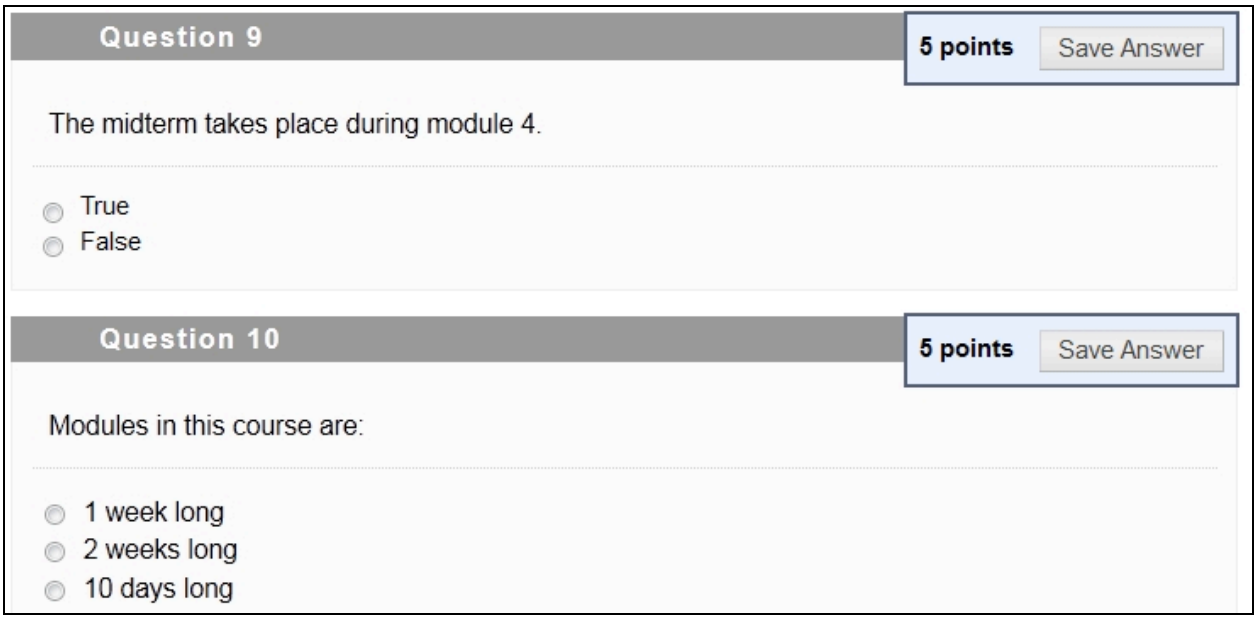

Figure 1. Sample questions from a syllabus scavenger hunt.

Third, testing for prior knowledge is a cognitive intervention that can easily be integrated through a LMS. Students can be introduced to the learning objectives of a given module, and then they can be prompted

to take a short survey to gauge their familiarity with the module concepts. This kind of learning activity will assist students in the process of planning as they identify the skills that will be needed to carry out the assignments in the module. The assessment also draws on the SRL processes of controlling and reflecting as students must select strategies and assess their level of understanding. Figure 2 illustrates a question format that prompts students to determine their level of familiarity with content that they will encounter. The prior knowledge assessment serves as a primer, and it is the first activity students complete upon starting a new module. Prior knowledge assessments can also be designed to test students' actual knowledge of the learning outcomes so that they have a starting point from which to approach the course material.

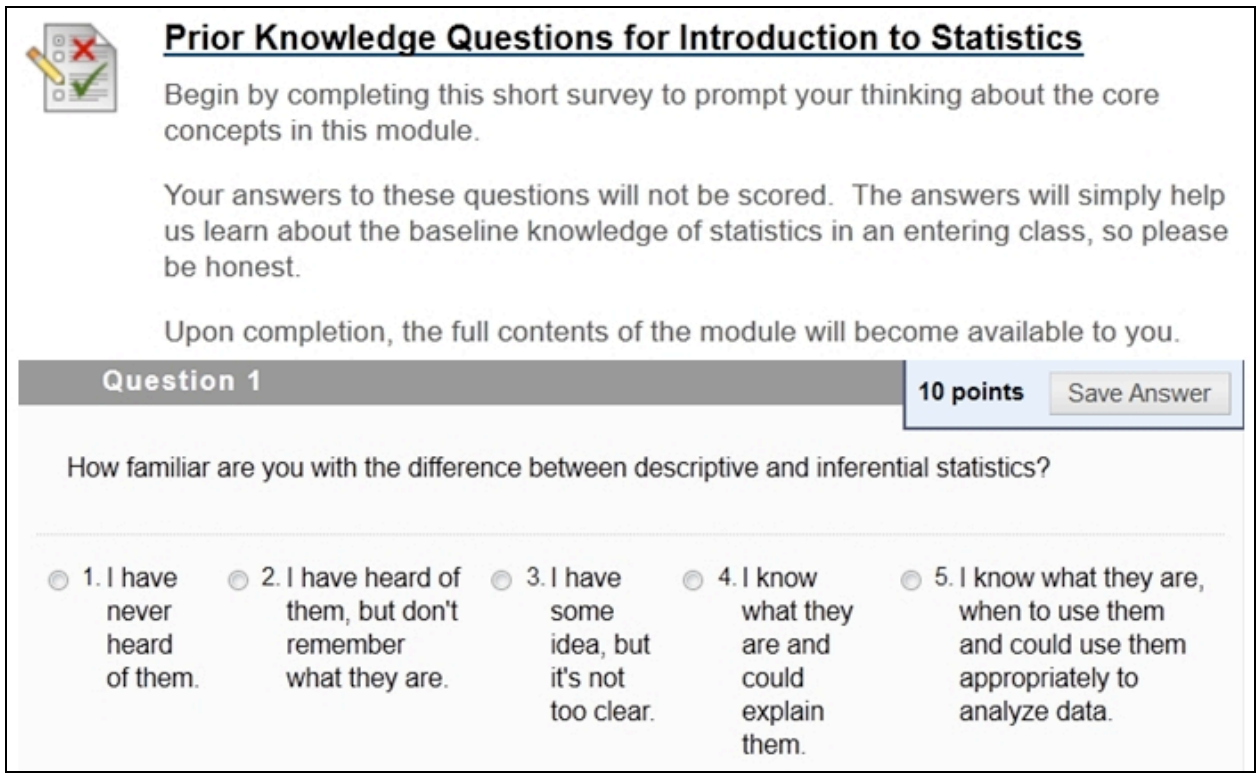

Figure 2. Sample prompt and question from an assessment of prior knowledge.

Fourth, another approach that can be taken for supporting SRL in e-learning environments is to provide explicit training on skills associated with the SRL processes.

For example, the authors of this paper created a video series on the topic of time management to encourage student reflection on behaviors that lead to academic success.

The videos could be integrated into the course activities in multiple ways:

- embedding the video link in an online course and integrating its content into the learning objectives during the first week of the course,
- requiring students to watch the videos and take a short follow-up quiz on the content,
- creating a discussion board activity that prompts students to discuss the content of the video, or
- attaching the videos to instructor commentary when providing feedback to students.

Another SRL training approach could be to have students respond to statements about their study habits as shown in Figure 3.

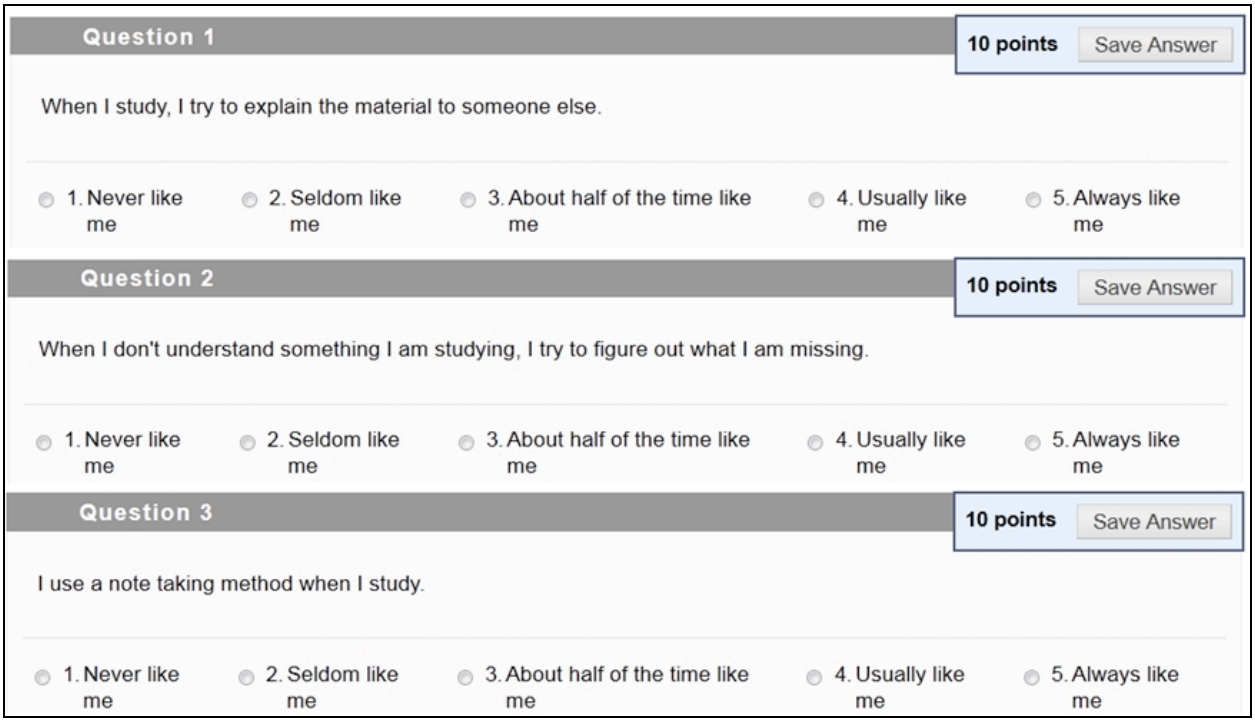

Figure 3: Sample statements about study habits

This kind of questionnaire could be set up to provide suggestions for improving study skills after the student has submitted the assessment. The feedback would be specific to those questions that the student did not answer correctly. An SRL training of this kind would prompt students to analyze their behaviors in relation to the suggestions provided by the questionnaire. Adaptive settings could be utilized to prevent students from proceeding to subsequent modules until they have completed the questionnaire and any other tasks associated with the SRL training.

From prompting to training, the aforementioned examples for supporting SRL are not difficult to implement. Appropriately used, a LMS or web-based tool can support educators applying SRL strategies in their instruction. Tool selection and the design of the intervention should be based on the learning goals and the literature on SRL.

In closing, the authors wish to encourage educators and designers of e-learning environments to reflect upon the empirical studies and recommendations provided in this paper and find ways to use SRL interventions in their courses. A key point that this paper has tried to reinforce is that students' academic performance in e-learning environments is significantly higher when the design of the course supports SRL. To that end, instructional design models and quality standards for e-learning environments could consider SRL interventions as a key indicator for improving student learning outcomes.

References

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.

Bandura, A. (1991). Social cognitive theory of moral thought and action. In W. M. Kurtines & J. L. Gewirtz (Eds.), *Handbook of moral behavior and development: Vol. 1. Theory* (pp. 45-103). Hillsdale, NJ: Erlbaum.

Bannert, M., Hildebrand, M., & Mengelkamp, C. (2008) Effects of a metacognitive support device in learning environments. *Computers in Human Behavior*, *25*(4), 829-835. doi:10.1016/j.chb.2008.07.002

Bixler, B. (2008) The effects of scaffolding student's problem-solving process via question prompts on problem solving and intrinsic motivation in an online learning environment. *Dissertation Abstracts International*, 68(10), 4261A. (UMI No. AAT 3284910).

Caprara, G. V., Fida, R., Vecchione, M., Del Bove, G., Vecchio, G. M., Barbaranelli, C., & Bandura, A. (2008). Longitudinal analysis of the role of perceived self-efficacy for self-regulated learning in academic continuance and achievement. *Journal of Educational Psychology*, *100*(3), 525-534. doi:10.1037/0022-0663.100.3.525

Chang, M-M. (2007). Enhancing web-based language learning through self-monitoring. *Journal of Computer Assisted Learning*, *23*(3), 187-196. doi:10.1111/j.1365-2729.2006.00203.x

Chen, C. S. (2002). Self-regulated learning strategies and achievement in an introduction to information systems course. *Information Technology, Learning, and Performance Journal*, *20*(1), 11-25. Retrieved from http://www.osra.org/itlpj/chenspring2002.pdf

Hu, H. (2007) Effects of SRL strategy training on learners' achievement, motivation and strategy use in a web-enhanced instructional environment. *Dissertation Abstracts International*, (UMI No. AAT 3301559).

Kauffman, D. F. (2004). Self-regulated learning in web-based environments: Instructional tools designed to facilitate cognitive strategy use, metacognitive processing, and motivational beliefs. *Journal of Educational Computing Research*, *30*(1), 139-161. doi:10.2190/AX2D-Y9VM-V7PX-0TAD

Kauffman, D. F., Ge, X., Xie, K., & Chen, C.-H. (2008). Prompting in web-based environments; Supporting self-monitoring and problem solving skill in college students. *Journal of Educational Computing Research*, *38*(2), 115-137. doi:10.2190/EC.38.2.a

Kauffman, D. F., Zhao, R., & Yang, Y.-S. (2011). Effects of online note taking formats and self-monitoring prompts on learning from online text: Using technology to enhance self-regulated learning. *Contemporary Educational Psychology*, *36*(4), 313-322. doi:10.1016/j.cedpsych.2011.04.001

Kuhl, J. (1984). Volitional aspects of achievement motivation and learned helplessness: Toward a comprehensive theory of action control. In B. A. Maher & W. B. Maher (Eds.), *Progress in experimental personality research* (Vol. 13, pp. 99-171). Orlando, FL: Academic Press.

Pintrich, P. R., & de Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology*, *82*(1), 33-40. doi:10.1037/0022-0663.82.1.33

Pintrich, P. R. (2000). The role of goal orientation in Self-Regulated Learning. In M. Boekaerts, P. Pintrich, & M. Zeidner (Eds.), Handbook of self-regulation (pp. 451-502). San Diego, CA: Academic Press.

Pintrich, P. R., Wolters, C., & Baxter, G. (2000). Assessing metacognition and self-regulatory learning. In G. Schraw & J. C. Impara (Eds.), *Issues in the measurement of metacognition* (pp. 43-97). Lincoln, NE: Buros Institute of Mental Measurements.

Saito, H., & Miwa, K. (2007) Construction of a learning environment supporting learners' reflection: A case of information seeking on the web, *Computers & Education, 49*(2), 214-229. doi:10.1016/j.compedu.2005.07.001

Santhanam, R., Sasidharan, S., & Webster, J. (2008). Using self-regulatory learning to enhance e-learning-based information technology training. *Information Systems Research*, *19*(1), 26-47.

Shen, P.-D., Lee, T.-H., & Tsai, C.-W. (2007). Applying web-enabled problem-based learning and self-regulated learning to enhance computing skills of Taiwan's vocational students: A quasi-experimental study of a short-term module. *Electronic Journal of e-Learning*, *5*(2), 147-156. Retrieved from http://www.ejel.org/issue/download.html?idArticle=46

Schober, B., Wagner, P., Reimann, R., & Spiel, C. (2008). Vienna e-lecturing (VEL): Learning how to learn self-regulated in an Internet-based blended learning setting. *International Journal on E-learning*, *7*(4), 703-723.

Whipp, J., & Chiarelli, S. (2004). Self-regulation in a web-based course: A case study. *Educational Technology Research and Development*, *52*(4), 5-22. Retrieved from http://www.jstor.org/stable/30220400

Zimmerman, B. J., Bandura, A., & Martinez-Pons, M. (1992). Self-motivation for academic attainment: The role of self-efficacy beliefs and personal goal setting. *American Educational Research Journal*, *29(*3), 663-676. Retrieved from http://www.jstor.org/stable/1163261

Zimmerman, B. J. (2000). Attaining self-regulation: A social cognitive perspective. In M. Boekarts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 13-39). San Diego, CA: Academic Press.

Zimmerman, B. J., & Schunk, D. H. (Eds.). (2001). Self-regulated learning and academic achievement: Theoretical perspectives. Hillsdale, NJ: Erlbaum.