Learning-Style, Oriented Web-Based Support Modules for K-12 Education

Douglas M. Mattox, Bahador Ghahramani

**Ceramic Engineering Dept., University of Missouri-Rolla, Rolla, MO/
Engineering Management Dept., University of Missouri-Rolla, Rolla, MO**

Abstract

Recognition of the importance of learning styles in math and science education holds the promise of improving education delivery in grades K-12. It is felt that teachers and students in K-6 are at the greatest disadvantage in having learning-style oriented lesson presentations, due in part, to the general absence of math and science specialists in these grades. Because classroom instruction may now be linked to unlimited virtual resources through ready connection to the worldwide web, the potential exists to bring extensive math and science expertise to the support of teachers and students in math and science education. To begin to realize this potential we are developing web-based teaching science concept modules for students and teachers alike, which are oriented to the four most widely recognized learning styles of students. Developing modules will be systematically keyed to existing, public school lesson plans, therein serving as reference sources for teachers and follow-up sites for students with web access. Self-paced, follow-up learning can take place according to the student's learning style preference. The resources will be continuously expanded through ongoing, age-targeted, learning-style, oriented submissions, both invited and volunteered by educators at large.

Introduction

There is increasing concern to find improved delivery systems and concepts for K-12 education. New director of the National Science Foundation, Rita Colwell, has made assisting K-12 education one of her top three priorities in her beginning tenure has Director (1). She is particularly sensitized to the issue of differing learning styles among children. Her concern isn't new, but echoes earlier studies by Dunn and Dunn (2). McCarthy (3) developed a four-style model, which has received considerable acceptance, although others do not consistently use the summary names.

Studies by Harb (4) and others show that science majors have rather limited learning style preferences. Of the science majors who become teachers, their preferred learning styles are found to be even narrower, and consequently, they tend teach and write texts according to their narrow learning-style preference. This affects the non-science major, middle school teachers in that they may not have teaching training and resources compatible with their preferred learning and teaching sciences. Thus, they may not teach with the confidence they

could in the sciences, nor, have the confidence to modify presentations to the broad range of learning-style preferences of the students.

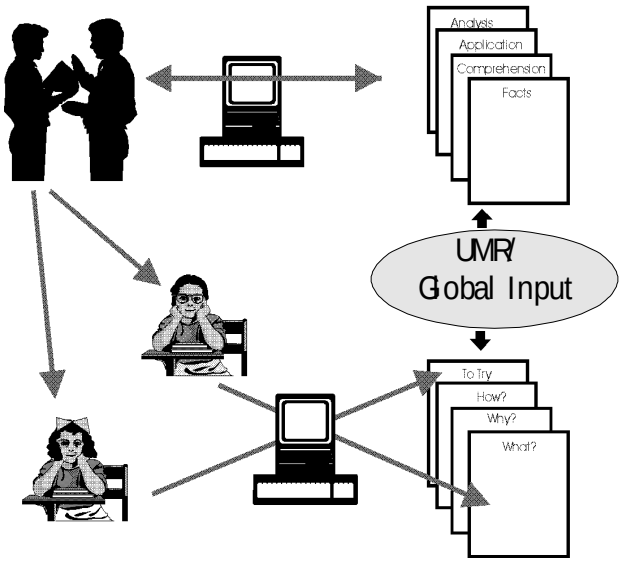
Table 1 – Learning Style Categories

Innovative Learner	**Analytic Learner**	**Common-Sense Learner**	**Dynamic Learner**
Learner	***Learner***	***Learner***	***Learner***
Seeks meaning	Wants to know facts	How do things work	Needs self-discovery
Wants reasons for learning	Perceives abstractly, Processes reflectively	Seeks Utility	Takes risks
Needs involvement	Creates concepts, Builds models	Hands-on	Likes change, flux
Likes working with others	Data collector	Practical	Follows through
Imaginative	What do experts say?	How will it be useful	Likes trial and error
Divergent thinker	Sequential thinker	Give it a try	Actively tests ideas
Teacher	***Teacher***	***Teacher***	***Teacher***
Motivator	Information provider	Coach	Resource
Hi interaction	Knowledge giver	Involves student	Evaluator
		Feedback	Multiple learning styles

To address this limitation, we are endeavoring to make available multiple-learning style modular supplements for the teacher's existing lesson plans, to expand the teacher's resources for teaching the knowledge basis of science and math content. These activities will include expanding the breadth of learning orientations in existing presentations of core math and science concepts. The aim is not to replace current lesson plans, but to augment them sufficiently, that teachers will have supplementary materials, which raise their confidence in understanding the material and explaining it by various approaches.

Secondly, we want to generate options for individual student's web-based study of the syllabus topics, by generating learning-style, sensitive, complementary student-oriented materials for student self-study. These materials can be accessed from computers available in the classroom, school computer laboratories and in their homes (Figure 1).

Figure 1 – Knowledge-Teacher-Learner Linkage

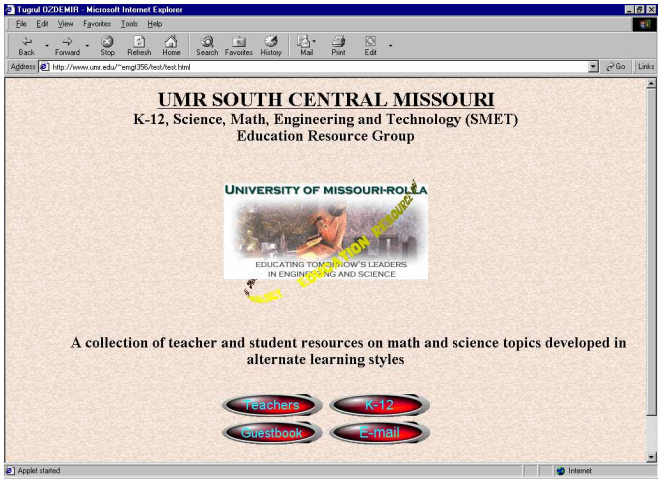


We have developed some pilot topic modules, which employ learning-style-suggestive link icons, so that after a few experiences, the student will explore topics according to his or her learning style preference. This paper describes our preliminary efforts.

Prototypical Model

We have developed a module on heat flow aimed at fifth and sixth graders and posted the module at http://www.umr.edu/~emgt356/test/test.html. The opening screen appears in Figure 2.

Figure 2 – Welcoming Screen – Science Module



Teachers or students may access this page. When teachers access the page, they are led to a page, which gives them the module choice. In the example module the choice is to select "Heat Flow", a subcategory of "Physical Sciences." The topic of heat flow is then developed for the teacher according to Bloom's taxonomy, i.e., knowledge (content), comprehension, application, and personalization (5).

Content: At the first teacher's window, the knowledge of heat as energy, the measurement of energy (temperature) and the direction of heat flow between bodies of different temperature are explained. If the teachers are satisfied with their comprehension, they may proceed to a comprehension-based section.

Comprehension: This section asks questions about the concepts articulated in the Content section. The questions are answered by placing a cursor over the "answer" button. Five simple questions review the grasp of content on the first page and direct the teacher to the *Application* page.

Application: The application page gives multiple questions concerning the learner's (teacher) ability to apply or use the facts presented about heat flow. These questions all relate to the common observation of most children and adults, the frying of an egg. If the teachers are confident in their ability to apply the facts of heat flow to their normal experience, they may move on to a section entitled "Explain."

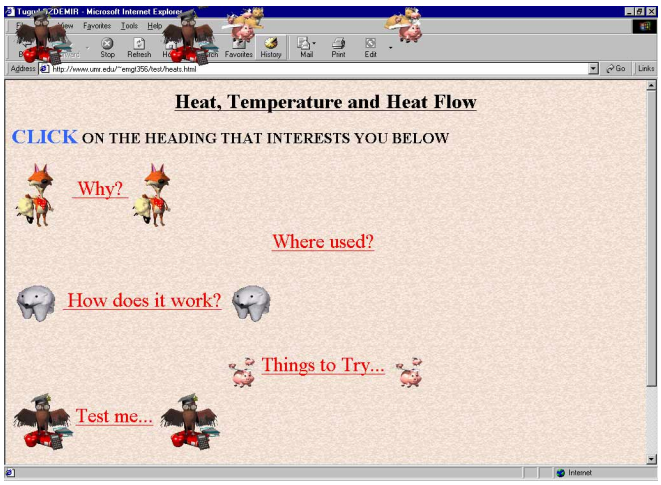
Explain (Personalization): This section encourages the teacher to extend the learned concept to less direct experiences in the world around the teacher. Such extensions of insight should raise the confidence of the teacher to resourcefully illustrate and apply the concept to the students.

The concept developed for the teacher need not be hidden from the student. The point of all the materials is to expand the instructional resources of basic science concepts available to teachers and students, alike; yet, in a learning style sensitive way.

Student Access

Whether through computers available individually in the classroom, computer laboratories or at home, the student may explore the classroom topics at their own pace, according to their own interests (learning style). Pressing the K-12 button on the opening screen leads the student to a topic choice window, and after selecting the topic, is brought to the following window (Figure 3):

Figure 3 – Student entry window



These figures are animated and are meant to suggest different learning styles of students (Figure 1). A student may pursue any or all questions that interest him or her. The same knowledge base appears under each heading, but modified as to learning preference. It is assumed that their teacher has first introduced students to the concept (heat flow), and that they now want to learn more. For instance, the student who always wants to know "why", is asked how the sun melts a frozen pond. The student who wants to know whether something is important, who asks, "where is it used", finds himself being asked to explain how ice cubes cool tea in the summer. The student who wants to know "how it works", is walked through an explanation of how water is heated to make tea. And finally, the experimental type student is asked to apply the concept taught by his teacher to the sensations he experiences handling ice cubes and touching "cold" surfaces. There is a test of the concept, which rewards the correct answerer with a small computer game to play.

It is intended that students with strong learning style preferences will find themselves attracted to presentations catering to their preferred learning style, as suggested by the icons, which will be used consistently with the four learning styles in all modules.

Expansion and Continuous Improvement

The fact that these modules are web based makes both module evolution and dissemination very straightforward. Site entry will promote involvement of a global community of learning-style educators as web site visitors, who will be invited to submit effective learning-oriented and cultural accommodative teaching activities from their experience, as well as suggested improvements and corrections. All activities will be structured so improvements can be effected rapidly so that the site becomes a resource of first call to the nation's teachers.

In presenting these plan and progress to teacher groups it is clear that the modules will be of most use if closely keyed to existing lesson plans. We will next be targeting an existing lesson plan syllabus to prepare modules compatible with it. We will then survey the teachers and indirectly, the students about the effectiveness of the support modules. In addition we plan to invite submissions of modules or module ideas by K-12 teachers and university faculty members. Such interactions will be purely web-based and relatively inexpensive. As a natural partner we have begun an association with SuccessLink (www.successlink.org), an existing K-12, web-based teaching resource in Missouri.

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DOUGLAS M. MATTOX
Doug Mattox is Professor of Ceramic Engineering in the Ceramic Engineering Department of the University of Missouri-Rolla, Rolla Missouri. He received B.S. and Ph.D. degrees in Ceramic Engineering from Rutgers University. Following graduation he began a twenty-five year career in industrial research and management, mostly with the Westinghouse Electric Corporation in Pittsburgh, PA. He came to the UMR in 1989 where he first served as Department Chair. He is particularly interested in the use web-based technologies and experts to assist in K-12 education.

BAHADOR GHAHRAMANI
Dr. Ghahramani is Associate Professor of Engineering Management at the University of Missouri-Rolla since 1995. He was previously Distinguished Member of the Technical Staff at AT&T Bell Laboratories as an expert in ergonomics. He holds five degrees from Louisiana Tech University, Southern University , Texas Tech University and Oklahoma State University and served as a tenured professor at Southern University. Bahador is also interested in computer assisted K-12 education.