

# Evolution of a Web-Enhanced Course

## Incorporating Strategies for Self-Regulation

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*A Web-based course  
incorporated a protocol  
for self-directed student  
learning to foster  
students' self-regulation*

The number of courses delivered via the World Wide Web is increasing rapidly, but courses delivered through distance education often have a high attrition rate caused, in part, by individual students' characteristics. Success in these courses often depends on students' abilities to successfully direct their own learning efforts.

In her book *Designs for Self-Instruction*, Keirns described a self-directed learner as one who "works with instructional materials on his or her own time, without direct supervision or guidance from either instructor or fellow students."<sup>1</sup> This article describes the evolution of a Web-based university course that incorporated a structured protocol designed to promote active self-directed learning, as well as strategies we have found beneficial in fostering students' self-regulation efforts.

In January 1997, we<sup>2</sup> began planning the redesign of a university course in human development. The course professor had received a \$25,000 grant through Virginia Tech's Center for Innovation in Learning to develop Web enhancements for her course, which typically enrolled 250 to 300 students per semester. As in many classes of that size, the professor spent her time lecturing, with students hastily scribbling down notes. Students were expected to read the book, attend class twice a week, and participate in lab activities. Midterm and final examinations assessed learning. Occasional quizzes provided incentives for class

attendance. Students seemed quite content with the class, and the professor had been selected as the university's outstanding undergraduate teacher in 1997. Nonetheless, the professor saw the opportunity to develop a Web-enhanced course as a chance to redesign her course to be consistent with principles of active learning.

The professor, a 25-year veteran instructor, struggled with a debilitating health condition that hampered her energy levels. She hoped that new technologies and online teaching would allow her to carry out class preparation and student communication activities from home. The professor's disposition provided a context for experimentation and contributed to the success of this project. She perceived the risks (such as student anxiety and unfavorable course evaluations) to be outweighed by the possibilities for enhanced instructional materials and freedom from "teaching the text" in class. Having taught the same course for many years, she was willing to try a new approach.

The design and development team consisted of an instructional designer and several graduate students with expertise in the content area, Web site development, and instructional design. Initial conversations between the design team and the professor focused on developing a shared understanding of the audience, the course content, and the professor's philosophy and preferred style of teaching. Guided by the characteristics of the audience, the number of students in the course, and the professor's desire to redesign her course consistent with student-centered ideas of teaching and learning, the team developed five possible scenarios for the course. Scenarios ranged from a traditional lecture course supplemented with online materials designed to encourage learners to become more self-directed to an enhanced self-study format where learners gained essential content knowledge online with class sessions devoted to small group sessions on topics of interest.

Despite the professor's desire to redesign her course to become more

consistent with the ideas of active learning, she was reluctant to commit to a scenario that would require radical changes in her teaching. Simply adding an extensive Web site to the course seemed enough of a change initially. She preferred to develop Web enhancements that provided redundancy with her lecture sessions and flexibility for students unable to attend class or who needed to review course materials outside of the scheduled class times.

The majority of students enrolled in this course were freshmen. We were concerned about their ability to manage the freedom and responsibility of a course where the primary content was offered over the Web and where class attendance was optional, as they came from the more structured environment of high school. Given the attrition rate of distance learning courses, coupled with our concern that these students might not successfully direct their own learning efforts, we incorporated techniques to foster and promote active

self-regulated learning into the design of the course.

## Course Development

The development of the site spanned an eighteen-month period (see Table 1). During the spring of 1997, the design team conducted an extensive review of the literature on self-regulation and metacognition. Based on this review, we planned the Web site. The course Web site was designed to scaffold students while they learned the skills of self-regulation critical for active, self-directed, self-paced learning. The site consists of a structured arrangement of activities to encourage self-directed learning, an inventory of learning strategies, and several support tools.

## The GAME Plan

The literature indicates that successful self-directed individuals constantly plan, monitor, and evaluate their activities.<sup>3</sup> Research also suggests that the

**Table 1**

<b>Course Development Timeline</b>	
<b>Date</b>	<b>Action</b>
Spring 1997	<ul style="list-style-type: none"> <li>■ Literature review on self-regulation and metacognition</li> <li>■ Initial planning and interviews with professor</li> </ul>
Summer 1997	<ul style="list-style-type: none"> <li>■ Professor developed open-ended study guides, PowerPoint presentations, and a test item bank of approximately 80 questions for each chapter in course textbook</li> <li>■ Graphics and page layout developed</li> </ul>
Fall 1997	<ul style="list-style-type: none"> <li>■ Assembly of site</li> <li>■ Quiz program developed</li> <li>■ Initial prototype tested for one week and minor revisions made</li> </ul>
Spring 1998	<ul style="list-style-type: none"> <li>■ Semester-long pilot test</li> <li>■ Interviews with 15 users</li> </ul>
Summer 1998	<ul style="list-style-type: none"> <li>■ Analysis of interview data</li> <li>■ Modification of site based on interview data</li> </ul>
Fall 1998	<ul style="list-style-type: none"> <li>■ Online requests for student suggestions on site improvement</li> <li>■ Grades Online feature developed</li> <li>■ Goals Checklist developed</li> <li>■ Enhanced Motivated Strategies for Learning Questionnaire (MSLQ) feedback added</li> <li>■ Pre-post MSLQ data collected</li> </ul>
Spring 1999	<ul style="list-style-type: none"> <li>■ Professor on sabbatical</li> <li>■ Data collected during previous semester analyzed</li> </ul>
Summer 1999	<ul style="list-style-type: none"> <li>■ Fully revised and functional site deployed</li> </ul>

**Figure 1**

## The GAME Plan

Chapter	G Goals	A Activities	M Monitor	E Evaluate
Week 1 Chapter 1: Basics of Child Development	Topic: Cell, Tissue and Pattern Development	Read: Chapter 1 Assigned Class: Aug. 24 & 26 TWP: Lecture/Class	Portfolio: Unit 1	Unit 1, to be graded by Aug. 26
Week 2 Chapter 2: Basics of Child Development	Topic: Cell, Tissue and Pattern Development	Read: Chapter 2 Assigned Class: Aug. 29 & 30 TWP: Lecture/Class	Portfolio: Unit 2	Unit 2, to be graded by Aug. 30
Week 3 Chapter 3: Biological Background	Topic: Cell, Tissue and Pattern Development	Read: Chapter 3 Assigned Class: Aug. 31 & Sep. 1 TWP: Lecture/Class	Portfolio: Unit 3	Unit 3, to be graded by Sep. 1

tasks inherent in expert learning can be modeled and demonstrated by teachers and instructional systems, thus providing the scaffolding structures necessary for students to learn and internalize self-regulating strategies.<sup>4</sup>

Consistent with the idea of scaffolding, the support for developing strategies of self-regulation should be available to students when they need it, they should be provided various levels of support, and they should be able to select the level of support they need.<sup>5</sup> We translated these recommendations into an easy to remember acronym: the GAME (Goal, Action, Monitor, and Evaluate) Plan (see Figure 1). We developed the GAME acronym to provide a constant reminder to the students of the steps to follow for self-directed learning.

Course materials and activities associated with goal setting include topic outlines and study guides. The study guides consist of open-ended outlines used to structure students' notetaking. Students take action by attending class, reading the textbook, viewing PowerPoint "lectures" online, completing the study guides, and participating in lab activities. Students monitor their actions by completing practice quizzes as often as they like. Quizzes consist of 10 questions randomly selected from a test item bank of approximately 80 questions for each chapter. Feedback following each

response informs students whether the answer is correct; if incorrect, they receive the correct response.

In addition to randomly selecting and rearranging the test items, the quiz program randomly rearranges the distracters so that students must learn the answer to the question, rather than the distracter number. Finally, students evaluate their actions by completing an online quiz for credit and reviewing their grades.

### Self-assessments

We also included support for developing self-regulation skills through a

self-assessment questionnaire. During the second week of class, students complete the Motivated Strategies for Learning Questionnaire (MSLQ) developed by Pintrich and his colleagues.<sup>6</sup> This index assesses students' motivational orientations and their use of different learning strategies within a college course. Sample statements from the index include "If I can, I want to get better grades in this class than most of the other students" and "When I take tests, I think of the consequences of failing." These statements are rated on a seven-point scale ranging from "very true" to "not true at all."

As they complete the MSLQ, students receive individualized feedback as to their strengths and weaknesses in each skill identified by Pintrich and his colleagues as necessary for self-directed learning (see Figure 2).<sup>7</sup> Students are referred to additional information on increasing their skills in needed areas (see Figure 3). Supplemental pages provide tips for increasing one's intrinsic motivation, extrinsic motivation, interest in topic, task value, expectancy for success, time and resource management, use of cognitive strategies such as rehearsal, elaboration, organization, and metacognitive skills, and decreasing test anxiety. These supplemental pages contain an explanation of the term, suggestions for improving or developing skills in that area, and

**Figure 2**

## Student Feedback

Year Book	Description of Skill	Feedback
1.1	<b>Self-Motivation:</b> This is a measure of how interested you are in the course. It is related to your motivation to learn. It is a high score means you like the course and are very motivated to learn.	You should probably look at the following strategies to increase your motivation to learn: <a href="#">Self-Motivation</a>
4.2	<b>Expectancy for Success:</b> This is a measure of how confident you are in your ability to succeed in the course. It is a high score means you are confident you will succeed in the course. It is a low score means you are not confident you will succeed in the course.	You should probably look at the following strategies to increase your expectancy for success: <a href="#">Expectancy for Success</a>
6.3	<b>Test Anxiety:</b> This is a measure of how nervous you are about tests and exams. It is a high score means you are very nervous about tests and exams. It is a low score means you are not nervous about tests and exams.	You should probably look at the following strategies to decrease your test anxiety: <a href="#">Test Anxiety</a>

**Figure 3**

## Supplemental Tips



annotated links to other Web sites devoted to developing the target skill.

### Prototype Testing

During the fall of 1997, students had to use the initial prototype to complete one week of course activities in a campus computer lab. The development team observed and interviewed them as they worked on their assigned tasks. Based on the information collected, the team implemented a fully developed site in the spring of 1998. After the students used the course site for at least 10 weeks, a design team member interviewed 15 students extensively to determine the typical pattern of site usage. Students also commented on their likes and dislikes, and suggested improvements. During the summer of 1998, we analyzed the data from the student interviews and modified the site based on the students' input.

These evaluations heavily influenced the final version of the Web site. Based on students' desire for a simple yet effective Web site, the graphical layout and site interface were simplified. Students preferred to communicate and receive announcements via a list server, and didn't use the technical help section, so the announcements and help features were eliminated or modified in later versions. In addition, we had originally provided links to the self-regulation questionnaire in each grid of

the GAME plan table. Because students found the redundancy confusing, these links were eliminated.

During the fall of 1998, students used the modified site. On three separate occasions, we asked for student input on how we could make the site more useful to them. Although we had many ideas about modifying the site to more strongly support active learning, the students requested only a few improvements. They wanted to access their cumulative grades on a continuous basis, so a Grades Online feature was added. They also wanted help in time management, so the Goals Check-

list feature was developed. The Goals Checklist allowed students to create their own time-dependent goals, which were then e-mailed to them daily via an automated system (see Figure 4).

### The Evolution

During the first few semesters the Web-enhancements were offered, the Web site provided redundancy of the live class content. Course attendance slowly declined, yet grades remained high. Gradually, the professor and students who attended the class noted changes in the style of presentation and the purpose of class meetings. The professor noted that her class meetings changed from the presentation of fact-based verbal information, hastily copied by students, to more intimate and detailed discussions of the application of this information drawn from her own experiences and those of her students. She liked to call this process the "illumination" of the content.

Although the professor initially resisted the scenario where the essential course content was presented online and course meetings consisted of small group sessions on topics of interest, the course naturally evolved to that point. Currently, classes consist of optional workshops during scheduled class time. Students who attend class indicate that obtaining material online at their own pace affords more productive class

**Figure 4**

## Goals Checklist



meetings. The students who attend these workshops are those interested in the topic of the day. Students often stay after class to ask substantive questions. The professor noted that a core of 30 to 40 students attend regularly, with another 20 to 30 students who fluctuate from week to week. Rarely, however, does a student not attend any of the class meetings.

Students who choose not to participate in person can still communicate via e-mail. For example, one student chose to communicate about child abuse that occurred in the home via e-mail, which seemed more comfortable for her. In addition, students began to voluntarily look up and share resources related to the class content. They participated because of interest, with no points awarded for the extra effort.

One participant called the online instruction the “tedious part of the class,” which allowed time for lectures, videos, and guests’ presentations during scheduled class meetings. Another student enthusiastically remarked, “It is really cool having a class like this, with notes and lecture online and a real teacher to back it all up.”

Recently, the professor reported, I have finally let go of the old way — reviewing PowerPoint lectures in class. Class time is now used strictly for active experiences — cooperative group projects, problem solving, simulations, guest speakers, demonstrations, etc. I’ve never had so much fun. And the student evaluations of my instruction have continued to be very high.

## Conclusions

We believe we have created a course that supports active, self-directed learning. Analysis of students’ scores and written responses on anonymous student evaluations confirmed our belief. Comparisons of students’ scores on the MSLQ from the second and sixteenth weeks of class indicated that students significantly increased their metacognitive self-regulation abilities, decreased their test anxiety, and increased their self-efficacy for learning and performance.<sup>8</sup>



Interviews revealed that most students followed a very specific learning procedure.<sup>9</sup> They learned the basic course content by reading the goals for the week, printing the study guides, using the Goal Checklist to create dated goals that were e-mailed back to them when due, viewing the lecture online and/or reading the textbook to complete the study guide, and completing lab assignments. Then they took the appropriate practice quizzes several times. When they felt confident that they knew the material, they took the online quizzes.

This pattern suggests that the course’s structured protocol did indeed facilitate skills that can be characterized as self-regulating. Students planned their learning by reviewing the goals for the week and creating dated goals in the goal checklist. They used the study guide to structure their learning activities. They monitored their own learning by completing the practice quizzes. And finally, they evaluated their learning by completing a graded quiz and reviewing their grades.

Students told us repeatedly that the site’s organization facilitated their learning. The calendar-like GAME plan interface, with course materials organized in a table arranged by weeks, was extremely popular. Students commented, “I like how the GAME plan is

organized with the lecture routine and study guide and everything for the week you are on” and “Having the calendar set up works nicely and keeps me on schedule.”

The Web site proved easy to use. Students employed a common Web browser and their preferred e-mail software. Based on feedback from students about extraneous graphics, graphics were reduced in size and reused throughout the site to decrease download time. The student may turn off graphics used in online lectures and view them as text only. All materials are consistent, from the layout to the structure of instructional materials within the page. As noted above, student behaviors in obtaining instructional material were highly consistent, as well.

In addition, the design allows for a variety of learning patterns. Students may choose to interact with the Web pages or print alternate versions of course materials to review offline. Course materials are highly interactive, with questionnaires and practice quizzes engaging the learners and providing immediate feedback.

The development of the Web site has changed the nature of the course, the way it is taught, and the way students learn. When asked how we could improve the Web site, one student responded,

I honestly cannot ask for anything more. I am so happy that I have been given the chance to work through a class the way this one is set up. It is so different from anything I have ever done in high school, and I absolutely love it!

With the Web pages providing the basic factual information and assessments, students confirm that they have become more actively involved, not only in learning online, but when participating in the face-to-face class sessions.

Often we hear that technology should be used for what technology does best, and face-to-face meetings with professors should be used for what face-to-face interaction does best — this course does that. Providing fact-based information, practice activities,

and quizzes online allowed the professor to change her approach to her face-to-face presentations. Although this change occurred over several semesters, the course has evolved from a traditional large-lecture course to a self-study course incorporating small-group meetings with meaningful interactions between the professor and students.

It wasn't always easy, but along the way we've learned some things that can and are being applied in online courses in a variety of content areas:

■ *Facilitate goal setting.* A familiar calendar-based design metaphor emphasizes self-regulation skills as well as course events. An automatic messaging system reinforces goal setting by sending reminders to students.

■ *Support students' reviewing strategies.* Students should be able to quickly access the information they want to review through a navigation structure that is easy to understand and applied consistently. Students want printed material to review prior to testing, and they will print materials whether or not they are designed for printing. Thus, it's preferable to create printer-friendly pages with limited use of graphics and frames.

■ *Provide online assessments and skill practice.* Both are invaluable as students monitor their learning. Students often want to take practice quizzes numerous times before they take the graded quizzes. They want constant, up-to-date access to their course grades. And, of course, assessments must correspond closely to learning activities.

■ *Maintain patience and flexibility.* Most of all, teaching a Web-enhanced course to 250 students each semester requires patience and flexibility. In reflecting on the course development process, the professor commented,

I'm basically secure in my position, so it was OK to try something that might not work out the way it was intended. I had to learn to trust the design team and to occasionally let go of the past in order to reach out for something new.

We believe that, through the devel-

opment of Web enhancements to the course, the basic nature of teaching and learning human development at Virginia Tech has changed for the better. *e*

## Endnotes

1. J. L. Keirns, *Designs for Self-instruction* (Boston: Allyn & Bacon, 1999).
2. Authors include instructional designer and faculty member Katherine Cennamo, instructional technology graduate student John Ross, and course professor Cosby Rogers. Other design and development team members include Rodney Williams, Sherri Turner, and Jared Danielson. To clarify roles of the authors, titles are used when activities involve only one author.
3. P. Ertmer and T. Newby, "The Expert Learner: Strategic, Self-regulated, and Reflective," *Instructional Science* 24 (1996), 1-24.
4. See, for example, J. Bruer, *Schools for Thought* (Cambridge, Mass.: MIT, 1994); P. Simons, "Constructivist Learning: the Role of the Learner," in *Designing Environments for Constructive Learning*, T. M. Duffy, J. J. Lpwick, and D. H. Jonassen, eds. (New York: Springer-Verlag, 1993), 291-313.

5. M. P. Driscoll, *Psychology of Learning for Instruction*, 2nd Ed. (Boston: Allyn & Bacon, 2000), 251-252.
6. P. R. Pintrich et al., *A Manual for the Use of the Motivated Strategies for Learning Questionnaire* (Ann Arbor: National Center for Research to Improve Postsecondary Teaching and Learning, 1991).
7. Ibid.
8. J. D. Ross, *Regulating Hypermedia: Self-regulation Learning Strategies in a Hypermedia Environment* (Blacksburg, Va.: PhD dissertation, Virginia Tech, 1999), 83-106.
9. S. G. Turner, *A Case Study Using Scenario-based Design Tools and Techniques in the Formative Evaluation Stage of Instructional Design: Prototype Evaluation and Redesign of a Web-enhanced Course Interface* (Blacksburg, Va.: PhD dissertation, Virginia Tech, 1998), 40-55.

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