Rethink Reading

Build an Assistive Technology Toolkit

End the Math Wars

Is the Digital Native a Myth?
Smart investments for our future...

...Your investment to education begins here.

School Purchasing information available at:
www.usa.canon.com/educationalsales or
email: canonsales@sedintl.com • phone: 800-344-9862

Canon’s Education Sales Division is your ONE STOP SOLUTION for all of your school’s imaging needs. From Digital SLR cameras for Photojournalism and HD Video to a full line of High Definition Camcorders for recording events. The simple operation of PowerShot digital cameras make them perfect for class projects.

Multifunction printers make it easy to Print, Copy, Scan & Fax anything from documents, books, photos and negatives. Or, create 13” x 19” posters easily on PIXMA Pro Printers.

From academics to administration, Canon has the equipment for your imaging needs. Projectors, Binoculars and Calculators are also available.
Build an Assistive Technology Toolkit
Kelly Ahrens

You can instill independence and confidence in students with special needs by finding free tools and working with your IT department to streamline the process for creating an assistive technology program.

Reading Redefined for a Transmedia Universe
Annette Lamb

Once upon a time, reading was as simple and straightforward as words on a page. No more. Digital age technologies have made such an impact on the way we interact with content that the old definitions of reading and books no longer apply.

End the Math Wars
Matt Kuhn and Kathleen Dempsey

Increase your math students' procedural fluency and build greater conceptual understanding in virtual environments.
LEARNING CONNECTIONS

Computer Science

26 No Robotics in School? 4-H Can Help
Bradley Barker and Richard Mahacek

Literature

30 QR Codes in the Literature Classroom
Hannah Walden

Multidisciplinary

32 Designing Effective Global Collaborative Projects
Micaela Manso and Magdalena Garzón

Multidisciplinary

36 10 Tips for the Education Blogger
Katie Stansberry

Science

38 Teach Your Budding Scientists to Be Gamers
Timothy Barko and Troy D. Sadler

Tip

41 Snag the Perfect Film
Shannon McClintock Miller

LEADING CONNECTIONS

Issue Oriented

4 Cool Tools Enhance How We Learn and Teach
Anita McAnear

Point/Counterpoint

6 Is the Digital Native a Myth?
Sylvia Martinez and Marc Prensky

Readers Respond

8

ISTE News

9 Connected Classroom

10 Introducing Mechatronics in Schools
Glen Bull, Willy Kjellstrom, and Joe Garofalo

Bloggers Beat

25 Twitter Is a Great Tool, but Is It Professional Development?
Diana Fingal

As I See “IT”

45 True Tech Integration Is More than a Computer and an App
Susan Poling

ISTE in Action

48 ISTE’s T-Rx Program Is No Dinosaur
Clare Strawn

PRODUCTS & SERVICES

Buyer’s Guide

42 Web Conferencing Tools
Maureen Yoder

What’s New

44

What’s New
From web 2.0 tools to mobile devices and apps, cool tools are nearly overwhelming us. The Apple app store has more than 900 offerings listed for education alone. Some of these tools and apps, along with multimedia publishing, are actually forcing us to redefine what we mean by books and reading.

In this issue, Annette Lamb discusses how digital age reading technologies have changed what it means to “read” a book and proposes a revised definition of reading (see page 12). She introduces some really cool books organized into five digital reading environments: e-books, interactive storybooks, reference databases, hypertexts and interactive fiction, and transmedia storytelling. She also discusses the new opportunities and challenges of technology-based reading.

My new favorite cool tool is my iPad. Not quite on the bleeding edge, I joined the craze with the second generation. The turning point for me was listening to Lamb describe her use of the iBirds Pro iPad app for bird watching and the Star Walk iPad app for exploring the night sky. (My secret desire is to become a citizen scientist.) These tools help us engage with the natural environment in ways that reference books just can’t because they don’t have search engines. The iBirds search engine makes it easy to identify birds while teaching you about the features of these animals as you input your choices for wing shape, head pattern, or other features. You can even listen to categories of birdcalls and the specific calls of each bird. The Star Walk app lets you point your iPad at the sky and see what stars, constellations, and satellites you are looking at in real time. You can click on an object to see its name and access information about the object. You can also drag a timeline to see how the object moves over time and space. As you interact with these apps, you learn what to look for as you observe the natural world.

Camilla Gagliolo, an instructional technology coordinator for Arlington County Public Schools in Virginia, USA, introduced me to another book app that takes advantage of all the features on my iPad. Al Gore’s Our Choice app explores the causes of global warming and presents insights and solutions for the problem. Its multitouch interface allows you to explore narrative, photography, interactive graphics and infographics, animations, and video.

This cool tool and others have tremendous potential for students to explore and engage with content. Matt Kuhn and Kathleen Dempsey discuss ed tech uses in math that help students improve computational fluency and explore real-world problems (see page 18). Ed tech contributes in three areas: engagement and relevancy, differentiation, and inclusivity and multiple feedback channels.

Cool tools also promote access for individuals with special needs. Kelly Ahrens will help you build an assistive technology toolkit using web 2.0 tools and handy features included with your computer’s operating system (see page 22). For more cool tools, check out the Learning Connections section on page 26, and have fun learning!
Five new books from ISTE to help you learn, teach, and succeed

- Introduce students to career mentors
- Cultivate media-savvy students
- Connect theory to practice
- Engage students in a new way
- Master digital citizenship

Check out these and other great resources at ISTE’s online store.

iste.org/store
It makes little sense to debate whether the digital native is a myth, because it exists only as a metaphor and a definition (meaning someone who was born in the digital age). To dismiss the term as merely a catchy phrase, however, is to deny the enormous power it has had to help huge numbers of people understand an important part of 21st century reality.

For me, the metaphor has never been—as some have tried to make it—about capabilities or knowledge about all things digital. No matter who you are, you have to learn those things. The distinction is much more about culture. It is about younger people’s comfort with digital technology; their belief that it is easy, useful, and benign; and their view of it as a fun “partner” they can master without much effort, if they choose to (they don’t always).

Because they have grown up with digital technology, digital natives are more comfortable with it than the generations that did not. But this doesn’t mean they know everything about it or want to. A nonintuitive file system that dates back to the
challenge students by creating experiences with substance and meaning. Parents can model values through words and actions. If adults walk away from our responsibility to teach young people about appropriate, thoughtful uses of technology, it’s our fault when silly or inappropriate uses fill that vacuum.

And we should go further than just helping young people use technology. They need to know why adults think it’s important, and they need to be partners in the process. By giving students a role in decision making about using technology in education, we empower them to think beyond their own enjoyment of the moment. By sharing the “whys” of educational technology with them, we gain powerful allies and advocates in the effort to improve education.

Being a digital immigrant is also a convenient excuse for teachers who don’t want to learn something new. It implies that adults will never “get” technology the way kids do because their brains are wired differently, something that has never been scientifically proven. There is no doubt that the hidden message of being labeled a digital immigrant is that, no matter how good you are with technology, you will always “speak with an accent” and your brain is out of whack with the modern world—so why even try? I have all the sympathy in the world for teachers who are overburdened and who have learned to ignore all the hype that never pans out. But it’s 2011—c’mon people, no more excuses!

Educating today’s students means teaching them how to use computers. No one is saying that the fundamentals aren’t still important—that critical thinking and reading and math aren’t required to succeed in today’s world. But technology makes those things accessible to students who might have been left behind before. Blogs give shy students a voice in a class discussion or allow a student who is not even physically in the classroom to participate. Wikis represent the technology of democracy and everything we try to teach students about collaboration and teamwork. Getting these tools up and running is important; challenging students to use them wisely even more so.

Labels only solidify boundaries and imply that teachers and students are adversaries. It’s simply the wrong model for a collaborative learning environment, where both teachers and students are fellow lifelong learners.

—Sylvia Martinez is president of Generation YES (http://genyes.org), a nonprofit that evangelizes for student involvement in education reform through technology integration and service learning.

Labels only solidify boundaries and imply that teachers and students are adversaries.
Is the Digital Native a Myth?

Although most poll respondents think digital natives are the real thing, many commenters point out that we still have much to teach them.

Did You Mean Digitally Naïve?

Students think of computers strictly as a way to listen to music. If the internet goes down, they don’t know what to do with themselves. Although they are quite adept at surfing and texting, they flit from one posting to another, sampling many but savoring none. They no longer have a burning desire to learn, experiment, or solve issues. I think today’s generations are digitally naïve.

Russ Weintraub
Computer Teacher
Lafayette Hill, Pennsylvania, USA

Let Them Take Charge

We need to compare what students really are doing with technology to Bloom’s Taxonomy. For many, it will be at the levels of remembering, understanding, and applying. Getting to analyzing, creating, and evaluating might be a challenge for both teachers and students. Teachers will need to allow students to tear apart things, including their own knowledge, and take charge of their learning. No need for labels, just learning.

James Freeman III
Director of Technology
Columbus, Ohio, USA

Even Natives Need Teachers

Digital natives might be more comfortable using new technologies, but they still need teachers to teach them how to use new tools. When you start evaluating their skills using Bloom’s Taxonomy, they often appear to have either splinter skills or skills on the lower end.

Hindie Becker Dershowitz
District Assistive Technology Coordinator
Katy, Texas, USA

It’s a Matter of Fluency

It’s not so much about natives and immigrants as it is about fluency. Adults who grew up without the internet (or even computers) did not formally learn the technology and therefore have had fewer opportunities to become fluent.

Gary Needham
Director of Technology
Kearney, Nebraska, USA

What about the Digital Divide?

The flip side of multitasking is that students’ attention spans are short unless they are digitally engaged. They lose interest quickly if they don’t understand something immediately. This instant gratification rears its ugly head when it comes to challenges. Many of my students were excited about using Wacom tablets, until they found it takes getting used to. Their attitudes turned from positive to negative in a very short time.

Jeremy Kalbstein
Digital Media & Design Teacher/E-Leader
Melbourne, Victoria, Australia

Digital Age History

Just as children learn about history to help them prepare for the future, they need to understand where technology has come from, what the working parts of a computer are, and the difference between hardware and software. By doing this, they acquire transferable skills to structure their own solutions, whether creating a template in a blank Excel worksheet to examine alternative solutions or creating a Scratch routine to animate an object.

Carmela N. Caratola Knowles
Technology Integration Specialist
Hatboro, Pennsylvania, USA

Never Assume

It’s insulting to assume that all students have equal access to technology. Do we want to put those most in need of support at a further disadvantage by assuming they’re all tech savvy?

Don Davis
Comment on ISTE’s Facebook page

LETTERs

I wanted to express my appreciation for this wonderful resource. Whenever I receive a new issue, I can’t wait to read what’s inside. I especially like the What’s New and Learning Connections sections. I relay the information to our teachers, and they always respond with an enthusiastic “thank you.” Our high school social studies teacher was thrilled with the “Plantation Letters” article [see L&L, May 2011, “Exploring History in Plantation Letters,” pages 24–26] and accessed it immediately. The “Using Games to Teach Ocean Awareness” [see L&L, May 2011, pages 32–33] article offered an exciting way to teach an important subject. Our fifth grade talented-and-gifted teacher is going to use it with her students.

With the economy being what it is and additional budget cuts headed our way, resources that supply beneficial information are truly appreciated.

Lori Wells
Network Coordinator
Aurora, Oregon, USA
Free Computational Thinking Resources

ISTE and the Computer Science Teachers Association are offering teacher and school leader resources focused on the emerging field of computational thinking (CT) for K–12 education.

These free resources include Computational Thinking Teacher Resources and the Computational Thinking Leadership Toolkit as well as resources that can help educators value and understand CT.

You can download the resources at iste.org/computational-thinking and access other CT resources as they become available.

Leadership Conference Postponed

School leaders won’t want to miss the ISTE Leadership Conference scheduled for fall 2012. The inaugural conference was originally slated for fall 2011 but was postponed one year to ensure sufficient time to launch a high-quality program.

The conference will provide the opportunity for leaders and change agents in the field of education to come together and “focus forward.”

Participants will unite and collaborate in an effort to transform learning environments so that all students can reach their creative and intellectual potential. It will be a time of learning, growing, and networking.

Stay tuned for dates, location, and program details. For more information, contact Leslie Conery at lconery@iste.org.

Translate ISTE’s Website

Now you can translate ISTE’s website into dozens of languages. Check out the NETS in Czech, Spanish, Swahili, and many other languages. The Google Translate bar is in the top center of every page on iste.org.
Use of microcontrollers as logic modules to control movement is bringing about sweeping changes in the field of mechanical engineering. In the past, mechanical engineers worked with cams, gears, levers, and mechanical actuators to produce desired motions and actions. Microcontrollers have largely replaced this step.

Microcontrollers are a common component in washing machines, cars, and any other device with embedded intelligence. They are essentially a computer on a chip that is small, programmable, and inexpensive. Today, they cost just a few dollars, and the price is likely to drop.

Intro to Mechatronics

The word mechatronics combines mechanical engineering and electronics. The emergent field of mechatronics encompasses mechanical, electronic, and computer engineering. Digital fabrication is an efficient way to design and create rapid prototypes of mechanical systems. Electronics engineering provides a means of designing actuators to control movement of these systems, and computer engineering provides the logic for communication and control.

Activities for Young Students

Papert’s work at the Massachusetts Institute of Technology (MIT) led to adaptations of these systems for educational use that continue today. Mitch Resnick, the Papert Professor of Learning Research, directs the Lifelong Kindergarten group at MIT. This group conducted the research

<table>
<thead>
<tr>
<th>Products and Features for Exploration of Mechatronics</th>
<th>Controller</th>
<th>Integration</th>
<th>Sensors &amp; Actuators</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEGO WeDo [<a href="http://info.scratch.mit.edu/WeDo">http://info.scratch.mit.edu/WeDo</a>]</td>
<td>Computer controls motors and sensors</td>
<td>No microcontroller</td>
<td>Prepackaged kit</td>
<td>Early elementary and above</td>
</tr>
<tr>
<td>PicoCricket [<a href="http://www.picocricket.com">www.picocricket.com</a>]</td>
<td>Stand-alone microcontroller controls motors and sensors</td>
<td>Microcontroller, preassembled on circuit board</td>
<td>Prepackaged kit</td>
<td>Upper elementary and above</td>
</tr>
<tr>
<td>Arduino [<a href="http://www.arduino.cc">www.arduino.cc</a>]</td>
<td>Stand-alone microcontroller controls motors and sensors</td>
<td>A breadboard for prototyping circuits</td>
<td>Components sold separately (prepackaged educational kits available)</td>
<td>Middle school and above</td>
</tr>
</tbody>
</table>
A new product that combines a Pico-Cricket controller with built-in buttons and sensors on a pre-assembled circuit board.

**Activities for Advanced Students**

For more advanced students, the Arduino is an open-source microcontroller designed to allow non-technical users to explore the field of mechatronics. Artists and museums are adopting it to create interactive objects and environments. It is also useful for many educational projects. Leah Buechley, director of the High-Low Tech group in the MIT Media Lab, uses a version of the Arduino called the Lilypad that students can sew into cloth to create interactive fashions. Roger Wagner has developed a version of his widely used program HyperStudio that offers control of the Arduino with simple button-based actions. This provides a useful entry point for students before they begin using text-based programming languages with the Arduino.

**Microcontrollers**

In the early 1970s, Papert and Solomon assumed that computers would be able to spin motors, switch lights, and read the state of light-sensitive cells, but they may not have guessed that this would be possible with tiny microcontrollers that cost just a few dollars. A microcontroller allows projects to stand on their own without a connection to a laptop computer. The PicoCricket is a microcontroller developed at MIT that uses lights, motors, and sensors to make things spin, light up, and play music. The Playful Invention and Exploration website (www.pienetwork.org) is a useful source of PicoCricket project ideas for a variety of content areas. Examples include analyzing graphs of data gathered from light sensors attached to a wearable belt as well as kinetic sculptures that incorporate the principles of simple machines. The PicoBoard is about open and closed circuits, they customized their creations with LED lights that lit up when parts of the mechanism reached an apex. As an extension, students connected these automata to the LEGO WeDo motor and controlled it with Scratch. The additional computer-controlled elements allowed the students to redesign their card-stock models and solve problems that required precise measurement.

**Scratch**

Scratch, a kid-friendly programming language that Resnick’s group at MIT developed, now includes control motors and sensors. Students can drag program blocks that control motors and sensors onto the Scratch programming workspace, fulfilling Papert’s vision. For example, students can use the motion sensor to construct an alligator that snaps its mouth shut when an object comes near it.

Scratch’s accessibility, combined with the LEGO WeDo’s functionality, creates opportunities to connect mechatronics with traditional curricular content. For example, students in Paula White’s fifth grade class at Crozet Elementary School in Crozet, Virginia, USA, constructed hand-cranked mechanisms using card stock. To learn that led to development of the LEGO Mindstorms robotics systems. More recently, it developed a LEGO robotics kit for elementary students. The LEGO WeDo robotics kit contains working motors and sensors that children as young as 7 can assemble and control.

Scratch’s accessibility, combined with the LEGO WeDo’s functionality, creates opportunities to connect mechatronics with traditional curricular content. For example, students in Paula White’s fifth grade class at Crozet Elementary School in Crozet, Virginia, USA, constructed hand-cranked mechanisms using card stock. To learn
Reading Redefined for a
Once upon a time, reading was as simple and straightforward as decoding words on a page. No more. Digital age technologies have made such an impact on the way we interact with content that the old definitions of reading and books no longer apply.

Times, as they say, are changing. The digital age is transforming nearly every aspect of our culture, from business to education to social life. Reading and books are no exception. Mobile devices, multimedia publishing, and social technologies are having a major impact on the reading experience both inside and outside the classroom. Instead of carrying backpacks full of 40-pound textbooks from class to class and trading paperbacks with their friends, today’s young people are downloading and exchanging digital novels and textbooks on their smartphones, e-book readers, and tablets. Besides taking a load off our students’ backs, this development has turned on its head the very idea of what it means to read a book.

Don’t believe it? Read The Pedlar Lady of Gushing Cross from Moving Tales on a tablet, or watch the book trailer on YouTube. This story contains text and images, like a traditional book, but it also has digital animation and audio. So is it a book?

Given these new realities, it’s time to expand the meaning of the phrase reading a book.

First, let’s tackle the definition of reading. What’s involved with the activity? Must it involve only text, or can it include graphics, sounds, motion, and other kinds of symbols in addition to or instead of the text? Does a book need to have a traditional start and finish? Or could the content emerge or even be created as the reader moves through the experience?

Here’s a revised definition that encompasses all these elements: Reading is the process of constructing meaning from symbols.

Now let’s redefine the term book. Does a book need to be made of paper, or can it be digital? Can it contain artifacts or other elements? Does it need to have pages? Must it be linear, or can it be branched or chaotic?

A new definition that allows for all of these options is: A book is a published collection of related pages or screens.

This expanded meaning not only reflects the changing landscape of reading, it also opens up new worlds of possibilities for students to engage with content inside and outside the classroom.

Digital Reading Environments

It’s taken 20 years for PK–12 interactive books to make a comeback (see “History of Digital Reading,” page 16). But this resurgence has brought with it an explosion of reading choices.

Let’s explore five electronic reading environments: e-books, interactive storybooks, reference databases, hypertext and interactive fiction, and transmedia storytelling.

E-books. From current favorites such as The Hunger Games trilogy by Suzanne Collins to traditional series such as the Boxcar Children by Gertrude Chandler Warner, many publishers are selling e-book versions of their titles for the Kindle, Nook, and other e-book readers. Some companies also give users access to their e-books on other devices, including smartphones and laptop computers.

In a 2010 study of young readers published in Reading Teacher, Lotta Larson found that digital reading devices promote new literacy practices, such as digital note-taking, and provide readers control over how they engage with the text. While e-books feature linear content, just like a print book, many also contain additional tools, such as highlighters, dictionaries, virtual bookmarks, and note-taking tools. Search tools allow readers to easily locate words and passages. Some e-book readers give users control over screen resolution, text and background color, font size, and display orientation. In some cases, users can even insert or remove text, mark up pages, add comments, insert notes, attach files, and record audio to e-books.

Enhanced e-books for the iPad, iPhone, and other multimedia devices contain multimodal features—images, web links, and embedded media—within the linear text. These media elements have been particularly popular in nonfiction books such as The Kennedy Detail by Gerald Blaine. Increasingly, audio and video are integrated into books with a movie tie-in, such as I Am Number Four by Pittacus Lore.

Books in James Patterson’s popular Maximum Ride series are available as Kindle e-books that students can read not only on Kindle e-readers, but on iPhone, Windows PC, Mac, Blackberry, iPad, Android, and Windows Phone 7. Supplemental materials
The revolution in digital reading didn’t just happen overnight. It began 20 years ago, in the early 1990s, when interactive storybooks such as Mercer Mayer’s *Just Grandma and Me* introduced a revolutionary new way to experience children’s books on CD-ROM. Unfortunately, these electronic reading environments were limited to titles for beginning readers and a few informational reading resources from companies such as Dorling Kindersley.

By the late 1990s and early 2000s, people expected to find free reading materials on the web. But free websites with high-quality content were difficult to find, poorly formatted, and usually contained ads. Students could read classics online at websites such as Project Gutenberg, but only a few children’s book resources, such as International Children’s Digital Library, emerged.

Although some websites, such as Sesame Street E-books, provided access to a combination of free and fee-based reading materials throughout the 2000s, most ad-free websites (such as Tumblebooks) became subscription-based.

The recent explosion of e-book readers, smartphones, and tablet computers has expanded opportunities for digital reading. You can now read full-color newspapers, including USA Today, on smartphones, and a new wave of episodic fiction for young adults, such as *Dark Eden* and 3:15 by Patrick Carman, is emerging with accompanying iPad apps that combine text with interactive maps, audio, and video.

Interactive storybooks. These were introduced on CD-ROM back in the 1990s. Today, many are available as mobile apps for smartphones and tablets. New companies, such as mytales digital, are producing these multidimensional stories.

Interactive storybooks feature a narrator reading a linear story aloud. To help beginning readers, the text is often highlighted as the words are read, and the book may provide options for defining words or exploring elements on the screen. Many of these storybooks, such as *One Snowy Day* by Tammi Salzano, give children different ways to access the content of the story, including “read to me,” “read by myself,” and “play with me.”

In recent years, the introduction of mobile apps for iPhones and iPads, such as the app for Donald Crew’s *Freight Train*, has renewed students’ interest in interactive storybooks. And today, these types of extended reading experiences are reaching beyond the elementary grades to prekindergarten. For instance, the Touchy-Books apps contain a number of child-friendly demo stories.

Many researchers, including Larson and Cathy Pearman, have noted that struggling readers benefit from the support that interactive books with high-quality navigation provide. However, in a 2001 study in the *British Journal of Educational Technology*, John Trushell, Clare Burrell, and Amanda Maitland found that, even though these books have arrows encouraging readers to move forward through the story, many children choose to go backward or in a nonlinear way, which adversely affects their recall of the story.

Engaging interactive experiences are also available for young adults. Classical Comics provides graphic novel adaptations of classic literature that incorporate interactive animation and audio features.

The options to hear words pronounced aloud, read definitions, explore glossaries, see labels on illustrations, and experience reading support are useful for all ages, but particularly in guided learning situations for children with special needs and English language learners.

Reference databases. Students no longer need to lug around heavy reference books to have information at their fingertips. Increasingly, they are using mobile apps, such as the iBirds Pro iPad app for bird watching or the Star Walk iPad app for exploring the night sky, to explore the natural world. Reference databases provide nonlinear, organized access to records of information through search tools, indexes, or subjects. They also often incorporate tools for bookmarking and note-taking, as well as photos, maps, audio, and video elements. For instance, The Elements by Theodore Gray iPad app provides a visual exploration of the periodic table. Dorling Kindersley produces an Eyewitness Travel series exploring popular world destinations using clickable maps, scrolling photo galleries, and zooming images.

In her 2009 article “Digital Literacies” in the *Journal of Adolescent & Adult Literacy*, Larson points out that today’s readers expect to be immersed in multimodal resources that combine a variety of modes and media. Rather than simply reading about history, geography, or science, students want information they can see and hear.
**Hypertexts and interactive fiction.** Students can access these nonlinear narratives through various hotspots or links online. Over the past decade, many authors have chosen to publish their interactive fiction on the internet because of how easy it is to create nonlinear texts. For instance, 253 by Geoff Ryman is a novel published exclusively for the web about an accident in the London Underground. And remember the Choose Your Own Adventure series that was popular in the 1980s? It has been re-created as an iPhone/iPad app.

In the article “Hypertext Narrative and the Reader: A View from Cognitive Theory,” published in 2005 in the *European Journal of English Studies*, Ralf Schneider notes that hypertext readers are empowered by the options this type of environment provides. However, he also points out that some users may become lost in interactive texts. This problem of coherence may be related to the uncertainty of nonlinear texts, as these reading experiences’ lack of a beginning, middle, and end may make it difficult for readers to sense how much of the content they have explored or to locate subplots and alternative storylines.

**Transmedia storytelling.** Transmedia storytelling involves a multimodal, multimedia story with nonlinear, participatory elements. Resources connected to the story might include print materials; documents; maps; web-based clues; mobile apps; cell phone calls; social media connections; activities and games; and media such as audio, video, or animation.

The main storyline may or may not reside in one location, such as a traditional book or website. The narrative may be told through a series of media. For example, the series 39 Clues includes a traditional book and game cards along with access to an engaging website containing clues, missions, background information, and games.

The Skeleton Creek intermediate-level books connect novels written in a journal format with web-based videos. Social technology has become a core element of transmedia storytelling for young adults. The Cathy young adult series begins with a book and accompanying evidence packet, but social features—including cell phone numbers, websites, Flickr pages, and Facebook connections—are woven throughout the book. And the Amanda Project series website is a place for readers to engage in discussions, contribute content, and expand the reading experience.

The publishing industry is continuing to look for ways to extend the reading experience. For instance, *The Search for WondLa* by Tony DiTerlizzi provides book trailers introducing the
reading experience, an iPad app to extend participation, and an augmented reality option called WondLa-Vision that immerses readers in a map connected with the story.

**Transmedia Reading in the Classroom**

In his article “Transmedia Education: The 7 Principles Revisited,” Henry Jenkins challenges teachers to actively involve students and put what they see, hear, and read to use. Transmedia environments ask readers to seek out content, explore information in different contexts, evaluate ideas across formats, and interact with other readers.

Educators don’t need to toss their current curriculum to make use of these new reading environments. Instead, select those technology elements that enhance the learning experience. For instance, in the October 2008 issue of the *Journal of Adolescent & Adult Literacy*, Larson suggests transforming the traditional reading workshop into an electronic reading workshop by exploring e-books, writing in electronic journals, holding online discussions, and using technology tools for publishing.

You can also use e-book readers to differentiate instruction. Some students may benefit from hearing words defined or pronounced, and others will find the bookmarking and note-taking features valuable.

Increasingly, learning games are being woven into reading experiences. While playing **Lure of the Labyrinth**, middle school students read digital comics as they work their way through a series of math games. Students can work at their own pace while the teacher tracks their progress.

Social studies and science teachers will find a growing number of immersive interactive that involve students in text, audio, video, and animation content. At the **Changing the Balance** website, participants seek a cause-and-effect relationship between climate change and the impact of deadly parasites. The online role-playing simulation **Mission US** allows participants to explore...
different aspects of the American Revolutionary War. Both of these digital reading environments provide depth to the learning experience, along with multiple ways to access and use information.

**New Opportunities, New Challenges**

Today, young people may choose from many different devices that serve a variety of functions. But does technology-based reading enhance or distract from the learning experience?

The answer may depend on whether the media elements and technology tools are integral or incidental to the reading experience. Elements that support struggling readers, cue readers to important events, contribute to the mood of the story, clarify difficult concepts, or reinforce key ideas activate thinking and promote comprehension. Yet over-reliance on audio, bells-and-whistles features that distract readers, and “eye candy” unrelated to the story can divert attention, cause readers to lose focus, and adversely affect learning. When evaluating reading resources, consider the role of the audio, graphics, motion, and interactive elements and determine whether the navigation and support tools are easy to use and contribute to the reading experience.

And remember that, despite all the new formats and ways to interact with them, the content is still the part of the reading experience that provides value for the learner. Unfortunately, it’s becoming increasingly difficult for readers of all ages to differentiate between fact, fiction, and fake information.

Traditional fiction is a representation that is invented or imaginary and not factual. Nonfiction, in contrast, is information that is real, truthful, and factual. But what happens when you’re in a fictional augmented or alternative reality world but working with non-fictional materials? Or when you’re in the real world working with fictional materials? Or when authors develop websites that are intended to be misleading or deceptive?

The intermediate-level novel *Space-headz* by Jon Scieszka is advertised as a work of fiction about a boy and his experiences at home and school. However, the book also contains pages with factual information about topics such as sound waves and electromagnetic fields. To make it even more complicated, links within the story take readers to websites with fake content, such as the Mrs. Halley’s Comets, the Anti-alien Agency, and SPHDZ. These websites are intended to look real and could easily deceive readers.

As reading continues to expand beyond the printed word, it’s going to be more important than ever for young people to be able to evaluate information and distinguish fact from fiction. Scholastic’s BookFlix subscription service matches fiction and nonfiction reading to provide this foundation for young readers.

Redefining reading may be the key to nurturing the next generation of readers and promoting lifelong reading practices. According to the 2010 *Kids & Family Reading Report* by Scholastic, children enjoy digital reading. One third of young people in the study stated that they would read more books for fun if they had access to e-books. As digital content quality catches up with the explosion of easy-to-use technology, educators will discover new ways to motivate digital age reading across the curriculum.

Annette Lamb has been a school library media specialist, computer teacher, and professor of education and library science. She is currently teaching online graduate courses for librarians and educators as a professor at Indiana University-Purdue University (IUPUI), Indianapolis, Indiana, USA.
End the Math Wars

In 1999, Richard Lee Colvin published an article in The School Administrator titled “Math Wars: Tradition vs. Real-World Applications” that described the pendulum swing of mathematics education reform. On one side are those who advocate for computational fluency, with a step-by-step emphasis on numbers and skills and the algebra-geometry-trigonometry-calculus sequence. On the other side are those who think students must engage with real-world problems that employ a variety of mathematical disciplines and deep learning of math concepts that comes from struggling with complex problems, comparing multiple solution paths, and learning from trial and error. As the role of ed tech continues to evolve, can it bring the two together and help meet the needs of both sides in ways that were not possible or even considered in 1999?

Some schools don’t look very different than they did in 1999, 1989, or even 1959, while others are rocketing into the future with one-to-one laptop initiatives, educational gaming, and intelligent tutoring. Printed textbooks are becoming dusty in these modern classrooms, and publishers know they must offer robust digital versions of textbooks or be left behind. Some schools and districts are not even buying printed books anymore. Instead, they are putting their precious funds into laptops that have enhanced digital versions of textbooks with multimedia, tutoring software, and statistical analysis tools. For an example, check out Empire High School in Vail, Arizona, USA (see Resources on page 21).

To understand what it will take to bring the two sides of the mathematics debate together, first consider the approach each side takes to improve student achievement. One side wants to focus mostly on building scaffolded computational fluency through repetition and practice, while the other wants to focus mostly on engaging learners in deep and meaningful problem solving. Do these goals have to be mutually exclusive, or is there a middle ground? Many would say that we have tried this combination and failed, and that the complexity of combining these approaches using just paper and pencil is very difficult with today’s digital natives. Indeed, many integrated mathematics textbooks have produced mixed results. Ed tech, however, has changed the debate. Three areas where technology helps create schools where students learn what they need to know about math are:

- Engagement and relevancy
- Differentiation for digital natives
- Inclusivity and multiple feedback channels

Engagement and Relevancy
Engagement and relevance are interdependent. If students think something is exciting and challenging, they usually perceive it as relevant. Likewise, if they see a problem’s topic as relevant to their community, it tends to pique their interest and motivate them. In other words, it challenges them to engage in deep problem solving. Although using technology to learn mathematics is often merely drill and practice, much of the latest software is more engaging than ever.

For instance, the algebra game DimensionM uses exciting scenarios to engage learners in algebraic problem solving to overcome challenges and achieve a series of increasingly challenging goals. Students who play the game often have so much fun that they barely notice the large amount of mathematics they are doing. Teachers who employ educational games will tell you that they often see students searching sites, such as www.purplemath.com, frantically ruffling through a book, or trying to get help from the teacher quickly to learn how to apply an equation that is holding up the game. To see the level of excitement a game can generate, go to www.dimensionu.com/math and view the tournament video between New York City and Chicago.
We can’t think of any paper-and-pencil lesson that generates this amount of student enthusiasm about algebra.

**Differentiation for Digital Natives**

Let’s face it, when it comes to inclusion, teachers are dealing with a wide array of student abilities, interests, and needs. And with budget cuts hitting schools hard, class sizes are only getting bigger. Under such challenging conditions, many teachers fall back on “teach to the middle” out of necessity, not desire. Here is where technology offers a better way.

For example, mathematics teachers can differentiate content by using intelligent tutoring software that is diagnostic, prescriptive, interactive, and adaptive to students’ readiness. One such tool is Cognitive Tutor. This program works with Carnegie Learning’s Bridge to Algebra readiness series, giving the student a battery of assessments to diagnose deficiencies in his or her mathematical background. It then produces a customized set of scaffolded lessons and gives the teacher and the student rich feedback as the student progresses through them.

DimensionM is a 3D multiplayer game for learning math. The teacher’s role is to guide, facilitate, give feedback, and monitor progress. As the student moves through the lessons, the software notices patterns and difficulties and adapts the package of lessons and types of feedback.

**Inclusivity and Multiple Feedback Channels**

When students learn, mistakes and misconceptions are inevitable. Technology provides a vehicle by which students can receive feedback without risking embarrassment. As you know, students are sensitive to the perceptions of peers, and faced with asking a question during class or remaining confused about a topic, many students simply choose to remain confused. One way to address this is through student response systems. These handy devices allow students to give a response anonymously and then learn whether the response is on target or off the mark. With student response systems, teachers have a better understanding of which topics their students have mastered and which they need to revisit. The fact that the feedback is immediate further affects a student’s course of action. Generally, students will seek corrective steps if they realize they have made mistakes or have misconceptions.

Opportunities for online collaboration also allow students to seek and receive feedback in a less inhibited environment. Whether students are working on a group project, seeking input for ideas on a class blog, or asking the teacher for additional assistance, an online environment can help even shy students gain the confidence they need to enrich their learning.
**Ed Tech in Math Class**

If ed tech can help meet the needs of math learners better than ever, why aren't more of us integrating it into mathematics instruction? The reasons are complex and multifaceted. Economics, generational trends, and pedagogical knowledge all play a role.

While finding funds to pay for technology is still a challenge, this has become less of a barrier because hardware and software have become cheaper, and that is likely to continue. Math teachers’ attitudes about tech integration, however, are still a hindrance to progress. You will find pockets of excellence, but many math classrooms are so textbook driven that technology is an afterthought or a reward rather than a systemic tool for learning. Consider the descriptions in the table below to determine your level of technology implementation.

**Levels of Technology Implementation**

Misconceptions, such as the belief that technology use does not improve learning, can also create barriers for tech integration. Many state standardized tests may actually support this notion because they measure learning from the lower levels of Bloom’s Taxonomy, while the systemic use of ed tech spans a much wider range of learning activities. This misconception also stems from the difficulties researchers have with trying to measure the impact of ed tech, although many studies show technology can be used effectively in learning and teaching. For example, “Foundations for Success: The Final Report of the National Mathematics Advisory Panel” published in 2008 found that instructional software has generally been shown to have positive effects on student achievement in math, as compared with instruction that does not incorporate technology.

Another especially troubling misconception is that using ed tech means that “master teachers’ will lose some clout if they admit they need to learn how to employ a new technology in the classroom. Some teachers find it easier to avoid the issue altogether and continue trying to use teaching methods that worked in 1980 but are now outmoded.

**Encouraging More Tech Integration**

Most individuals find change unsettling, so before real change can occur within an organization, you must create a demand for change, and members of your organization must understand that it will yield worthwhile outcomes. Creating a demand for change is a function of leadership, but that doesn’t have to be relegated to the school principal alone. Working with leadership teams, a culture of tech integration can take hold. When the school’s culture for tech integration gains momentum, a feeling of “this is how we do things at our school” begins to permeate the culture. Of course, high-quality staff development is essential, and according to the National Staff Development Council, professional development should be comprehensive, sustained, and intensive to improve teachers’ and principals’ effectiveness.

Staff development initiatives need sustained support, and this is especially important in technology integration. Timely, on-site support for integration can be the single factor that makes a difference in effective teacher implementation and increased student learning. A 2006 study published in the *Journal of Technology and Teacher Education* found that “teachers who believe that they have the skills to implement computers successfully and who valued the outcomes associated with integration were more likely to be at the high end of the ‘technology user’ spectrum.”

Failing to maintain a tech initiative’s momentum is common. Once you’ve launched an initiative, establish milestones to help individuals as well as the organization move toward its goals. Monitoring progress is also an important part of the implementation phase.
Leadership teams can keep the initiative in the forefront through discussions at staff meetings and through school learning communities. When teachers share information about the ways they are integrating technology, other teachers are more likely to move toward increased tech integration with their own students. Principals can also take a direct role by requiring that integration be a part of each staff member’s professional growth plan. In this way, all staff members set individual goals for increased tech integration and establish an action plan to reach the goals.

Accountability in the subjects of science, technology, engineering, and mathematics (STEM) is greater than ever. To meet these rigorous expectations, educators must be willing and able to incorporate the best tools available. Whether using virtual manipulatives, intelligent tutoring systems, dynamic visualization software, or web 2.0 collaboration tools, teachers who understand and leverage the power of these resources will be better able to address their students’ diverse needs.

Ed tech is bridging the divide in the debate over mathematics reform by providing opportunities to increase procedural fluency and integrate it with greater conceptual understanding. We encourage educators to set goals for tech integration and request ongoing professional development to support the initiative. In the end, students will be the ones who benefit most.

Resources
Carnegie Learning Bridges to Algebra: www.carnegielearning.com/secondary-curricula/bta
Cognitive Tutor: www.carnegielearning.com/secondary-solutions/adaptive-math
Empire High School: http://ehs.valk12.az.us
Purplemath: www.purplemath.com
Tabula Digita DimensionU Games: www.dimensionu.com/math

A Better Way Forward

Today, learning can happen almost anywhere. New and innovative technology enables Pearson to provide a complete spectrum of personalized learning solutions for greater flexibility in class, at home, or anywhere in between.

Our goal is to make a measurable difference in learning outcomes for students, for educators, and for education systems through our products, services, professional development, and partnerships.

Discover all that’s new at Pearson today.
pearsoned.com

Matt Kuhn, STEM professional developer with Mid-Continent Research for Education and Learning (McREL), is co-author of Using Technology with Classroom Instruction that Works (2007). He is a Google Certified Teacher and provides staff development. Learn more at www.mcrel.org/technology.

Kathleen Dempsey, principal consultant with McREL, provides services to support improvement efforts in mathematics teaching, curriculum development, and technology integration to school districts across the United States.
Build an Assistive Technology Toolkit

Assistive technology (AT) by its very nature consists of a variety of personal and customized tools for multiple learning styles and physical challenges. As director of technology for the East Providence School District in Rhode Island, USA, I encourage students, parents, and educators to advocate for AT services. But I also want them to go a step further and build their own AT toolkits that can instill independence and confidence in students with special needs.

First, you can unearth a lot of free and low-cost tools in two very accessible places: on your computer's operating system and online. Once you find the tools you want to use—both free and paid—you need to know how to work with your school IT department to develop a systemwide AT program that successfully supports students.

Find Free Tools
You may be surprised to discover the many AT tools built into Windows Vista, Windows 7, and Apple's Snow Leopard operating systems. Microsoft and Apple make it easy for users with special needs to see, hear, and use their computers. Both have increased the number and improved the performance of AT tools in recent years.

On a PC, go to your control panel and click on Accessibility Options to find the list of tools.

On a Mac, pull down the Apple menu and choose System Preferences.

In the Systems category, choose Universal Access or Ease of Access. Then check the box labeled Enable Assistive Devices.

See “AT Tools on Your OS” on page 24 for a list of built-in tools for Macs and PCs.

If you can't find what you need on your computer's OS, try searching for free options online. Here's a rundown of some of the libraries, concept-map software, brainstorming devices, and spell-checkers you can find on the internet.

Online libraries. Students with learning disabilities or visual impairments can find thousands of titles online in digital format so they can benefit from text-to-speech software. Here are a few online libraries to explore:

- Google Books (http://books.google.com) has increased the number of books available to visually impaired readers online by adding screenreading software to its books site. This functionality has created more titles than exist in all the libraries serving the blind throughout the world.
Build an Assistive Technology Toolkit

- Bookshare (www.bookshare.org) is a website that offers free digital books to those who provide proof of a visual disability.
- Project Gutenberg (www.gutenberg.org) offers more than 33,000 free e-books for computer or e-reader download.

Online concept maps. These software programs help students organize their thoughts and brainstorm ideas:

- Microsoft Office 2007 Smart Art plug-in (http://tinyurl.com/446uv2c) provides a visual representation of information. It's quick and easy to use, and students can choose from many different layouts to effectively communicate ideas.
- Bubbl (https://bubbl.us) is brainstorming software that is simple to use. Students can create, print, and share their own mind maps.

Online spell-checkers. You can find free tools, such as those below, to help your students get their spelling right—even in web forms:

- Google Chrome (http://Google.com/chrome) will check the spelling of text within web forms.
- ieSpell (www.iespell.com) is a free Internet Explorer browser extension that spell-checks web forms and text fields.

Many other websites offer AT tools online.

Work with Your IT Department

Free tools are great, but you may discover that they do not have the features offered by some popular AT packages, such as Co:Writer, which is word prediction software, or Boardmaker, a visual communication program.

Once you choose, you'll need to consult with your IT department. Most IT departments do not allow teachers or students to install software on school computers. The IT staff must add software themselves. For districts with large student bodies, diverse student needs, multiple computing locations, and various operating systems, the task of installing one AT program for one student can be very difficult to do quickly.

That's why software and hardware installation requests for individual students can get delayed, creating a gap in service to students in need of tailored AT packages.

By understanding the IT terminology, you can work with your IT department to ensure that your students' needs are being met and help create a successful AT environment for the whole school or district.

Local administrative rights. To install software on computers, you need to log on as an administrator of the computer. An administrator is a user who has full rights to the computer or on a number of computers across the network. In most districts, IT departments do not extend administrative rights to students and teachers because they want to prevent viruses, hacking, and other activities that can disable network environments. But there are other ways your IT staff can distribute software for a systemic integration of AT tools on every computer.

District or school site licensing. By requesting school- or districtwide site licensing for AT software, educators and students will benefit in two very important ways. First, IT departments are free to install the AT software on every computer in the building or district, encouraging wide distribution of AT software packages. Second, if all educators in a school or district are using the same AT software, professional development will be streamlined and efficient. Installing Boardmaker or a concept-mapping tool, such as Inspiration, saves the district from training teachers on several similar software packages.

Disk imaging. IT departments roll out, update, and service computers using this important tool for computer management. With disk imaging, the IT staff can quickly install every piece of software students require without taking the time to install each software package one by one. If you have students with specialized computers, ask your IT department to image the computer to save time when the computer is serviced or when your student moves to another classroom, grade level, or school.

Microsoft Installer (MSI) files. Another way to help get AT programs onto computers is to buy software that can be packaged in the MSI format. This allows you to send the software to specific computers or groups of computers over the network. The next time your student boots up his computer, the software automatically installs. Many AT software companies are now offering the MSI installation format.

You can help your school or district create and deliver a successful AT program by becoming familiar with the built-in AT tools within your computers' operating systems, finding free software online, and working with your IT department to get AT
toolkits installed and updated quickly. By joining your local special education, budget, or technology advisory committee, you can advocate for consistent and systemic support for students with AT needs.

Kelly Ahrens is the technology director for the East Providence School District in Providence, Rhode Island, USA. She is working on her master's degree from Lesley University in Cambridge, Massachusetts, USA.

### AT Tools on Your OS

<table>
<thead>
<tr>
<th>Accessibility Options</th>
<th>How It Helps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnification</td>
<td>This tool magnifies the screen or a portion of the screen to make text, images, and objects easier to see. Students with visual impairments can adjust screen size to read books or type papers.</td>
</tr>
<tr>
<td>On-Screen Keyboard</td>
<td>This tool displays a visual keyboard that students can use instead of a physical keyboard. A physical keyboard can be difficult for students to navigate easily because of hand or finger challenges. Installing the on-screen keyboard allows them to use the mouse to type.</td>
</tr>
<tr>
<td>Narrator or Voice Over</td>
<td>This feature reads on-screen text aloud. This feature is great for students with visual and learning challenges. Students select information on the computer screen and click Alt-N, and the computer reads what is on the screen. This is useful for computer navigation, websites, and digital textbooks.</td>
</tr>
<tr>
<td>Speech Recognition</td>
<td>This tool allows students to interact with their computers using only their voices. Students can dictate notes or papers to Microsoft Word, and they can even correct what was typed by saying, “Correct that.” Available in seven languages, including Spanish and French.</td>
</tr>
<tr>
<td>Change Text Size</td>
<td>This feature displays text and objects larger without sacrificing graphics quality. It allows students to increase font size for icons on the desktop, making them easier to read.</td>
</tr>
<tr>
<td>Personalization</td>
<td>Students can install gadgets, such as language translators, talking clocks, to-do lists, and quick-launch programs.</td>
</tr>
<tr>
<td>Keyboard Shortcuts</td>
<td>Students can simplify commands for functions, such as saving documents. Find a list for PC at <a href="http://support.microsoft.com/kb/126449">http://support.microsoft.com/kb/126449</a> or for Mac at <a href="http://support.apple.com/kb/HT1343">http://support.apple.com/kb/HT1343</a>.</td>
</tr>
<tr>
<td>Sticky Keys</td>
<td>This feature allows students to press and release a modifier key, such as Shift, Ctrl, Alt, or the Windows key, and have it remain active until any other key is pressed.</td>
</tr>
<tr>
<td>Mouse Keys</td>
<td>This tool allows students who have trouble using a mouse to control the cursor using keys.</td>
</tr>
<tr>
<td>Filter Keys</td>
<td>These tell the keyboard to ignore brief or repeated keystrokes. This makes typing easier for students who tremble or hold the keys down too long.</td>
</tr>
<tr>
<td>Visual and Sound Notifications</td>
<td>These notify students with a pop-up message or sound when a computer error or other warning occurs.</td>
</tr>
<tr>
<td>Captions</td>
<td>Provides captions for important computer information.</td>
</tr>
</tbody>
</table>
Here’s little disagreement about the value of Twitter, Facebook, and other social media sites among educators who use these tools to share links, give advice, ask questions, and engage in discussions. But should we consider them professional development (PD)? And, if so, does it improve student learning?

On his blog, My Island View, Tom Whitby poses these questions in the post “Does Social Media Offer PD or Something More?” (http://tinyurl.com/3htyq5z). He writes:

I hear from educators almost daily about how their social media involvement, Twitter/#Edchat, is the best PD they have ever experienced. That is where I think I part ways. I do not see social media as the PD, but as a portal to the PD. It comes from educators engaging other educators in discussions and exchanging ideas that lead to the best sources in order to access the specific PD.

Now the question arises, is this PD resulting in an improvement in the student learning? I have often said, “To be better teachers, we must first be better learners.” It would seem to me educators who are seeking professional development to meet their specific needs as educators would certainly be a first step to better learning.

The post drew 13 comments, mostly from educators singing the praises of social media:

Surely PD is for the teachers’ benefit, and anything that equips them to be better lifelong learners will inevitably benefit their institution, colleagues, and students as well as themselves. Very few teachers spend their whole professional lives working in one school or in one subject area. PD, which broadens the mind, which opens up teachers’ awareness of current thinking and practice in subject areas and schools other than their own, can only be a good thing. —Nigel Bentley

PD gets a “bum rap” because of how it’s presented.

With rare exceptions, everyone gets the same regardless of what they teach. That’s probably because it’s easy to set up and “check” that everyone is there for it. The time I spend on Twitter or other social media is much more valuable and targeted because it gives me something I can really use. PD? Yes, but hard to document or track. —Alan Buhler

How many times have we had to sit in traditional PD sessions “learning” about a topic that either does not have anything to do with what we teach or an area in which we are already adept or experienced? Discussing, debating, collaborating, and sharing ideas and resources with educators from all over the world is the essence of professional development via social media and takes learning to places and levels that were unimaginable even 10 years ago. —Debbie Fucio

It is clear that social media can open the door to a much richer version of professional development. Teachers using it effectively can then show students how they engage in this process and guide them to do the same thing. —Douglas Green

Whitby’s comments prompted blogger Dorian Love to write his own post titled “PD in Your PJs” (http://tinyurl.com/3lkmnrf) on the Digiteacher blog. Love writes that it’s not so much about the PD, but about being engaged as a teacher:

I have undergone very little formal PD in my career as a teacher. Most of it has been on my own initiative, and at my own expense. Most of it has been in my own time, too, in my PJs! Most of it has been on the internet, researching things that interested me. Those passions kept me engaged in what I was doing and gave me new perspectives, which helped me to constantly re-evaluate what I was doing as a practitioner in the classroom. Tom [Whitby] argues that social media are key tools in engaging teachers in the teaching and learning process, and he is spot on. But I would argue that the content of the PD is almost immaterial.

Maybe instead of debating whether social media makes for effective PD, we should be questioning whether traditional PD makes for effective PD.
There’s no shortage of opportunities for young people to engage with robotics. They can participate in competitions, after-school clubs, summer camps, and even a few classes or mini-classes. But robotics activities can be expensive, often requiring pricey kits as well as computers to program the robots. That’s why 4-H offers a way for students to learn about robotics and the connected science, technology, engineering, and mathematics (STEM) skills without a robot. We developed a program that allows students to learn about robotics in one of three ways:

- Participating in a virtual robotics environment
- Taking part in Junk Drawer Robotics activities using items found in a typical classroom
- Using off-the-shelf robotic kits

Our program, 4-H Robotics: Engineering for Today and Tomorrow, allows students to explore technology and engineering concepts using robotics and associated systems as an integrated theme. And they can do it with or without buying a robot.

Our goal in creating the 4-H robotics program was to give students and teachers flexibility in costs, materials, and subject areas by developing three diverse learning tracks. The program was developed by teachers, extension educators, engineers, and university researchers. It uses various technol-
A 4-H volunteer helps facilitate Junk Drawer Robotics activities as youth implement engineering designs they have created based on science concepts they have explored.

This track comes with a leader’s guide, a student robotics notebook, and an optional supply kit of the basic components or everyday materials used to construct robots.

It focuses on three activity outcomes: learning (science), doing (engineering), and making (technology). These focus areas are not independent of one another. The structure of the track allows each focus area to be addressed separately yet highlights and reinforces the interconnections.

The lesson modules start with an exploration science learning activity. These activities allow students to build conceptual understanding by exploring scientific processes and information. Engineering design activities promote concept development of what students discovered in their exploration.

The design activities build on the knowledge students gained in the exploration by allowing them to solve a problem and overcome constraints.

The design phase promotes problem identification, framing, and solving as students work within the given constraints to engineer a solution to the challenge.

In the third phase, students apply these concepts using tools to construct a physical model. They strengthen their reasoning skills as they make and test their designs, observe solutions, find sources of failure, and consider redesigns. This iterative process of engineering and technology allows for deeper exploration into the concepts.

The three types of modules spotlight science, engineering, and technology while encouraging a scaffolding of learning as students work to understand the elements of robotics systems.

The Junk Drawer Robotics track. This track guides students through the design, construction, and testing of robots using everyday objects. Students build working robots that lift, move, or float to explore topics such as robotics design and subsystems; mobile robotics, including constructing remotely operated underwater vehicles; and robot control and behavior, including basic programming and sensors.

The Virtual Robotics track. We created this track using the Unity 3D game development tool, which allows students to build and test robots in a virtual robotics laboratory. The track contains 12 modules focused on physics, electricity and circuits, motors and gears, computer programming, sensors, and robot behavior. The learning experience includes videos, simulations, and animations. Students explore a virtual world representing an industrial environment and must employ robots to stop gas leaks and other disasters too dangerous, dirty, or dull for humans. While sensors on the virtual robots collect data about the environment, students maneuver their robots using keyboard controls and computer programming to deal with the industrial challenge.

The three types of modules spotlight science, engineering, and technology while encouraging a scaffolding of learning as students work to understand the elements of robotics systems.

About 4-H

Head, heart, hands, and health comprise the four H’s in 4-H, and they are the core values participants focus on while in the program. The U.S. Department of Agriculture, the National 4-H Council, and the 109 land-grant universities in the Cooperative Extension system provide leadership to the 4-H youth development network. 4-H engages kids ages 5–19 in a wide range of nonformal educational programming, including projects in the field of robotics. 4-H reaches more than 6 million youth annually in urban, suburban, and rural communities in every part of the country with out-of-school time science, engineering, technology, healthy living, and citizenship projects. Moreover, the 4-H learning environment emphasizes positive development and helps youth develop essential skills they will use throughout their lives, such as identifying interests, setting goals, communicating, leading, and giving back to their communities.

Engineering and technology play a vital role in the world economy, yet no U.S. engineering education standards exist to help guide program development, and scant research is available on existing levels of youth engineering proficiency. In 2008, the USDA 4-H National Headquarters responded to the lack of STEM literacy by establishing the 4-H Science, Engineering, and Technology Initiative. This initiative tasked a multistate collaborative with developing a 4-H robotics curriculum to engage the next generation of leaders in science, engineering, and technology.
For example, an important consideration in mobile robotics is the concept of friction. A properly designed robot will minimize friction to reduce energy consumption and extend the longevity of the robot’s mechanical parts.

To teach this concept to students, we begin by sliding a box of paper clips down an angled cardboard ramp containing a number of surfaces with varying degrees of resistance. In the final challenge, student teams design and build a “clipmobile,” a vehicle that can overcome friction and travel down the ramp and continue for a specified distance.

The challenge becomes even more interesting when students have a base kit of parts and $45 of pretend money that they use to purchase additional parts for their clipmobile. Student teams are evaluated based on outcomes related to their efforts, including: weight capacity of the vehicle, performance, complexity of parts used, efficiency in the number of parts used, and the cost effectiveness of their budget.

Teams are required to present their vehicle, an inventory sheet of parts, and budget sheets. Even with the best performance record, a team will not necessarily win the challenge if they buy and use a large number of parts. In the end, students learn that the engineering design process often includes real-life constraints that determine the engineering design process.

**The Robotics Platforms track.** This track uses LEGO NXT or the VEX robot kits. However, our goal in the Robotics Platforms track was to focus on learning important technology and engineering concepts and to help students develop important workforce skills. As students move through each
module, they record their progress and keep records in a robotics notebook.

**Results from the Classroom**

Engineers piloted and field-tested all three tracks of the curriculum to ensure the lessons worked as intended and met the science, technology, and mathematics national standards.

The first phase of the piloting process was a formative review of the lessons by faculty curriculum specialists at the University of Nebraska. We revised the lessons and piloted them with 640 students and 62 facilitators (teachers, extension educators, and adult volunteers) at various locations across the country. Finally, the program was field-tested with 35 students and 13 teachers during the summer of 2010 in a meeting involving seven school districts in Nebraska.

Results of the field tests showed positive attitudes toward technology and engineering as well as increased conceptual learning related to big ideas, such as variables, engineering design, and robotics. In particular, students made good progress in their understanding of robotics and engineering design.

For example, when asked what a robot is prior to the program, one student in the Junk Drawer Robotics track answered “not sure.” After the program, the same student answered, “A robot is a machine that can operate without a person.”

When asked to define the engineering design process, one student in the Virtual Robotics track answered, “I have no clue.” After the program, the same student answered, “The engineering design process is the process of designing something, revising the design, and testing it.”

Robotics, in many ways, is an ideal field to engage youth in STEM education. Science, engineering, and technology are all connected and undergirded by mathematics. Each domain informs the other: Scientists inquire about the natural world, developing new theories. Engineers use scientific knowledge to design technological devices to meet the needs of human society. The field of robotics is multidisciplinary, involving concepts in physics (friction, electricity, and magnetism), computer engineering (programming and binary numbering), mechanical engineering (gears and sensors), and unifying science concepts (form and function as well as science inquiry) and engineering concepts (engineering design and flowcharts).

**Discussion and Recommendations**

It may well be that some of the benefits of engaging youth in educational robotics do not need to involve expensive robotics kits and computers. Our experience is that well-structured, creative, and engaging alternative activities using common materials found in a classroom may be able to achieve at least some of the STEM benefits sought in the context of using the more expensive technologies.

**Acknowledgments**

The authors would like to thank Steven Worker, the 4-H science, engineering, and technology education coordinator for the University of California 4-H Youth Development Program, in Merced, California, USA, and Neal Grandgenett, the Haddix community chair of STEM education at the University of Nebraska, Omaha, USA, for their help with this article.

**Resources**

National 4-H Council: [www.4-h.org](http://www.4-h.org)

Unity 3D: [http://unity3d.com](http://unity3d.com)

—Bradley Barker is the Nebraska, USA, 4-H extension science and technology specialist. He lives in Lincoln, Nebraska, USA.

—Richard Mahacek is county director and 4-H youth development adviser with the University of California Cooperative Extension, Merced, California, USA.
QR Codes in the Literature Classroom

When my 12th grade British literature students started reading *The Great Divorce* by C. S. Lewis, I knew I would have to come up with an engaging activity to help them grasp some of the difficult, abstract ideas Lewis introduced.

*The Great Divorce* challenges the reader’s perception of reality. The narrator travels through different realms of the afterlife and experiences worlds where reality is enhanced. For example, the narrator can barely stand to walk in the lower level of heaven because the grass is too sharp for his ghostly nature.

When I started rereading the book to prepare for the unit, I got an idea: I would incorporate some aspect of QR codes into a project to connect the text with my students in a creative way.

To do this, I put together what I called the C. S. Lewis Wall Project. I gave my students a wall in my classroom to create what they imagined to be a room in Lewis’ house. Working from a rubric that focused on creativity, use of space, group cooperation, individual contribution, and research, my students spent a week transforming a plain wall into an interactive space.

Virtual Reality vs. Augmented Reality
First, I introduced QR codes to my students. Many of them had seen QR codes on advertisements and in magazines but didn’t know what they were for. I discussed the differences between virtual reality and augmented reality: Virtual reality replaces our world, whereas augmented reality enhances our world with technology.

A QR code is a 2D digital code that people can scan with apps on a smartphone or on a computer with a webcam. The scanned image can connect to a webpage, display text, or even transmit a text message.

QR codes are everywhere. They’re posted on bulletin boards for college building tours, placed in advertisements in magazines and on billboards, and slapped on T-shirts. The technology is simple but effective.

QR Codes to Cite Sources
Our class project involved researching the life and times of C. S. Lewis. Collectively, my students decided to design the wall to reflect the 1940s. They learned about Lewis’ loves—both bookish and human—and researched furnishings common to the 1940s in Great Britain.

I encouraged each of my students to choose one feature of the wall that was fully his or her own. Their creativity shined in this area. Jake chose to make his mark with a shelf full of books Lewis probably would have owned, Brittany painted unique artwork, and Kris drafted a comfy reading chair.

The students worked together to cover the wall in period-appropriate wallpaper. Ashley and Kelli found a colorful fleur-de-lis wrapping paper that they used to cover the top half of the wall. Ray, Trevor, and Kris worked together to recreate a barn-board wainscoting for the bottom half of the wall with butcher paper.

After all of the 2D elements were in place, the real fun began. I showed my students how to print out QR codes and sent them to the computer lab to get their sources. I required each of my students to use QR codes to cite their sources instead of creating an MLA works-cited list. Each QR code linked to a website that the student used to research their element for the room. For example, students had QR codes connecting to websites that listed authors who influenced Lewis, desk styles of the 1940s, and degrees he had acquired, to name a few. They printed out their codes and attached them on the wall next to the appropriate elements.

Once all the pieces were in place, I was ready to test the wall! I took out my smartphone, opened a QR code scanner app, and tried it out. As I looked at the various elements on the wall, I also scanned the codes and read more information from the sites that my students used. Instead of the wall being a static, poster-like presentation, it was an interactive experience using augmented reality, which referenced Lewis’ manipulations with reality in *The Great Divorce*. It also encouraged digital rabbit trails where the observer could explore their interests relating to Lewis as they connected with the wall.

By Hannah Walden
My students created a Facebook page to encourage discussion around their wall. Other students and teachers could access the page through a QR code placed prominently on the wall, and then post comments.

Exploring augmented reality was a new experience for my students. Initially they were skeptical about how the project tied in to their readings. Once we got going and they learned how easy it was to interact with QR codes, the pieces started coming together. They began making connections between the reality shifts in The Great Divorce and the interactive levels of reality that we created on our classroom wall. By providing a way to combine technology and literature in a hands-on format, the students were able to engage with the text in a new and meaningful way. It piqued their interest, appealed to their creative instincts, and encouraged them to interact with the reading in an active way.

This project lends itself to many different applications. Imagine QR codes linked to posters of World War II propaganda in a history classroom or items in a Spanish classroom labeled with QR codes tied to their Spanish translations. The possibilities are limitless. This technology takes advantage of tools our students already have (smartphones and webcams) and enhances their educational experience through interactive connections.

—Hannah Walden is a high school English teacher at Calvary Christian Academy in Philadelphia, Pennsylvania, USA. She has a MEd in teaching and learning. She enjoys exploring ways to creatively integrate technology into the classroom.
Participating in global initiatives empowers teachers and students from around the world to work on projects together using the internet and new communications technologies. The opportunity to collaborate with others around the globe is highly motivating for both teachers and students, promotes diversity and cultural awareness, and allows students to write for and share their ideas with a distant peer audience for a very specific purpose.

But how do you pull it off?

Our work with the design and analysis of global collaborative projects led us to consider what makes these projects successful. The following is a breakdown of the necessary components as well as specific guidelines to help educators design collaborative projects that promote the effective integration of information and communication technology (ICT), genuine collaboration between participants, and deep learning in students. The guidelines build on Punya Mishra and Matthew Koehler’s Technological, Pedagogical, and Content Knowledge (TPACK) framework and Martha Stone Wiske’s Teaching with Understanding for Technology framework. We believe that these practical ideas can be useful to support high-quality global project designs for educators around the world.

### Guidelines for Collaborative Projects

**Topic.** What kind of topics make good projects? What learning challenges or problems does the project topic raise? The topic should:

- Be relevant for the school context and raise a learning challenge to be the leading thread of the project.
- Be connected to a specific and core curricular subject for an area or discipline.
- Propose a new approach to content that is difficult to teach.
- Connect with students’ everyday lives or interests.

**Goals.** What should the students learn from the activities proposed? The goals should be:

- Public and explicit for teachers and students.
- Expressed in terms of what you expect students to learn, not do. For example, students will understand the causes of air pollution.

**ICT integration.** What is the role of ICT for the development of the project? How does it facilitate the learning or the central purpose of the project? The collaborative project should include:

- A good selection of ICT tools that enhance the learning of the subject matter. Start by selecting the learning goals and the type of activities and then choose the technologies that best adapt to develop the objectives and activities. For example, suppose the purpose is developing students’ creative writing abilities, and the activity is collaboratively writing and performing a production.
- A collaborative writing tool, such as a wiki, Google Doc, or blog, rather than a forum where each participant sends a comment. Forums are useful to maintain thematic conversations but do not allow writing with others. Also consider the sort of text one aims to produce. For texts that require a temporal sequence, a blog may be best; for texts that require a structure of webpages, a wiki might be better. A report or monograph might be better suited for a Google Doc.
- An ICT tool that effectively enriches or enhances the learning of the subject matter. If the selected tool is a wiki, you should consider the characteristics of the wiki and set it up to support student learning. The wiki...
allows various authors to write simultaneously. It also allows participants to return to previous versions and sustain an exchange in an associated forum in case they don’t reach an agreement. Set up the wiki and project guidelines to exploit all these potentialities. The limitation of a wiki is that it is only a blank page that has no organizational structure. An effective use offers students the necessary scaffolding and structure to carry out the task. Use headings to organize the writing, assign roles, and specify who is to write which paragraph. Consider some way to identify the authors, perhaps by text color.

**Collaboration.** How can you promote collaboration? What aspects of the project design must you consider to encourage the participants to collaborate? Collaboration in a global project implies that:

- Parties are committed to learning something together and cooperating in the achievement of a goal that they cannot achieve individually. At least two students or small groups, led by their teachers, work on a common subject, not only simultaneously but also in a coordinated manner, generating a positive interdependence. This implies sharing responsibilities; giving and receiving support (emotional and cognitive); arguing/discussing their own ideas; establishing agreements; listening to opinions; exchanging information and points of view; and comparing ideas, interpretations, and alternative representations.
- Participants know what is expected of them in terms of products, learning, and what their roles (commitments and responsibilities) will be.
- Work dynamics sustain the collaboration. For example, participants can work simultaneously on the same task, studying a common subject during a specific period of time to create a shared product. By the same token, Student 1 can develop a production or do one of the steps, which is a requirement for what Student 2 must perform. Between them all, they develop a final product. Or Student 1 can produce a part of the total, Student 2 another part, and so on. Between them all, they also develop a final product. Finally, both students can perform the same task in a parallel manner: They describe or investigate the same subject and exchange constructive feedback on the work that the other student has prepared.
- Schedules and common activities are established.
- Participants in a simultaneous project create an awareness of “us” and generate a climate of belonging.

**Exchange.** How can the global exchange facilitate the proposed learning objectives? How do you encourage and maintain exchange between participants? Exchange should:

- Be a necessary step to advance within the activities.
- Have a clear objective in support of some learning purpose.
- Be promoted and sustained through consistent, precise instructions. For example, the expression of an argued opinion on a controversial subject may awaken the appearance of other similar, or opposing, points of view. And based on this, participants consider the different arguments.
- Have clear criteria that allow students to understand how their participation is documented and evaluated. An example would be requiring a certain number of substantial messages focused on the topic.
Designated participants. What criteria should you use to determine the participants in a project?

To determine the recipients, consider that the project theme or problem, topics, goals, and assessment criteria must be cognitively viable for all students and be neither too easy nor too difficult. For example, if you want to attract a range of age groups, you must adjust the objectives, activities, and evaluation criteria so that all of these are duly represented. One strategy is to differentiate the project objectives, activities, etc., by age groups.

Students’ roles. What are the students’ roles in the project? Do the students have a clear picture of what they must do and for what purpose?

The collaborative project should:

- Encourage student autonomy, decision-making, and task commitment by showing them clearly what they have to do and what they must learn as well as the characteristics of the product they develop. They must also know the dates or delivery terms. For age 10 and above, a Student Guide is useful.

- Engage students in tasks where they solve problems or transform information in a new or creative manner.

- Promote the division of roles, encourage groups to document their opinions, and later exchange points of view to arrive at agreements and resolutions.

Assessment. How do the teachers know what the students have learned? How do the students know what they have learned?

The assessment should:

- Be ongoing throughout the collaborative project.

- Be clear, stated from the beginning of the project, and aligned with the expected learning.

- Provide self, peer, or teacher evaluations; be formal or informal; and allow students to reflect on their own learning process.
Technological requirements. What technological infrastructure is required?
The technological infrastructure should provide clear requirements for equipment, frequency of computer use, and internet connections for a teacher to decide if he or she can meet the requirements.

Resources. What support materials are offered?
Students and teachers should be able to access tutorials for the work platform, participate in the forum, learn more about the specific content of the project, and offer didactic orientations.

Potential
Global collaborative projects invite both teachers and students to focus on curriculum-based learning first and technologies last. Designs should also put special emphasis on in-depth learning and genuine collaboration. This is where the true potential of a global collaborative project lies for students and educators.

Acknowledgments
This article is based on a research project financed by Canada’s International Development Research Centre (www.idrc.ca). The authors wish to thank Cecilia Rodriguez and Paula Perez from Fundación Evolución (Argentina) for helping with this article.

Resources
iearn: www.iearn.org
TPACK: www.tpck.org

—Micaela Manso is a research coordinator at Fundación Evolución, Argentina. She has led national and international research projects in Latin America. Her research focuses on K–12 curriculum-based ICT integration and online collaborative educational projects.

—Magdalena Garzón is a consultant in global collaborative projects at Fundación Evolución, Argentina. Since 1998 she has worked in government, nonprofit, and private sectors developing content for ICT integration for students and teachers.

EXPLORE THE BENEFITS OF ISTE SPECIAL INTEREST GROUPS

“For me, being involved in a special interest group made the learning personal. I felt as a volunteer I’m giving back to the organization, but it also made the learning relevant and meaningful to me.”

—Brenda Anderson, SIGMS member, ISTE member since 2007

iste.org/SIGs
Blogs in education tend to be much like that famous little girl in the nursery rhyme with the one curl in the middle of her forehead: When they are good, they are very, very good, but when they are bad, they are horrid.

Here are my top 10 tips for educators who want to start a blog:

1. **Choose your URL carefully.** You can change the name of your blog at any time, but the URL you choose at the start of the process is the foundation on which you will build your blogging empire. Keep it short and pithy, and make sure it’s something you can live with long term. “SassyTeacherTude.Wordpress.com” may seem like a good idea right now, but what if you later decide to use your blog as a parent communication tool? That fun, feisty name has already built online connections but may not be a good fit for future blog plans.

2. **Schedule time several days a week to develop blog posts.** To build an audience and keep them coming back, your blog should be updated at least three times a week. There are infinite blog topics out there for you to address. If you’re not doing something interesting, find someone else who is and blog about that. By scheduling times for writing posts, rather than just waiting until inspiration strikes, you ensure a steady stream of fresh content. This is particularly important during the first few months of a blog launch.

3. **Find your voice.** The tone of blog posts is very different than that of an academic paper, casual email to a friend, or piece of journalistic writing. Keep things casual, and let your personality come through. It’s okay to use colloquialisms in blog writing that would seem out of place in most written work. A good rule of thumb is to write the way you talk. If it sounds right when you read it out loud, you’re likely on the right track for a solid post.

4. **Keep it short.** A journalism teacher of mine once told me that the best pieces were like a woman’s skirt—long enough to cover everything and short enough to keep you interested. Inherent sexism of that statement aside, he was right. Most of the posts I write fall in around the 400-word mark. There’s no hard-and-fast word-count rule, but the blog format is not for the chronically verbose.

5. **Grammar and spelling count.** Major grammatical errors are distracting to readers and embarrassing for the writer. Even microbloggers need to adhere to the basic rules of the English language. When faced with word limits, many Tweeters will lapse into netspeak or text-message shorthand, but using obscure acronyms without apparent need can confuse the reader.

6. **Links are currency in the blogging world.** If you refer to someone else’s thoughts or ideas, link to them. If you mention an article, find the online version and link to it. If you want to talk about a great product you’ve found, link to the manufacturer’s site or the product page on Amazon. Not only will building links into your site help build your blog network, but you improve the reader experience as well. People navigate the web through impulsive clicks. By providing links, your blog can become a starting point for further topic exploration.

7. **The first step to starting an education blog is to listen.** There is a vast and active education blogger community on the web. Find out...
what they’re talking about so you know how you can contribute. The weekly Twitter #edchat, held every Tuesday at noon and 7 p.m. EST, is a great way to get to know the topics of interest to web-savvy educators. Edublogs is also a great starting point if you’re looking for other education bloggers or want a safe, secure platform to build your own web presence.

8. Be clear about who you are and why you’re blogging. If you are blogging as an individual, make it clear both in your introductory post and in your “About Me” section that all blog content represents your personal opinions and are not reflective of the positions of your school or employer. This won’t completely cover your back if you go off the deep end and truly offend with your blog, but at least you’ve made it clear that your blog is not the official voice of the organization you work for.

9. A blog is not a monologue. Your first thought should always be, “What’s in it for the reader?” Completely self-serving posts isolate your readers rather than embrace them. A blog is a dialogue. As a blogger, you are part of a much larger community of communicators. Think of jumping into the online world as walking into a party where you don’t know anyone. Work the room, figure out the tone of the event, and find your niche. Once established as a friendly, polite, and eager guest, you’ll find that other education bloggers are more than ready to welcome you into the fold.

10. Have fun with your blog. If you don’t enjoy blogging, you won’t be able to maintain the activity long term. Blogging is a huge time commitment. Choose a blog topic you’re passionate about, and you’ll find numerous opportunities to grow your professional learning network and expand your interest. But if you’re dipping a toe into blogging with only lukewarm interest in a topic, don’t be surprised if your blog goes days, then weeks, and finally months between updates. If it’s not enjoyable, it’s probably not worth doing.

—Katie Stansberry is working on her PhD in communication and society with a focus on online community building at the University of Oregon in Eugene, Oregon, USA. She is also a blogger for ISTE Connects.
Teach Your Budding Scientists to Be Gamers

We all know that video gaming is a popular form of entertainment with teens and adults. But games can also be excellent educational tools. Gaming technology provides inherently motivating contexts for engagement in learning, and it creates opportunities that are otherwise inaccessible. Games can transport learners through space and time or to virtual environments that transcend space and time. Consider, for example:

• A new game commissioned by NASA that takes players to Mars and beyond
• The commercially successful game, World of Warcraft, which transports players to the magical world of Azeroth
• The political science game PeaceMaker, which allows players to take on the role of key policy makers in the Israeli-Palestine conflict as they work toward a tangible peace process

In some cases, desired learning experiences may not be otherworldly or fantastic but are every bit as inaccessible to most learners as time travel. In the sciences, for instance, many activities could benefit learners, but cost, safety, and availability of materials deny those experiences to all but the most privileged. Gaming technologies create new avenues for learning experiences for all students.

Mission Biotech

Our work began with an interest in teaching secondary students about biotechnology. The tools and processes of biotechnology have revolutionized the life sciences, yet most secondary science classrooms offer very limited access. Today’s science curriculum may emphasize core biological and chemical principles, but students seldom have opportunities to see and experience the ways that cutting-edge biotechnological processes, products, and ideas shape issues of central importance to modern life, including health care, agriculture, and the environment. The reasons for the under-representation of biotechnology in school science are varied and include limited curricular materials, safety concerns, and a lack of equipment and resources. We wanted to find out if gaming could solve some of these problems.

Game Supports Science

To bring biotechnology into classrooms, we created Mission Biotech (MBt) with support from the National Science Foundation. MBt is a first-person adventure game that puts the player in the position of a biotechnologist tracking the causes of emerging epidemics. We designed MBt to look and feel like an actual biotechnology laboratory with a fully interactive environment, including materials and equipment commonly found in laboratories, such as sterile gloves, micro-pipettes, water baths, and centrifuges.

Students are able to interact with almost everything in the environment and learn science content by talking to nonplaying characters as well as finding information in manuals, magazines, and posters scattered throughout the laboratory and surrounding area. As the player investigates the environment, she learns about the laboratory techniques and viruses she will encounter, how to use biotechnology equipment, how to conduct experiments to inform the challenges, and ultimately how to interpret results to make appropriate diagnoses.

By Timothy Barko and Troy D. Sadler
In our initial testing of MBt, we have documented ways that game experiences lead students to learn biology and chemistry principles. Games such as MBt allow players to learn new roles. When players assume the position of a biotechnologist, they can see what it is like to be a scientist and even how to think like a scientist. As a result, students develop positive attitudes toward science and careers in science.

What We Learned through MBt

While working with more than 50 science teachers and hundreds of students in implementing MBt, we’ve learned a few things about integrating gaming into formal education.

First, we have been pleasantly surprised to discover that teachers, both young and old, have embraced the idea of using games generally, and MBt specifically. Many of these teachers have questions and concerns, but most are willing to try using innovative technologies and persist when they witness positive effects on their students.

Second, to be incorporated into classrooms, games need supporting curricula. To gain teacher support, game designers need to provide educators with curriculum materials that offer strategies for maximizing student learning of the content and practices. We found that specific lesson plans, extension activities, and assessments were instrumental in helping teachers implement the game in their classrooms.

Third, providing teachers with professional development that focuses on the technology itself as well as ways they can use it in their classrooms is essential. Many of the teachers we worked with were hesitant to play computer-based games. Some had gaming experience, but most thought of games as recreational activities for their children or students. Very few identified themselves as gamers. Our teachers knew most of the science content embedded within the game but needed time to become comfortable with the game’s mechanics.

We introduced MBt to teachers through a summer workshop. After the teachers developed confidence playing the game, we devoted considerable professional development time to introducing the curriculum. Working through sample lessons; demonstrating connections between game play, follow-up learning experiences, and state standards; and reviewing assessment tools helped teachers think about ways they could use the game.

Finally, providing continuing support, particularly related to technology-related concerns, is very important. Almost every teacher we worked with ran into some kind of technology challenge when they used the game in their classrooms. The challenges ranged from hardware issues to network problems to difficulties with school- or district-level security protocols. As a part of our project, we have a team member with considerable technology expertise available to consult with teachers and communicate with school and district technology coordinators. Although we have not been able to solve every chal-

Students Learn Biology and Chemistry

In Mission Biotech, players first must acclimate to the environment and game mechanic. By the end of the first level, players are using science ideas to progress through the game. If the gaming experience is truly effective, what players learn has value outside of the game as well.
challenge, providing teachers with consistent technology support has enabled the project to progress. Without this support, many of our teachers would not have remained with us.

**Video Game Education and the Future**

Video gaming must seek to integrate digital environments and virtual experiences into current curriculum and state standards. The goal is not to create more “edutainment” but to use computer-based gaming to build strong, equitable classroom experiences that promote student interaction with scientific investigation and science content—and allow students to have fun in the process!

Our digital natives expect to use technology and to have fun while learning. Therefore, video games and video game–based technology in the classroom becomes an important method for meeting students on a level that they can enjoy and learn from.

If we create video games that make learning fun, empower students to think scientifically, and build strong connections between students’ actions and the content, it would become a brave new world. Perhaps in the end, students will have the knowledge to make informed choices about their future careers as scientists, researchers, and technologists.

**Resources**

Mission Biotech: [www.missionbiotech.com](http://www.missionbiotech.com)

NASA’s Astronaut: Moon, Mars, and Beyond: [www.astronautmmo.com](http://www.astronautmmo.com)

Peacemaker: [www.peacemakergame.com](http://www.peacemakergame.com)

World of Warcraft: [www.worldofwarcraft.com](http://www.worldofwarcraft.com)

—Timothy Barko is a graduate student in science education at the University of Florida, Gainsville, Florida, USA. He is interested in the intersection of technology and science in the classroom and informal settings.

—Troy D. Sadler is a professor of science education and biology at the University of Missouri (MU), in Columbia, Missouri, USA. He serves as the director of the MU Science Education Center.
Snag the Perfect Film

**Problem:** You are looking for quality documentaries for projects, presentations, and research, but it’s difficult to find appropriate films among the thousands on the web.

**Here’s a solution:** SnagFilms ([www.snagfilms.com](http://www.snagfilms.com)) is a website where you can watch full-length documentary films for free. Its educational arm, Snag Learning ([http://learning.snagfilms.com](http://learning.snagfilms.com)), offers educational films and makes it easy to find appropriate selections based on subject, grade level, and channel (PBS, National Geographic, Explorer, and ITBS). The site allows you to “snag” a preview of a film and embed it in your website or blog. You might ask, “So how do I navigate through the 2,100 films in the SnagFilms library?” Well, SnagLearning is a fine-tuned, highly curated collection of titles, and it’s easy to find what you need. On the SnagFilms homepage, scroll down and find the Movie Matcher. This feature is a word tank that has descriptors of genre or mood that narrows down the library with each selected word.

Follow SnagFilms on Twitter @SnagLearning. The staff are always happy to answer questions, suggest films, and offer support. They also have a free iPad app. Just as the SnagFilm site states, “Find. Watch. Snag. Support.”

Shannon McClintock Miller is the district teacher librarian and technology coordinator at Van Meter School in Van Meter, Iowa, USA. She recently won a Shorty Award in the Connecting People category. Find her blog, The Van Meter Library VOICE, at [http://vanmeterlibraryvoice.blogspot.com](http://vanmeterlibraryvoice.blogspot.com) and follow her on Twitter @shannonmmiller.
Whether you are designing an online class or looking for a way to facilitate discussions with people in many locations, web-based conference applications are a convenient and effective solution. Participants can hear and see one another, share screens, type messages, and exchange files. An Internet connection, a browser, and access to a conferencing application are all that you need, but if you add a microphone and webcam, you enable two-way voice and video. Many have used video conferencing tools, such as Skype, or have chatted one on one in real time. The tools listed here, however, cater to groups.

The most obvious benefit of web conferencing is that participants can save travel time and related expenses by eliminating the need to be in the same location. As a result, new forms of collaboration are evolving as software publishers add innovative features in response to customers’ requests.

Many organizations use web-conferencing software for webinars, online classes, and virtual meetings. Webinars are web-based, real-time seminars held completely online. Facilitators invite participants to attend, sometimes for a fee, and provide them with a password and login information. The person leading the presentation can share a screen, demonstrate mouse moves in an application, and present a slide-show or video. Participants can even “raise their hands” virtually and ask questions. When called on, participants use their microphones to speak. A chat window also allows participants to type in questions or comments.

Some applications allow facilitators to pass meeting controls on to another participant or share them so that more than one person can enter text or edit an image at the same time.

All conferencing tools allow audio interaction, but video capabilities vary. If seeing the other participants is important to you, choose an application that allows the display of multiple videos on a screen at the same time, and find out if the maximum number is sufficient.

Archival features are important if you would like to record the interactions. Those who cannot participate in real time can view archived transcripts that capture the demonstrations and dialogue. This is particularly helpful with online classes when students miss a session or want to see one again for clarity and reinforcement.

If bandwidth allows, file transfers and video presentations move along quickly. When you begin to have more than three videos on the screen, service can slow down.

The challenge for educators is to make virtual presentations lively and interesting while facilitating dialogue to encourage meaningful participation. With powerful tools, teachers can deliver compelling lessons and provide an effective environment for engaging dialogue and productive collaboration.

—Maureen Yoder, EdD, is on the faculty of Leslie University’s Technology in Education Program.
<table>
<thead>
<tr>
<th>Prices</th>
<th>Free Trial</th>
<th>Max Users</th>
<th>System Requirements</th>
<th>Features</th>
<th>Mobile Apps</th>
<th>Polling</th>
<th>Training/Support</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>$55/host per month, $45/month annual plan, 32 cents/minute/participant</td>
<td>30 days</td>
<td>50</td>
<td>No download required; Windows, Mac, or Linux compatible</td>
<td>Screen sharing, multiple presenters, text chat, video, VoIP, annotating tools, recording</td>
<td>Yes</td>
<td>Yes</td>
<td>Videos, tutorials, forum, online and phone support, user group</td>
<td>Turbo Screen Sharing feature requires an exceptionally low bandwidth consumption rate</td>
</tr>
<tr>
<td>$2,000/year for unlimited web conferencing</td>
<td>30 days</td>
<td>200</td>
<td>Java-based client supports Windows, Mac, and Linux</td>
<td>Screen sharing, multiple presenters, text chat, VoIP, annotating tools, recording</td>
<td>Yes</td>
<td>Yes</td>
<td>Videos, tutorials, forum, online and phone support</td>
<td>Blackboard purchased and combined with Elluminate and Wimba, designed for educational settings</td>
</tr>
<tr>
<td>$49/month or $468/year for up to 15 users, GoToWebinar for $99/month for 100</td>
<td>30 days</td>
<td>15</td>
<td>Download required, Windows and Mac compatible</td>
<td>Screen sharing, multiple presenters, text chat, video, VoIP, annotating tools, recording</td>
<td>Yes</td>
<td>No</td>
<td>Videos, tutorials, forum, online and phone support</td>
<td>GoToWebinar for up to 1,000, GoToTraining for up to 200 available</td>
</tr>
<tr>
<td>Standard Edition: up to 250 users per meeting at $4.50/month/user, Professional Edition: up to 1,250 users per meeting at $16/month/user</td>
<td>30 days</td>
<td>250 or 1,250</td>
<td>Windows-based client software, web-based client for Mac or Linux</td>
<td>Screen sharing, multiple presenters, text chat, video, VoIP, annotating tools, recording</td>
<td>No</td>
<td>Yes</td>
<td>Tutorials, forum, online and phone support</td>
<td>Add-in to Microsoft Outlook, ad hoc meetings, IM to invite participants</td>
</tr>
<tr>
<td>$49/host/month, $468/year, 33 cents/minute/participant</td>
<td>14 days</td>
<td>25</td>
<td>No download required</td>
<td>Screen sharing, multiple presenters, text chat, video, VoIP, annotating tools, recording</td>
<td>Yes</td>
<td>Yes</td>
<td>Videos, tutorials, forum, online and phone support</td>
<td>Webex University offers self-paced or instructor-led courses, multiple foreign language options</td>
</tr>
</tbody>
</table>
What’s New

Califone has introduced a wireless, portable public address system for use with iPhone and iPod devices. Designed specifically for schools, the PA419 is a durable PA system that doubles as a media player, featuring a built-in DVD/CD player and an iPhone/iPod docking station. The PA system has a USB connection, so it can be used with computers, projectors, whiteboards, stereos, mixers, and other multimedia players. It features dual wireless mic receivers, allowing up to three presenters to use it at a time. The integrated tripod mount enables you to elevate it for enhanced sound delivery.


Peerless-AV has released the HD Flow Wireless Multimedia Kit (HDS100), an 802.11n transmitter and receiver system that allows users to install HDTVs, flat panels, projectors, and other displays up to 131 feet away from multimedia source devices. The HD Flow’s long-range, full 1080p 60Hz wireless media streaming provides flexibility in display placement, reduces installer costs, eliminates cable clutter and hole drilling, and provides instant real-time HD transmission even through walls, floors, and ceilings. It features plug-and-play operation with no software or driver installation, the ability to connect up to four source devices simultaneously and easily switch between sources using the remote control unit or push button on the HD Flow transmitter, and the option to switch to a second Wi-Fi channel in case of interference.

More info: www.hdflow.com

ISTE is releasing three new books this month, including Connecting Students to STEM Careers: Social Networking Strategies by Camille Cole, Media Literacy in the K–12 Classroom by Frank W. Baker, and Advocacy and Educational Technology: A Guide to Getting Your Voice Heard by Hilary Goldmann. Connecting Students to STEM Careers will help you introduce your students to STEM professionals who can act as role models and mentors. It costs $23.07 for members and $32.95 for nonmembers. Media Literacy in the K–12 Classroom will help your students “tune in” so they can begin to analyze messages and understand techniques used to influence them. It costs $25.17 for members and $35.95 for nonmembers. Advocacy and Educational Technology will help you develop a better understanding of the issues facing ed tech, learn about the programs that shape your ability to provide an effective education, and help ISTE and its members transform education in the digital age. It costs $5.57 for members and $7.95 for nonmembers.

More info: iste.org/store

A free iPad app called ScreenChomp developed by TechSmith is designed to help teachers easily create video tutorials for their students. ScreenChomp is a digital whiteboard that educators can write and draw on with the touch of a finger, then easily record all activity using Camtasia for Mac or Camtasia Studio to create video tutorials. You can download videos produced in ScreenChomp as MP4 files, making them easy to share on all video-hosting platforms.

The Kingsbury Center at Northwest Evaluation Association has launched the Kingsbury Center Data Gallery, an interactive microsite that features exhibits populated with videos, interactive data visualizations, and links to related studies and blog posts. The gallery encourages user interaction, and visitors are welcome to post comments and questions and share information.

MORE INFO: http://kingsburycenter.org/gallery

PenandFree has introduced the uBoard whiteboard system, an affordable, simple-to-use system that can transform any flat surface into an interactive environment. Users can enhance their presentations by writing notes and highlighting items onscreen, then save their presentations to share with colleagues or students. It easily moves from room to room, office to office, or on the road. Because there are no bulky presentation components, the entire uBoard system can fit inside a laptop bag with room to spare. An optional driver enables operation with Macs running OS X or above.

MORE INFO: www.penandfree.com

Acumen Solutions has launched SchoolForce, an open student information system (SIS) and performance management solution. The cloud computing application is built on the salesforce.com platform and is integrated with Google Apps. SchoolForce allows schools and districts to have open access to the source code of the SchoolForce application and enhance and extend it. The system includes core SIS modules, such as attendance, behavior, homework, student records, and a Common Core–compatible grade book as well as collaboration and document management—all of which schools can share with parents and students via a web portal.


Crestron has launched a new line of iPad docking stations. The charging docks turn the tablets into tabletop or wall-mount touch screens. IDOC-PAD and IDOC-PAD2 enables any iPad or iPad 2 to be stationed and used while charging in a sleek, minimalist in-wall design, or in a slim ergonomic tabletop model. Just press the slim frame on the wall-mount model, and the dock extends, allowing you to slide the tablet in or out. The curvy and lightweight tabletop model is designed for quick docking.

MORE INFO: www.crestron.com/apple

COMING NEXT ISSUE

Use Social Networks to Teach Netiquette
Districts can take steps to prepare students to be responsible digital citizens. Author Matthew Winn explains how Southwest Christian School in Fort Worth, Texas, USA, is teaching appropriate online etiquette by integrating school-based social networking into its curriculum.

Teach This and Other Controversial Issues
Debate this and other controversial issues at www.iste-community.org/group/LandL.

Less Than a Class Set
Think you need an entire set of iPads to use the device effectively in the classroom? Think again. Kristin Redington Bennett from Wake Forest University in Winston-Salem, North Carolina, USA, explains how just one tablet device can engage each student and enhance learning.

Should Students Use Their Own Devices in the Classroom?
Recently, as I signed off on a hefty purchase order for some educational software the Instruction Department wanted, I imagined one of our freshmen posting to Facebook: “I’ve got Plato for math and Rosetta Stone for Spanish. Does anyone know who these teachers are?” Since the days of the Apple IIe and IBM’s Writing to Read, educational applications have been trekking along their own evolutionary path. Despite their latest and greatest releases, I am glad that a dwindling number of educators consider the use of a computer and an app to be true technology integration. In our district, we’ve been doing our best to stamp out this notion altogether.

Last school year, we organized the effort by designing and launching a local initiative called i-am21. This catchy phrase conjures up a pivotal point in the lives of every red-blooded American. It’s an age that we all have some memory of, a happy event that double-dated with the realization of taking on new responsibilities and accountability. In our district, i-am21 also means time for fun and time to take responsibility. In this case, it is the responsibility to integrate authentic, meaningful 21st century skills into learning and teaching regardless of the grade level or curriculum.

Our initiative incorporates goals found in several popular models, such as ISTE’s NETS for students and teachers as well as work done by the Metiri Group, the Partnership for 21st Century Skills, and a few others. We combined, adapted, tailored, and trimmed from these excellent resources to make i-am21 our own. The result was an expectation that all students would experience five areas of focus at grade-appropriate levels: collaboration and communication, technology literacy, information literacy, global awareness/diversity, and creativity and innovation. Once entrenched, we will revisit these to ensure that they continue to align with student needs and the world we live in.

In its first year, the i-am21 initiative resulted in measurable and observable improvements in the frequency and quality of true tech integration taking place throughout the district. I attribute much of this early success to the dozens of hours we devoted to administrator professional development, but that’s another story. We are nowhere close to the fantastic environments you might find in “new tech” high schools, but we are certainly on our way to stamping out the notion that clicking a mouse 1,000 times while using an educational application provides students with the digital age skills they need for success. Learn more about i-am21 at www.shelbyed.k12.al.us/iam21/index.html.

The ISTE’s annual conference and exposition in Philadelphia in June provided ample evidence that true technology integration is happening in school districts all over the United States. It is my hope that someday the term technology integration won’t have any meaning at all. It will just be learning and teaching as usual. How will we know when this new pedagogy has become the limitless landscape of education? Will the data tell us, or a whitepaper, perhaps? I think we’ll know when we search for clip art using keywords such as school, teacher, student, or classroom, and get results that look nothing like the 19th century Rockwellian images that you get today.

Susan Poling is the technology coordinator for Shelby County Schools, which serves 28,000 students in Columbiana, Alabama, USA. She has 20 years’ experience as a district-level technology coordinator and has served as an officer for the Alabama Education Technology Association, an ISTE affiliate.
This Girl Has a Real Virtual Career Ahead of Her

Holly Baiotto

“I took two weeks and many phone calls to a man in Canada before we were able to fix the Immersadesk,” she said.

For Holly and her virtual reality cohorts, the workload didn’t diminish when school started up again in August. “We spent half of the next school year figuring out how to operate our MacBooks with the software,” she said.

Not everyone was as motivated as Holly. “A lot of the students didn’t want to put the time into doing the projects and learning the software,” she said. “That left me as the student leader of the group.”

Her VREP chapter began to wither until, in her junior year, a new shop teacher took over and the club became an independent study class. He taught 3D software programs, such as AutoCAD, Google Sketchup, and Blender, to his junior high school students. Then 10 younger students joined 10 high school students to begin working on virtual reality projects of each student’s choosing.

While some students replicated 3D designs of existing buildings, Holly created a wind tunnel. Using Twitter, Holly connected with some students in Minnesota who wanted to build a device to see how wind flows around airplane wings.

“They drew up some rough sketches on a whiteboard and sent them to me,” she said. “I then basically designed their wind tunnel in Blender. I finished it in, like, three days and sent it back to them.”

After the students built the wind tunnel, Holly was invited to sit in on a Skype videoconference where she talked to district school board members about her role with the project. She recently started working on a bigger wind tunnel for the same group.

Holly, now 17 and a senior, has become an advocate for the program and even spoke to the National Federation of Women Legislators in Des Moines, Iowa, about VREP. But she credits her success to the adults in VREP who have steered her along the way.

“This is a program where all teachers and administrators step out of the way and let students go wherever they want to take it,” she said.

—Diana Fingal is senior editor of L&L.
If you have ever asked this question, you will be interested in ISTE’s Technology Research Exchange (T-Rx) project, which is currently under development.

ISTE’s niche in the research world is to serve members and advance the field by closing the gap between research and practice. Journal of Research on Technology in Education (JRTE) editor Lynne Schrum, in her introduction to the new ISTE book The Best of JRTE: Considerations on Technology and Teachers, argues for a proactive approach to an ed tech research agenda. She contends that:

An effective return on future investments in educational technology is more likely to be realized to the extent that research captures past impact and provides directions for future use.

One reason that the introduction of technology into schools has not resulted in the expected educational reform, Schrum suggests, is that researchers do not necessarily choose to study what educators want to know.

In 2000, the Bill and Melinda Gates Foundation funded ISTE to develop “a web resource to help teachers, administrators, researchers, policy makers, technology planners, and grant writers find and use the best educational research.” This effort, the Center for Applied Research in Educational Technology (CARET), did good work; however, the CARET project was not sustainable past its funding program, so the most recent reports in the database are now more than five years old.

The challenge is to create and maintain an up-to-date searchable database of the best and most recent research that informs practice in ed tech. T-Rx will be an interactive bibliography of research annotated with implications for practice. It will be interactive on two levels.

First, you will be able to search the database for what the research says about a given topic and use the information to support advocacy for grant proposals and for program and professional development. Educators will be able to attach comments to the annotated citation about their experiential classroom knowledge on research topics and rate the most useful items. This will also give researchers welcome feedback on their work from practitioners.

Second, to keep the database up to date, we plan to offer training and clear guidelines for evaluating research and contributing to the database. ISTE’s Research and Evaluation team is designing a rubric for evaluating research reports that will help identify the quality of the research, the population that the findings are appropriate for, and the implications for practice that the research supports. ISTE Learning will offer an online graduate-level course called Research to Practice based on the rubric. Students will review current research reports, including peer-reviewed journal articles, program evaluations, and research reported online, against this rubric. The professor will evaluate the review, then post the annotated citation of the research report in T-Rx. Students enrolled in the course will also get support to develop a literature review for their theses or dissertations in the field of ed tech.

Would you like to use the T-Rx database? Are you interested in the Research to Practice course? Help develop this project by giving us your feedback at www.surveymonkey.com/s/TRx.
Get Involved! Join a SIG.
Three Things You Can Do Today!

What are you interested in? ISTE has more than 20 special interest groups (SIGs). From administrators to mobile learning to teacher educators, there’s a SIG community for you!

View
Watch the brief SIG tutorial to learn how to get involved and manage your special interest groups.

Engage
Want to find out what other SIG members are doing? Have something to contribute? Jump into a discussion in your SIG’s Ning group or add a resource to your SIG’s wiki.

Join
Browse the SIG directory to learn about each SIG’s mission, social networking opportunities, and resources to find the group for you!

“ I felt like it was really important to get involved with SIGML, because I can collaborate with other like-minded people and learn how they’re incorporating mobile learning throughout the world.”

—Scott Newcomb
SIGML member
ISTE member since 2010

iste.org/SIGs
Destination San Diego
The sun, the sea, the learning!

REGISTRATION IS NOW OPEN!

Join us at ISTE 2012 as we discover how educators from around the world are using innovative technologies to help students expand their horizons.

HOUSING RESERVATIONS
open early November.
Check the website for details.

isteconference.org