USING TECHNOLOGY *with* CLASSROOM INSTRUCTION *that Works* *2nd Edition*

Introduction

What a different world we live in now than when we were writing the first edition of this book in the summer of 2006. Consider that, at that time,

- Karl Fisch had not yet released the now-seminal "Did You Know?/Shift Happens" (2006) presentation.
- You had likely never heard of the Android mobile technology platform or the iPhone, iPod Touch, or iPad mobile digital devices.
- We knew that Google was in the process of creating the Google Docs program, but it had not yet been released.
- The Google Sites program would not emerge for several years.
- The Gmail webmail service was still by invitation only.
- Twitter would first launch in July, but would not be widely used until the following year.
- Facebook had fewer than 8 million users (Vogelstein, 2007). By April of 2012, it had over 900 million (Facebook, n.d.).

Our students must learn not only how to use current technologies, but also how to evaluate which ones work best for particular tasks or projects. To that end, it is with great enthusiasm that we bring you the second edition of *Using Technology with Classroom Instruction That Works*. Technology books have a notoriously short shelf life due to the constant evolution of hardware, software, concepts, and ideas. Even when we were writing the first edition of this book, we knew that the book's content was likely to be short-lived—and yet,

that first edition is still in the top-40 rankings on Amazon.com in the category of Education & Reference > Schools & Teaching > Computers & Technology.

We think we know the reason for this staying power: Although the technologies we discussed in the first edition may have evolved or even been replaced, the purpose driving their use has remained the same. For instance, in the first edition, we gave an example of a teacher who used the SurveyMonkey online questionnaire tool to gather data on his students' current knowledge and understanding of the Battle of Leyte Gulf. The need to gather data from students remains, but the tools for doing so have multiplied: Although SurveyMonkey remains a powerful and popular tool, it now has competition in the form of such programs as eClicker, Socrative, and Poll Everywhere that offer greater mobility for users.

Our intent is not to write a book about technology, but rather a book about using technology as one among several tools for providing good instruction. This way of thinking about technology is helpful for educators overwhelmed by the constant onslaught of the latest gadgets and applications. We have highlighted some of our favorites in this book, but educators should by no means feel limited by or obligated to choose any of the tools that we mention; instead, they should identify what they want a tool to do, then explore a few of the applications that do so, each with its own unique features. The advent of tablet devices and the slew of apps available for them can motivate educators to try out a variety of tools with students, and in so doing help them learn how to transfer their knowledge of existing technologies to ever newer inventions.

Why Technology?

Many exciting developments and findings have emerged since we last summarized the research on the effects of technology on student learning. For example, as multimedia tools have become cheaper to produce and more accessible to users, they have been shown to have a positive effect on student understanding and to help students fill in missing information and make better inferences (Chambers, Cheung, Madden, Slavin, & Gifford, 2006; So & Kong, 2007; Kendeou, Bohn-Gettler, White, & van den Broek, 2008). These findings are reflected in the growing popularity of the "flipped classroom" concept, in

which teachers record lectures as video broadcasts (or "vodcasts") and assign them to students as homework, saving class time for high-level discussions and activities (Schaffhauser, 2009). Even long-established technologies have proven beneficial to student learning: The use of databases, for example, has been found to increase students' cognitive loads by helping them to classify and interpret data and communicate findings (Li & Liu, 2007).

Research indicates that the use of technology can best affect student learning when learning goals are clearly articulated beforehand (Ringstaff & Kelley, 2002; Schacter, 1999). Applied effectively, technology not only increases student learning, understanding, and achievement but also motivates students to learn, encourages collaborative learning, and helps develop critical thinking and problem-solving skills (Schacter & Fagnano, 1999). Of course, computers have long been used to help students improve their performance on tests of basic skills, but the application of technology in schools has progressed beyond this narrow purpose. As Russell and Sorge (1999) assert,

> The new technologies allow students to have more control over their own learning, to think analytically and critically, and to work collaboratively. This "constructivist" approach is one effort at educational reform made easier by technology. . . . Since this type of instructional approach, and the technologies involved with it, are recent developments, it is hard to gauge their educational effects. (pp. 1–2)

We would add that student achievement outcomes are also difficult to measure because many existing assessments do not adequately capture the higher-order thinking skills that new technologies have the potential to affect.

Research shows that integrating technology into instruction tends to move classrooms from teacher-dominated to student-centered learning environments. In such "constructivist" classrooms, students tend to work cooperatively, have more opportunities to make choices, and play a more active role in their learning (Mize & Gibbons, 2000; Page, 2002; Waxman, Connell, & Gray, 2002). Technology allows teachers to differentiate instruction more efficiently by providing a wider variety of avenues for learning that reach all learning styles.

Some of the differences in how learning occurs in technology-rich classrooms as compared to traditional ones may account for consistent findings that

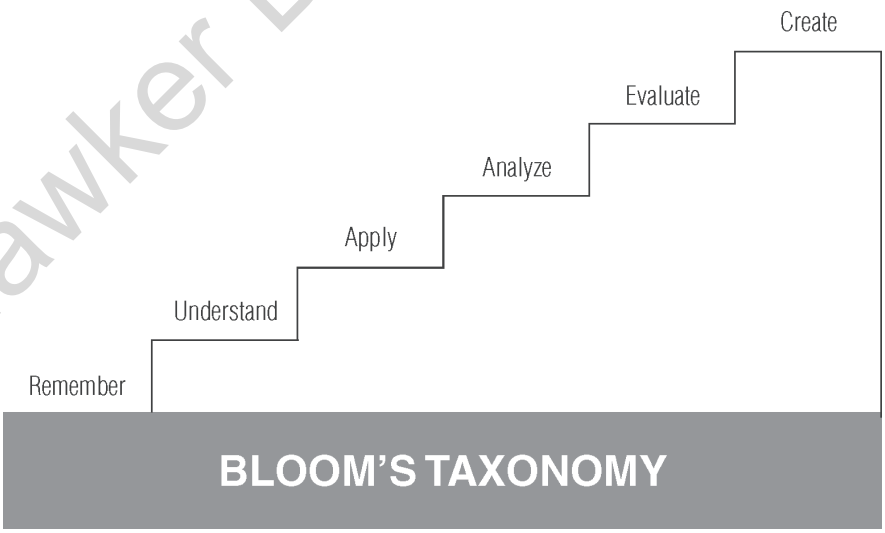
technology can be especially effective with at-risk and special needs students (Barley et al., 2002; Page, 2002). A research synthesis conducted by McREL suggests that the following characteristics of computer-assisted instruction (CAI) contribute to the learning of at-risk students (Barley et al., 2002):

- CAI is nonjudgmental and motivational.
- CAI gives frequent and immediate feedback.
- CAI can individualize learning through designs to meet students' needs.
- CAI allows for more student autonomy.
- CAI provides a multisensory learning environment (images, sounds, and symbols). (p. 97)

As we know, Benjamin Bloom created a taxonomy of learning activities that ranges from simple, factual recall of material to the application and evaluation of concepts (see Figure 1). Technology can certainly be used to provide immediate feedback for drill and practice, but it can also be used as a tool for the analysis, synthesis, and evaluation of information.

Figure 1

Bloom's Taxonomy as Cognitive Processes



Dr. Rae Niles, director of curriculum and technology for Sedgwick Public Schools in Kansas, tells the following story about one of her students to exemplify the impact that technology can have upon student learning:

> Educators from more than 45 different school districts came to visit our high school during the first year of our one-to-one laptop computer initiative. Most came thinking they were going to see the technology and left realizing it wasn't really about the technology at all. It was about the teaching and the learning and how the technology had transformed what was occurring within the school walls.
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> Typically, when visitors arrive at our school we conduct a 25- to 30-minute impromptu tour of the facilities, allowing for spontaneous conversations with faculty and students. Following the tour, the visitors then dialogue with a "panel of experts." The panel of experts consists of ten 16-, 17-, and 18-year-old students with a range of abilities and socioeconomic status who have been asked that morning to serve as experts for our guests.
>
> There are two simple ground rules for the types of questions the guests can ask the students: 1) there is nothing off limits that can be asked, and 2) there is nothing the students should be afraid to answer if what they are answering is the truth. During one visit, immediately after outlining the process for the next 45 minutes, the superintendent from a neighboring school district, in a very accusatory tone, turned to one of the students and said, "So, how is this [the one-to-one laptop computer access] really making a difference for you?"
>
> The young man, Casey, looked at the superintendent then looked back at me, obviously struggling with his response and stunned at how to answer. There was turmoil clearly written across Casey's face. He didn't know how to answer, or even if he *should* answer the man's question. Clearly struggling with how to articulate his response, Casey looked the superintendent squarely in the eyes and said, "Sir, sir, I'm special ed. and I've been special ed. all my life. But with this thing here"—he pointed to his laptop computer—"I am just as smart as the next kid."
>
> To say you could hear a pin drop would be an understatement. Those in the room sat in stunned silence. The superintendent recoiled and immediately asked, "No, *really* how is it making a difference for you?"
>
> Casey responded, "I don't read so well and learning through my eyes is hard. With the laptop what I do is write what I am going to turn in, like an essay or answers to the questions the teacher has on the assignment, and then I go up to the menu bar and pull down to 'speak it.' Then I put on my headphones, close my eyes, and listen as the computer reads back

to me what I have written. If what I have written makes sense, then I know what I have written is OK to hand in. If not, then I can go back and make my corrections."

Casey was a senior, and for the first time since his placement in special education as a 1st grader he had been allowed to learn the way he learned best, not the way his teachers *assumed* he learned best. For almost 12 years, his learning style had been controlled by his teachers. Technology had allowed Casey to use his strengths to learn in the way he learned best.

Casey went on to graduate from high school and to successfully complete a two-year fire science degree from a nearby community college. He now works as a firefighter/EMT, and was married this past spring. The effect of technology on his success beyond high school may never be fully measured, but there is no doubt that technology allowed him to use his strengths to learn how he learned best and to help him believe he could be successful. (R. Niles, personal communication, 2006)

New Instructional Planning Framework

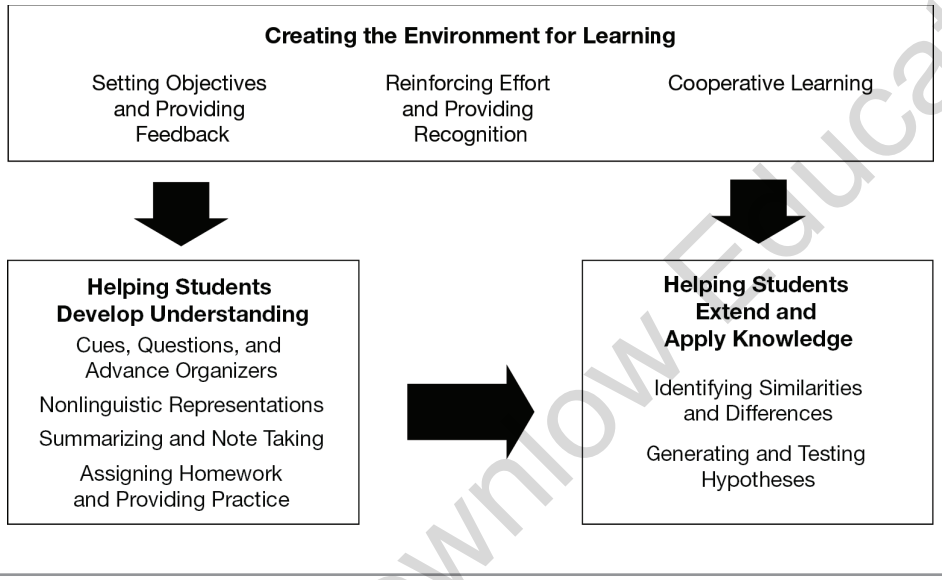
It is our intention, with this book, to show teachers how to effectively use the dynamic tools available to them to enrich their students' learning experiences, encourage project-based instruction, and give their students the skills they need to become lifelong learners and critical thinkers as they define the first half of the 21st century. This book is ideally a companion to *Classroom Instruction That Works, 2nd Edition* (Dean, Hubbell, Pitler, & Stone, 2012), and not a substitute; that book will provide a solid grounding for using the technologies discussed in this book.

Since 2007, McREL has updated the research behind *Classroom Instruction That Works,* as reflected in the second edition of that book. While the categories of strategies (see Figure 2) have not changed, the second edition analyzes more recent studies and modifies classroom recommendations accordingly. Most important, our thinking about the strategies and how to use them in the planning process has evolved since the first edition of *Classroom Instruction That Works*. The strategies are now organized in a framework for planning instruction (see Figure 3) to help teachers use them more purposefully and with greater intentionality.

The strategies in the first component of the framework, Creating the Environment for Learning, serve as the backdrop for every lesson. When teachers

Figure 2

The Framework for Instructional Planning



create an environment for learning, they motivate and focus student learning by helping students know what is expected of them, providing them with opportunities for regular feedback on their progress, and assuring them that they are capable of learning challenging content and skills. They encourage students to actively engage in and "own" their learning, providing opportunities for students to share and discuss their ideas, develop collaboration skills, and learn how to monitor and reflect on their learning.

The second component of the framework, Helping Students Develop Understanding, includes strategies predicated on the fact that students come to the classroom with prior knowledge and must integrate new learning with what they already know. The strategies included in this component help teachers use students' prior knowledge as scaffolding for new learning. Acquiring and integrating new informational knowledge requires students to construct meaning from, organize, and store the information. Constructing meaning is an active

process: Students recall prior knowledge, make and verify predictions, correct misconceptions, fill in unstated information, and identify confusing aspects of the knowledge (Marzano & Pickering, 1997). Students organize information by recognizing patterns (e.g., a sequence of events, a description), and they

Figure 3

The Nine Categories of Instructional Strategies

Category	McREL Definition
Setting Objectives and Providing Feedback	• Provide students a direction for learning and information about how well they are performing relative to a particular learning goal so that they can improve their performance.
Reinforcing Effort and Providing Recognition	• Enhance students' understanding of the relationship between effort and achievement by addressing students' attitudes and beliefs about learning. • Provide students with rewards or praise for their accomplishments related to the attainment of a goal.
Cooperative Learning	• Provide students with opportunities to interact with each other in groups in ways that enhance their learning.
Cues, Questions, and Advance Organizers	• Enhance students' ability to retrieve, use, and organize what they already know about a topic.
Nonlinguistic Representations	• Enhance students' ability to represent and elaborate on knowledge using mental images.
Summarizing and Note Taking	• Enhance students' ability to synthesize information and organize it in a way that captures the main ideas and supporting details.
Assigning Homework and Providing Practice	• Extend the learning opportunities for students to practice, review, and apply knowledge. • Enhance students' ability to reach the expected level of proficiency for a skill or process.
Identifying Similarities and Differences	• Enhance students' understanding of and ability to use knowledge by engaging them in mental processes that involve identifying ways items are alike and different.
Generating and Testing Hypotheses	• Enhance students' understanding of and ability to use knowledge by engaging them in mental processes that involve making and testing hypotheses.

store information most effectively by creating a mental image of it. Acquiring and integrating procedural knowledge involves constructing a model of the steps of the process, developing a conceptual understanding of the process and understanding and practicing its variations, and using the process fluently or without much conscious thought (Marzano & Pickering, 1997).

Strategies in the third component of the framework, Helping Students Extend and Apply Knowledge, emphasize the importance of helping students move beyond "right-answer" learning to expanded understanding and use of concepts and skills in real-world contexts. These strategies help students become more efficient and flexible in using what they have learned. They involve the use of complex reasoning processes, which are necessary for students to use knowledge meaningfully (Marzano & Pickering, 1997).

New Categories of Technology

In the first edition of this book, we identified seven categories of technology that helped us think about how we use various 21st century tools. It is indicative of the ever-changing nature of technology that, when we revisited our work for this second edition, we found those seven categories to be no longer adequate. For example, the category of web resources now makes little sense, as the advent of cloud computing has effectively turned nearly every tool into a possible "web resource." Similarly, we have integrated the category of spreadsheet software into the larger category of data collection and analysis now that we have multiple tools that allow users to easily aggregate data from many sources and filter them in multiple ways to reveal trends and patterns. You can see our new and expanded list of nine categories of technology in Figure 4.

We have often been asked by readers or workshop participants why we did not include a category for display tools such as interactive whiteboards, LCD projectors, and document cameras. Our answer is that display tools without appropriate software are little more than overhead projectors; it is the marriage of hardware and software that enables us to modify our environment to learn or teach. We believe that instructional technology at its best allows the learner to do things that would be impossible, unsafe, impractical, or uninspiring to do otherwise. Although display tools are certainly necessary to have in the classroom, we feel that referring to them as "instructional technologies" is