by Matthew S. Kuhn

Connecting Depth and Balance In Class

Ed Tech Gives Teachers a Better Way to Make Learning

Tremendous growth in educational technology tools, applications, and Web 2.0 resources have created a plethora of new methods to meet the learning needs of all students. Unfortunately, the potential of these methods is hardly understood before a new technological breakthrough makes its way into the classroom, through either teachers or, more commonly, through students. On the other hand, this technological progress has breathed new life into curricular taxonomies and learning style continuums. When used correctly, educational technology gives new meaning and utility to long-established educational paradigms, such as Benjamin Bloom's Taxonomy (revised) and Howard Gardner's Theory of Multiple Intelligences.

Learning Taxonomies

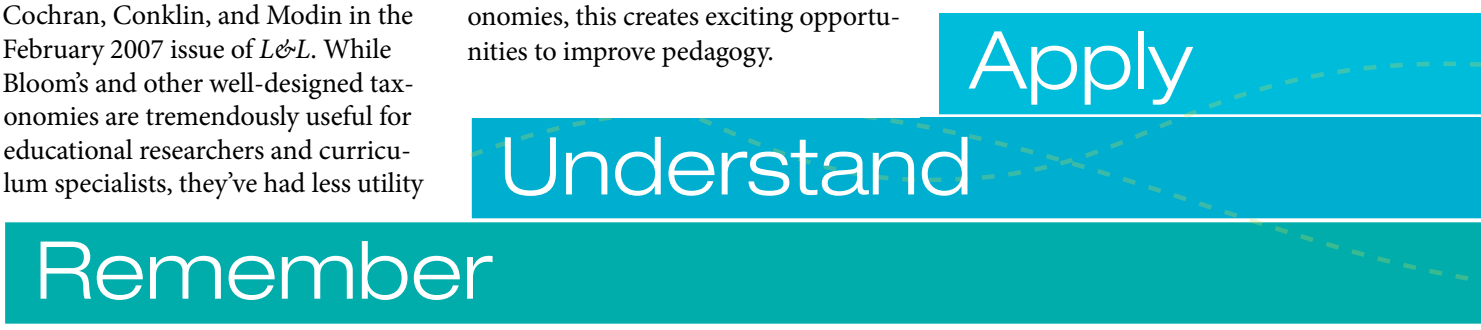
A number of prominent taxonomies have been used to plan, classify, and evaluate curricula. The best ones are backed by rigorous research and include detailed classification systems to determine curricular balance and depth. Educators are most familiar with the simplified depiction of the cognitive levels of Bloom's Taxonomy. For a more in-depth discussion of the revised Bloom's Taxonomy, one should see the skillfully crafted article "A New Bloom: Transforming Learning" by Cochran, Conklin, and Modin in the February 2007 issue of *L&L*. While Bloom's and other well-designed taxonomies are tremendously useful for educational researchers and curriculum specialists, they've had less utility for the average classroom teacher. In the day-to-day rigors of schooling, do teachers regularly use these sorts of taxonomies to plan their lessons? Not usually. Fortunately, the power of educational technology is making it easier for teachers to ensure depth and balance in their lessons, even if they do not deliberately employ one of the popular taxonomies.

Multiple Intelligences

Similar to Bloom's Taxonomy, learning style theories can be difficult to effectively apply in the classroom. Fortunately, the differentiating power of educational technology makes meeting the needs of different "intelligences" or "learning styles" more and more possible. Gardner's Theory of Multiple Intelligences and other learning style inventories (See Resources on page 21) seem to have been more useful in the theoretical realm of education than under the constraints of the practical classroom setting. However, we again see the beginnings of a paradigm shift as the differentiating power of educational technology makes meeting the needs of different intelligences or learning styles more practical in the day-to-day world of a classroom teacher. Combined with learning taxonomies, this creates exciting opportunities to improve pedagogy.

Lesson Plan Analysis

An interesting example of how schools are deliberately leveraging technology to add learning style variety and depth to the curriculum can be seen in Williamsburg, Virginia, where each school has Instructional Technology Resource Teachers (ITRT). We at Mid-continent Research for Education and Learning (McREL), a nonprofit education research organization in Denver, Colorado, worked with a talented group of ITRTs for a year to explore connections between instructional best practices and educational technology. In a recent workshop on technology and learning styles, ITRTs investigated various technologies used to meet individual learning needs. The culminating activity of the two-day workshop focused on evaluating the integration of technology in lesson plans drawn from participants' schools. ITRTs wanted to see if the technology they helped blend into lessons improved the depth of knowledge and variety of learning styles. As part of this evaluation, the ITRTs began with a Bloom/Gardner learning matrix created with Inspiration software and then created their own based on a classroom teacher's plans they were



Revised Bloom's Taxonomy

supporting. (See Figure 1 for an example of a customized matrix.)

The analyzed lesson had ITRT support from the beginning, so it made intentional use of educational technology. Notice how many of the completed cells concentrate on the deeper levels of Bloom's Taxonomy. While much of this is by design, it's also a subliminal characteristic of using technology. One cannot help but meet a variety of learning styles, with experiential depth, if technology is purposefully and wisely integrated into the regular day-to-day curriculum.

Innovative Technology and Multiple Intelligences

Conscientious teachers can use a matrix to incorporate learning taxonomies and multiple intelligences into lesson planning. With the huge demands on their time, one might think that incorporating this wisdom into the day-to-day lesson planning process is near the bottom of the priority list for busy teachers. But with technology, teachers can more easily differentiate instruction to meet the needs of each student's learning style with suitable and systematic depth. Consider some brief examples of how this is occurring in today's contemporary classrooms.

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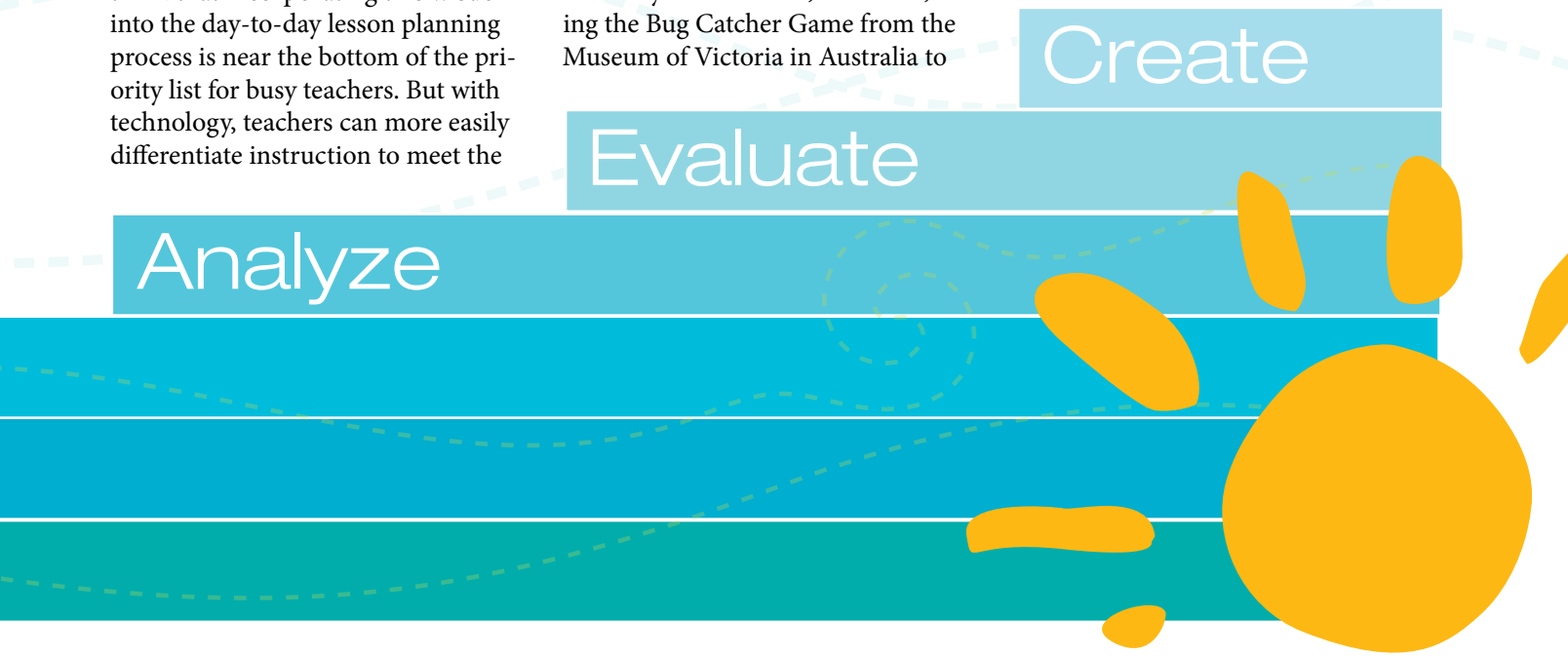
Naturalistic, logical, and kinesthetic learners' needs are served in science classes at JFK Middle School in Bethpage, New York, when they use laboratory probeware and wireless laptops to conduct experiments in and out of the lab on the acidity of local rainfall. This allows the students to analyze the data and propose solutions for any problems they may find. Another activity for naturalistic and logical elementary learners is carried out at American Academy in Lone Tree, Colorado, using the Bug Catcher Game from the Museum of Victoria in Australia to learn about and classify insects from around the world.

Verbal/linguistic and interpersonal learning preferences are attended to in English IV classes at Columbia Central High School in Columbia, Tennessee, by using blogs to facilitate in-depth group discussions, peer feedback, class notes, and highlights of exemplary student work.

Further examples can be found at Norcross High School in Norcross, Georgia, when mathematics and science students use logical and visual/spatial intelligences to deepen their understanding and evaluate different permutations of mathematical and



Grade Level: 3

The Water Cycle

Learning Objectives—The students will be able to:
- Identify the sun as the origin of energy that drives the water cycle
- Describe the processes of evaporation, condensation, and precipitation as they relate to the water cycle
- Construct and interpret a model of the water cycle

Virginia State Standards Addressed:
3.9 The student will investigate and understand the water cycle and its relationship to life on Earth.
Key concepts include:
a. The energy from the sun drives the water cycle;
b. Processes involved in the water cycle (evaporation, condensation, precipitation)

Gardener's / Bloom's	Logical/Math	Kinesthetic	Interpersonal	Visual/Spatial	
Remember			Research models/motion animations/ videos of water cycle (via Web)	United Streaming video on water cycle	
Understand			Role-play with students portraying different parts of the water cycle		
Apply	Video, Web, charts, graphs, maps, podcasts				
Analyze	Make maps, charts to support information				
Evaluate		Burn DVD(s), save all materials, and rate the movies for future examples			
Create	Take pictures of rainfall (or lack thereof), erosion; make charts and graphs showing historical scenarios, and forecasts of future dilemmas	Direct and choreograph action of student-made water cycle movies	Present the weather report with Movie Maker and explain future impact on the water cycle	Artistic design and staging/scenery for student-made water-cycle movies	

Figure 1: Williamsburg ITRT lesson plan evaluation matrix.

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scientific concepts. They do so with the aid of an integrated whiteboard system and interactive applications from Explore Learning.

High school students 875 miles away are using logical intelligences along with intrapersonal skill at La Follette High School in Madison, Wisconsin, as they use Inspiration software to organize their thoughts and create original poetry.

In addition, elementary students at Selinsgrove Intermediate School in Selinsgrove, Pennsylvania, use musical and visual intelligence in the music lab at San Francisco Symphony Kids to learn about tempo, rhythm, pitch, and harmony, and apply them to instrumentation and composition as they create their own music.

Middle school social studies students at Mont'Kiara International School in Kuala Lumpur, Malaysia, use a wiki to discuss the significance of historical and current events and collaboratively design pieces of original student work.

Even more intriguing is the new generation of learning software becoming more prevalent in today's schools. Many programs in the past were of the drill-and-practice variety, but now programs are drawing upon the large body of emerging neuroscience research about how the brain learns. This is spawning programs that can custom-

	Verbal/ Linguistic	Intrapersonal
	Create a word wall	Interactive technology activity: http:// kids.mtpe.hq.nasa.gov/droplet.html
		Prewriting activity "The Journey of One Droplet of Water"
	Teams of student movie critics discuss strengths and weaknesses of student-made water-cycle movies	Reviewing and editing the final student-made water-cycle movies
	Write script and dialogue for class multimedia project	Creating effects, edit class video project

ize and differentiate learning to a degree not seen before. For example, at Chestnut Elementary School in Kissimmee, Florida, students use FastForWord software by Scientific Learning Corporation to build the cognitive skills of memory, attention, processing, and sequencing in the context of key language and reading skills of listening accuracy, phonological awareness, and language structures. This program and others like it adapt to the needs of the student in real time and take advantage of a wide range of preferred learning styles. Furthermore, they are designed to mirror the way people learn and apply new knowledge in their everyday lives.

The future looks bright as more and more teachers use the power of technology to reenergize the theories of Bloom, Gardner, and others. Even the least-experienced teachers can provide more depth and learning-style differentiation if they effectively use educational technology to teach.

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Resources

Anderson, L. W., & Krathwohl, D. (2001). *A taxonomy for learning, teaching and assessing: A revision of Bloom's taxonomy of educational objectives (Complete Edition).* New York: Addison Wesley.

Bloom, B. S. (Ed.), Engelhart, M. D., Furst, E. J., Hill, W. H., & Krathwohl, D. R. (1956). *Taxonomy of educational objectives: The classification of educational goals. Handbook I: Cognitive domain.* New York: Longman.

Bug Catcher www.museum.vic.gov.au/bugs/

Cochran, D., Conklin, J., & Modin, S. (2007). A New Bloom: Transforming Learning. *Learning & Leading with Technology, 34*(5), 22–25.

Columbia Central High School blog: http://www.elizabethfullerton.com

Explore Learning: http://www.explorelearning.com

FastForWord software http://www.scilearn.com

Gardner, H. (1983). *Frames of mind: the theory of multiple intelligences.* New York: Basic Books.

Inspiration: http://www.inspiration.com

Learning styles inventories: http://del.icio.us/mattscottkuhn/Learning-Styles/

Mont'Kiara International School wiki: http://ssmeetsit.edublogs.org

San Francisco Symphony Kids: http://www.sfskids.org

Scientific Learning Corporation: http://www.scilearn.com

Technology and Learning Styles workshop: http://www.mcrel.org/technology/

Theory of Multiple Intelligences: http://del.icio.us/mattscottkuhn/learning-styles/

Matt Kuhn is a lead consultant with Mid-continent Research for Education and Learning (McREL). He conducts professional development in educational technology, science, math, and leadership, and is a co-author of Using Technology with Classroom Instruction that Works. *He has taught science and math in grades 6–12 and was a K–8 school principal.*

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