Specialty Classroom Technologies Special Report

A RESEARCH REPORT FROM **THE CENTER FOR DIGITAL EDUCATION** AND **CONVERGE**

THOM DUNNING, DIRECTOR OF THE NATIONAL CENTER FOR SUPERCOMPUTING APPLICATIONS (NCSA)

I FELL IN LOVE with a 2-foot-tall robot! We met at a convention in Austin this last February. He played the theme song for Star Wars while he danced and said, "Luke, I am your Father." The most amazing part: He was programmed by a high school student. This opened my eyes to how learning with specialty technologies is not only engaging, but also critical to students' futures — not to mention addictive. This type of "cool" learning leads to life-long endeavors in fields that could cure diseases, transform lives and enhance our economy. It may seem bold to cover all of the areas impacted by specialty technologies, such as STEAM (science, technology, engineering, arts and math) in one report. However, we hope to give educational leaders a vision of how overall learning can be transformed with innovative tools. We sincerely hope you enjoy it!

LEILANI CAUTHEN
Publisher, Converge Special Reports
Converge/Center for Digital Education

WE OFTEN WRITE ABOUT and discuss the big movements in education in these Special Reports, but in this issue we decided to look at more specific solutions. New technologies and educational solutions are being deployed in classrooms as well as online that address unique aspects of the education practice. These specialty technologies provide innovative solutions to improve outcomes for programs, students, instructors and campuses. What they all have in common is that they leverage digital resources to enhance instruction and assessment. STEAM seems to be the area where specialized technologies have been developed and adopted by educational institutions the most. This is natural since technology is logically embedded into these initiatives. However, schools are also adopting specialized technologies to improve the plight of at-risk students or students with special needs. These areas are showing promise as more solutions are deployed and more institutions are learning how technology can be an important part of the educational experience. Please read this Special Report with these aspects in mind: Specialty technologies can enhance learning, improve teaching, create more engaging lessons and improve student outcomes.

JOHN HALPIN
Vice President, Strategic Programs
Center for Digital Education

CENTER FOR DIGITAL EDUCATION

CONTENTS

2012 | ISSUE 4

LEGO EDUCATION

UNIV. OF IL. BOARD OF TRUSTEES/NCSA

FRONTROW CALYPSO LLC

e.Republic
SMART MEDIA FOR PUBLIC SECTOR INNOVATION

100 Blue Ravine Road, Folsom, CA 95630
916.932.1300 phone | 916.932.1470 fax

COVER PHOTO PROVIDED BY THE NATIONAL CENTER FOR SUPERCOMPUTING APPLICATIONS.

Specialized Technology Helps Fulfill a Critical Need

As of August 2012, there were 3.6 million job openings in the United States. Yet, nearly 13 million Americans remained unemployed.[1] Why is it so hard to fill jobs? One answer could be that our students aren't graduating with the specialized skills needed to enter the workforce. A recent study conducted by the ACT found that only 46 percent of high school graduates met the math college-readiness benchmark and only 31 percent met the science college-readiness benchmark in 2012.[2] Today's students are not receiving the specialized training needed to enter fields such as engineering, research, science and the arts.

To add to the problem: Students are losing interest in these fields as they progress through their education. Forty percent of undergraduates planning to major in engineering or science wind up switching majors or dropping out altogether; add in pre-med students, and the number rises to 60 percent, says a University of California at Los Angeles study.[3] This is despite the fact that many new jobs are being created in science, engineering and technology. Employment in computer and IT fields is expected to grow by 22 percent through 2020, adding 760,000 new jobs, according to the U.S. Bureau of Labor Statistics. Engineering jobs remain in high demand and are well paid ("biomedical engineer" is the fourth fastest growing profession in the U.S.); and the health care industry is expected to create 3.5 million new jobs by 2020.[4]

Campuses face challenges both in trying to interest students in these fields as well as to retain them; funding and a lack of trained educators are problems for both K-12 and higher education. However, a whole new class of specialized technology is emerging that not only can make up for campuses' limited resources, but can spark student engagement.

This Special Report highlights this specialty technology and showcases its use in campuses across the nation. It examines how technology is boosting student interest and transforming areas like STEAM (science, technology, engineering, arts and math), research and supercomputing, and special education — providing educators with valuable tools to ensure all students have the critical skills needed to enter the future workforce prepared. ■

Why Boost

*** And students are losing interest in these fields as they progress through their education.**

*** Why is it important for students to receive this specialized training?**

Student Interest in Specialized Fields?

13M
AMERICANS REMAINED UNEMPLOYED.

* Why is it so hard to fill jobs?

* Students are not receiving the training needed to enter specialized fields.

ONLY
46%
OF HIGH SCHOOL GRADUATES MET THE MATH COLLEGE-READINESS BENCHMARK.

ONLY
31%
OF HIGH SCHOOL GRADUATES MET THE SCIENCE COLLEGE-READINESS BENCHMARK.

40%
OF UNDERGRADUATES MAJORING IN ENGINEERING OR SCIENCE

+

20%
OF PRE-MED STUDENTS

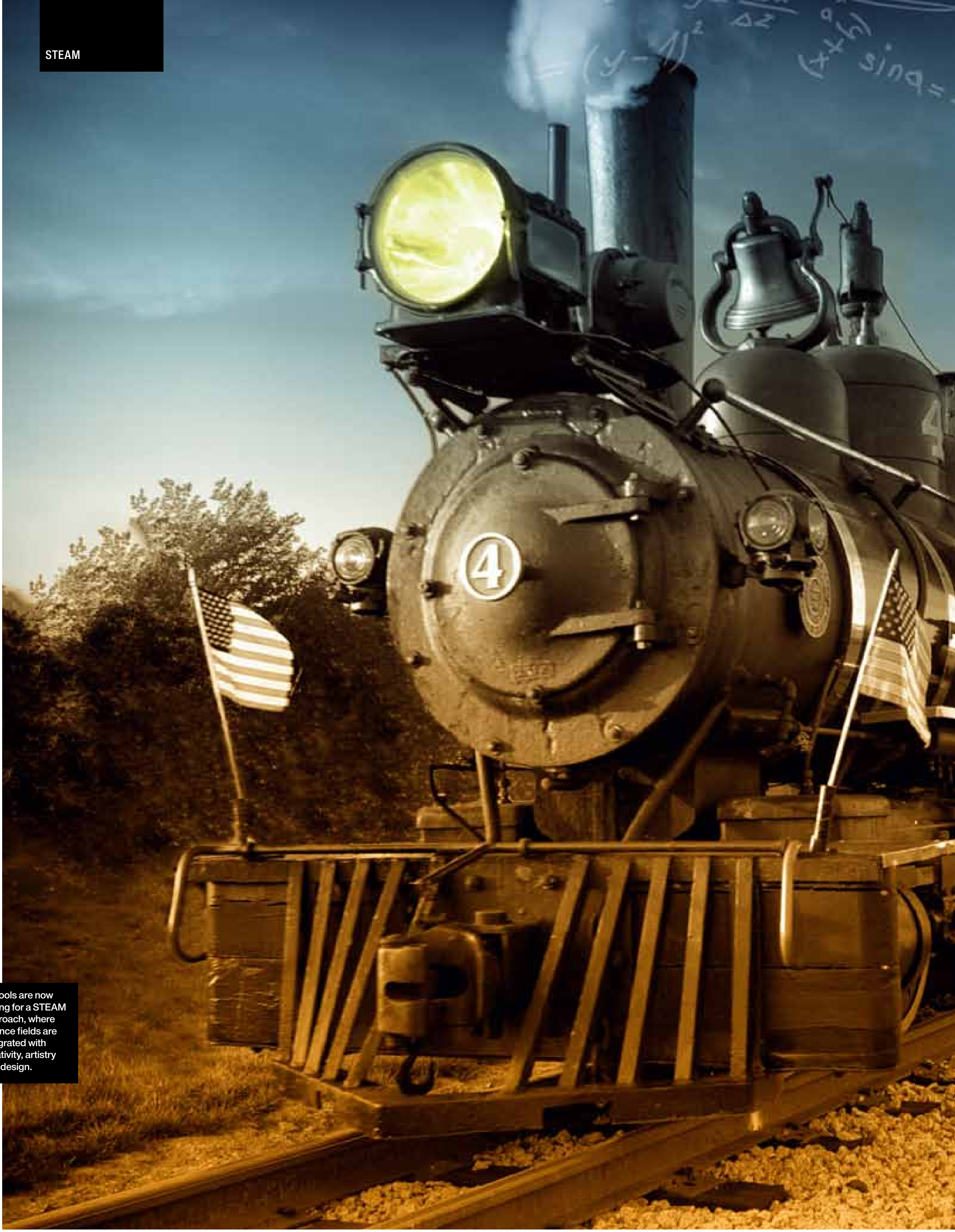
=

60%
OF UNDERGRADUATES THAT END UP SWITCHING MAJORS OR DROPPING OUT COMPLETELY.

+760K
NEW JOBS ARE SUPPOSED TO BE ADDED IN THE COMPUTER AND IT FIELD BY 2020.

BIOMEDICAL ENGINEER IS THE
4TH
FASTEST GROWING PROFESSION IN THE U.S.

3.5M
NEW JOBS ARE SUPPOSED TO BE ADDED IN THE HEALTH CARE INDUSTRY BY 2020.



Schools are now calling for a STEAM approach, where science fields are integrated with creativity, artistry and design.

FULL STEAM AHEAD

SPARKING STUDENT INTEREST IN THESE HIGH-NEED FIELDS

There's little argument that U.S. schools need to better prepare students for careers in science, technology, engineering and math (STEM). U.S. students lag other nations in STEM aptitude; STEM jobs are increasing rapidly, and they pay 26 percent higher than non-STEM jobs — yet there is a shortage of qualified applicants.[5] Too many students, especially females, African Americans and Hispanics, turn away from STEM courses early in their academic lives — often before high school.

LEGO EDUCATION

Whether schools use a STEM or STEAM orientation, new specialized technologies are helping push learning forward and engage students in these areas.

Additionally, the emphasis on STEM is expanding to include what is commonly thought of as the "right brain," or creative side of personality — in other words, to recognize that the arts are also an important part of the equation. Now, schools are calling for a STEAM approach, where science fields are integrated with creativity, artistry and design.

One obstacle to this movement is a lack of qualified teachers at both the K-12 and higher education levels — over half of STEM university faculty leave within 11 years.[6] To overcome this, President Obama has called for 100,000 new STEM teachers and asked Congress for $1 billion to, among other things, help identify 10,000 STEM master teachers nationwide. But more help is needed. Whether schools use a STEM or STEAM orientation, new tools and strategies are helping push learning forward and engage students in these areas.

Adding the "A" to STEM

The STEAM movement is being championed by, among others, the Rhode Island School of Design (RISD). "Our argument is that STEM alone will not drive the 21st-century economy," says Babette Allina, director of government relations for RISD. "One of the reasons we've been talking about the importance of adding art and design to the national push for STEM is because artists and designers have a lot of common foundation with sciences and engineering, and also some unique qualities that add to those kinds of collaborations."

Both artists and scientists, she points out, are "leap thinkers" — people who are "willing to imagine something beyond what we know. There is an unnatural bifurcation between the arts and sciences; when combined, they work beautifully together."[7]

Putting this philosophy into practice, RISD is offering STEAM fellowships to its students to work in public policy at places such as the Mayo Clinic. The school is also involved with the National Science Foundation's EPSCoR program (Experimental Program to Stimulate Competitive Research), which is running studios to see how to problem-solve in ways that combine art and science. First project focus: the impact of climate change on marine organisms.[8]

School President John Maeda points to Steve Jobs as an example of someone who integrated arts skills (creativity and a design sense) with technological abilities to create successful products. "I believe that art can help the economy the same way that Apple has helped the economy — by showing that making things more human makes them more desirable," Maeda said in a recent interview.[9]

RISD students can join a STEAM club that partners with the MIT Media Lab to create events bringing together art and science, such as a workshop featuring an artist who combined LEDs, microcontrollers, liquid crystal paint and moldable metal into expressive arts projects.[10]

Arts educators can also work with science and math instructors to create collaborative projects that deepen student understanding. For example, Jenny Montgomery, an art teacher at the Dayton Regional STEM School in Ohio, has taught 9th graders how to draw in one-, two- and three-dimensional perspectives, which prepares them for the computer-aided design (CAD) software they will use in their engineering courses.

"I work regularly with my colleagues to find connections that enhance and support student engagement with content," says Montgomery. Other projects include creating an exhibit about biomes and pollinators

PASCO

LEGO EDUCATION

comprised of cut paper and origami, and engineering pop-up books illustrating plate tectonics. Her students also use the Web and digital technologies — creating blogs, websites, podcasts, animations and digital graphics.

Another art teacher at the school, Emerie Whitman-Allen, has her students using Photoshop to create anatomically correct posters to explain ballet poses (fusing both biology and dance).

A big key to the successful integration of arts in STEM learning, says Montgomery, is having an environment like that at her school, where teachers use project-based learning and a collaborative, holistic approach supported by the administration. She and colleagues are given regular time outside of class to meet and develop the arts approaches that will best meet students' needs.[11]

Music is another art form that can be combined with technology to spark creativity and foster engagement. At the STEM Magnet Lab School in Colorado, music teacher Gregg Cannady uses audio cubes — small, coffee-cup sized computerized blocks with infrared sensors on all sides that connect wirelessly and communicate with computers to play musical notes and sounds.

"It's problem-based learning. Kids can record on their phones and email me a sound clip and I can drop it into this computer program and we can build a composition around it," says Cannady. "They seem to be very, very drawn to this technology," which he considers a key addition to his educational repertoire.

"The challenge is combining the love and passion for traditional music education with everything that's available to us now. It's very hard to do what I do without the technology — [students] can learn so fast when we can keep up with them."[12]

Other music technologies include "silent" instruments, which allow students to play electronic keyboards and guitars but with sound ported only to headphones, not to the entire classroom (in use at McCaskey High School in Pennsylvania),[13] and the use of videoconferencing to allow teachers to work with students remotely. For example, instructors at the Manhattan School of Music can teach while out of the country performing in concert tours; students can audition from Shanghai or other locations without having to travel to the school; and orchestras can collaborate virtually, with the joint performance available to watch online, either live or later.[14]

Digital Graphics Tablets

Graphics tablets are popular in art and industrial design programs, letting students use special pressure-sensitive input devices to create precision drawings and then zoom in and out, change brush size and make other changes in ways not possible with paper and pen.

Don Bosco Technical Institute — a high school in Rosemead, Calif. — has its students use graphics tablets, recognizing that these are commonplace in fields that incorporate industrial design, CAD, media arts or other types of digital graphics fields. By letting students become proficient with this type of digital input technology, they can better succeed in college as well as in the workforce once they graduate.[15]

Similarly, students at Sheldon High School in California use professional-level interactive pen displays in their animation classes to draw directly on screens. The school has won three high school Emmys for its animated films; some alums have gone on to use their skills in jobs at Pixar and the Cartoon Network.[16]

University students work in teams to design a robot.

Geographical Information System Training

Geographical information systems (GIS) use geographic data combined with other kinds of data to study patterns and relationships and to solve problems. Increasingly, Web-based GIS technology is being used in schools at all levels.

GIS can be used to teach not only science, but arts and other subjects. Literature students might look at conditions in the time and place a novel they are reading is set, for example.

Louisiana State University's Computer Aided Design & Geographic Information Systems Research Laboratory (CADGIS) is a multidisciplinary lab, jointly run by the university's colleges of art and geography. Students study not only GIS and CAD, but remote sensing, image processing and other computer applications in art, architecture, design, geography and anthropology, interior design and landscape architecture.[17]

Virtualization

Virtualization uses digital technology to provide virtual training for students to help them master any number of fields within which they might find future employment.

Science Labs

Virtual labs are an alternative for campuses that can't afford fully stocked labs or as a supplement for students who can work remotely on experiments from any location.

Late Nite Lab, for instance, offers more than 100 chemistry and biology lab simulations at a price of about $50 per student per semester. Students can run experiments with virtual E. coli and staph samples, using virtual Bunsen burners, microscopes and slides. If a student accidentally drops a lit Bunsen burner in the trash, fire starts — virtually, of course, but it's enough to warn students this is lab behavior to avoid.[18]

With many of its students living in remote and isolated areas in the Alaskan bush, Prince William Sound Community College in Alaska offers a variety of "wet lab" experiences in the virtual 3D world of Second Life. Students can study — from the comfort of their own homes — Mendelian genetics, gel electrophoresis, natural selection and mass density volume.[19]

Medical Simulations

In nursing simulation laboratories at California State University, Sacramento as well as other colleges and universities, life-size and life-like mannequins serve as patients for nursing students. Mannequins are able to speak (a professor or live actor in another room provides the voice), breathe, blink, produce faux bodily fluids and exhibit such vital signs as temperature and pulse rate.

If a student administers the wrong medicine or the incorrect dose to the mannequin, it will react — possibly even "die." If mannequins develop cardiac arrest, the students can initiate CPR and a defibrillator to restore it back to life.[20]

Mannequins can cost anywhere from $30,000 to $200,000 each, depending on model and functionality. A less costly, more flexible alternative to mannequins that simulate human patients is virtual patients.

At Duke University, medical and nursing students will use a virtual reality simulation environment built on the "Unreal" gaming engine to learn about neurology. Students work with patient avatars and each other to perform medical procedures and become familiar with the clinical environment. The medical school is developing several other training exercises for medical and nursing students using this virtual environment, which it plans to roll out in 2013, says Dr. Jeff Taekman, director of the Human Simulation and Patient Safety Center.[21]

3D Theaters

Students in the Richmond County School District in North Carolina use portable 3D theaters to design their own 3D content. Fifth through 12th graders learn 3D design and gaming software, designing content related to math, science and career topics. Students produced virtual scenes from "The Hunger Games" and learned flight and design simulation software to help create model aircrafts.

District IT Director Jeff Epps says the 3D program helps motivate and engage students. One student had failed Algebra I twice before, but after taking — and excelling in — 3D courses, he passed Algebra I. "What we have discovered is that many of the students walking our halls who are labeled 'underachievers' are those who excel in the 3D Academy," says Epps.[22]

Similarly, many formerly at-risk students participating in East Marshall High School in Iowa's Virtual Reality Education Pathfinders program wind up succeeding in advanced placement and honors courses and participate in STEM-related internships after graduation. They also see an average 1-point GPA improvement after taking 3D and virtual reality courses.[23]

Another type of virtual room is the SMALLab, or Situated Multimedia Arts Learning Lab, developed by Arizona State University and in use at some schools, including Elizabeth Forward Middle School in Pennsylvania. Students learn math, physics and other subjects in a room tricked out with a 15x15 foot display projected onto a foam mat on the floor by a ceiling mounted projector, motion-sensor cameras, wall projections and special wands. These immersive tools (which cost about $35,000) are used to, for example, play a game with brightly colored virtual balls; as they move the balls using their wands, they learn multiplication and other math concepts.

The "embodied learning" afforded by this 3D virtual technology helps students better understand and engage with the content, while developing critical thinking and reasoning skills, say Elizabeth Forward educators.[24]

Real-World Technologies

Students can also learn using real-world lab tools and other technologies that they are likely to experience in 21st-century careers.

In rural East Tennessee, schools have a hard time affording lab equipment

VADDIO

Advances in Lecture Capture

Capturing lectures on video has become easier and more affordable in recent years due to mobile devices and advances in video recording and transmission. Captured video today can be viewed on smartphones, whiteboards or other tools and enhanced with features such as indexing, which makes words spoken in the video searchable. A student can quickly advance the video to the spot where the teacher speaks about the War of 1812, for example. Or, a student might skip through a video featuring several speakers to just the speaker she is interested in.

This indexing is made possible by "pulse analytics" technology, which uses voice recognition tools to parse each word and convert it to text. Users can choose how many words they want indexed and can create their own list of keywords; the software also will automatically create a vocabulary of relevant keywords. Lectures can also include timeline comments and questions, posted either in real time when the videoconference is happening or later as the video is being viewed in captured form.

Lesson capture is similar technology, but at lower cost and without requiring cameras — only audio and whatever presentation a teacher may be making is displayed. In a typical lesson capture system, the instructor wears a transmitter microphone. At the press of a button, a recorder connected via USB cable to the teacher's computer begins recording. The recorder captures the instructor's voice and whatever is showing on the computer screen — perhaps a math problem being worked on the interactive whiteboard or a PowerPoint slide. Once finished, the recording is immediately uploaded for later viewing.

Career and Technical Certifications Power K-12 STEAM Programs

Dunbar High School in Fort Myers, Fla., is the world's first and only Microsoft-certified high school. Dunbar earned this designation by offering industry-standard certifications in tech areas, such as Microsoft Office Specialist, Certified Systems Engineer and Systems Administrator.

The magnet school, where about 85 percent of students qualify for free and reduced lunch, began its certification program in 2005 with 12 IT certifications, says Lead Technology Teacher Denise Spence. The school added more certifications over the years; today, it offers 24 professional certifications, covering not only IT but also digital arts, game design and programming, and engineering. Students use state-of-the-art software and equipment as part of the four-year program.

Students take their certification courses as electives, with the school fronting the cost of the exams. The school works with area businesses to line up internships, often paid. While about 85 percent of its graduates go on to college or the military, says Spence, others graduate directly to jobs — some "paying more than I make." Dunbar also coordinates with area universities and colleges so that students can receive college credits for the credentials they've earned.

Spence has found that students in the tech program who find they love technology transfer this attitude to their other core academic courses. "They tend to see a purpose for coming to school, so they will make it to the other classes," says Spence. Students learn testing, communication and collaboration skills that are transferable to other academic areas so that their overall performance improves; they are more likely to stay in school and go to college.[25]

Another school offering certifications is Thomas A. Edison Career & Technical Education High School in Jamaica, N.Y. There, students work with BioRAD lab equipment, processing DNA samples just like a modern crime lab technician. Some learn robotics using the Carnegie Mellon University robotics curriculum.

About 80 percent of graduates from the Thomas A. Edison Career & Technical Education High School go to college, with the remaining entering the service or industry in which they prepared for in school, says Principal Moses Ojeda (himself an Edison alum).

Edison gives students the chance to earn certificates in the career fields they study.

"Our students learn on industry-standard equipment and are industry certified in accordance with the most recent and up-to-date certification standards," says Ojeda. The most popular programs include: computer networking, computer repair, med/pharm and biotech, and robotics/STEM. The school also offers college prep and AP courses.

The school receives 7,000 applications for its 500 open spots each year, says Ojeda — a sign of the great demand for this type of education.[26]

The Thomas A. Edison Career & Technical Education High School receives 7,000 applications for its 500 open spots each year.

A third-year mechanical engineering student in the Penn State DuBois Engineering Lab programs a CNC machine to produce powder metal parts.

Increasingly, community colleges are working with employers to train students for the high-skilled industrial jobs that too often go unfilled — jobs that may involve the use of robotic controls, CAD software or other high-tech process controls.

for science classes. To help, a group of nine East Tennessee school districts formed the Rural Communities STEM Initiative along with Roane State Community College in Tennessee and an area lab supplier. The group started a middle-school pilot program in spring 2012, creating "Lab in a Box" kits (valued at $7,500 each) with lab materials and standards-aligned lesson plans that could serve up to 80 students per school. Afterward, a Roane State survey found that about 71 percent of students said the labs increased their interest in science and math.[27]

Some tools can be hooked to laptops or smartphones and are then used to measure all sorts of data — from EKG readouts to DNA sampling to climate analysis. These tools are called probeware and are increasingly used in science classes in K-12 education.

For example, Hillsborough County Public Schools in Florida uses probeware and data collection devices in all 27 of its high schools, as well as many middle schools and some elementary classes. The probeware allows teachers to "conduct complex labs more efficiently and with less preparation time and supply cost," says Superintendent MaryEllen Elia.

Because one problem is inadequate teacher preparation, the district is working to train more teachers in the use of these devices via introductory and follow-up workshops.[28]

Research shows students using probeware are more motivated and achieve higher test scores, says Sybil Young, project director for the Student and Teacher Excellence Project at Newport News Public Schools in Virginia, which uses probeware in its middle and high schools.[29]

Manufacturing Technologies

Additional real-world technologies include those found in modern-day manufacturing environments. Increasingly, community colleges are working with employers to train students for the high-skilled industrial jobs that too often go unfilled[30] — jobs that may involve the use of robotic controls, CAD software or other high-tech process controls.

Macomb Community College near Detroit devises courses for Fitzpatrick Manufacturing Co. in Sterling Heights, Mich., a supplier of high-tech machine parts used in robotics, aerospace and other industries. Students study advanced manufacturing, including CAD, geometric tolerancing and dimensioning, chemical process operations, solar manufacturing and other needed skills.

Students at Rock Valley Community College in Illinois receive training in robotics used in manufacturing jobs at nearby companies. One new tool: a bus-sized, $300,000 simulator featuring a load conveyor, robot unload conveyor and main control panel.[31]

Of course, high-tech manufacturing skills also can be taught in high schools or even middle schools. At Gulfstream Middle School in Florida, which serves a student population that is about 90 percent free and reduced lunch, students work with 3D engineering software, laser machines and CNC milling machines, and other tools.[32]

3D Fabrication and Rapid Prototyping

3D printers or rapid prototype machines can create objects from digital designs, typically using liquid plastic that forms a resin (though other types of machines use metals, ceramics or other materials). Such printers are becoming more common in schools and universities as prices drop; many are in the $2,000 range — but the cost of materials used in printing can make these expensive to use.

In California, students at Chico High School use a 3D printer to produce prototypes for local businesses such as plastic models for water bottle lids for Kleen Kanteen, a water bottle manufacturer. Another business, Westside Research, uses student help to prototype parts for cargo, ski and bike racks.[33]

At the University of California at Santa Cruz, anthropology Professor Alison Galloway "printed" valuable and fragile bones such as skulls into plastic forms so that students could use these for hands-on study instead of the originals.[34] ■

WIKIPEDIA

L. BARRY HETHERINGTON

Gaming Not Just for Fun Anymore

Educational gaming becoming an essential way for students to learn

Whether it's via video games, new educational apps, complex simulations or virtual reality environments, gaming is becoming more accepted in education than ever before — recognized as an effective, if not essential, way for students to learn content as well as develop critical thinking skills and become more creative.

Andrew Phelps, professor and director at the School of Interactive Games & Media at the Rochester Institute of Technology, notes that non-digital games have been used in classrooms for a long time — word games, playing Jeopardy with the class and so on. Digital games, however, were shunned from classrooms until recently. "Ten years ago, people looked at you like you were nuts when you said you wanted to use games and focus on games in an educational way," says Phelps. "We thought of games as being for kids and being trivial because they were centered around this notion of having fun. Over the last decade, we've understood games are a medium like any other artistic medium. ... There is increasing awareness and understanding that there is real value in them."[35]

Clark Aldrich, founder of the gaming firm Clark Aldrich Designs, says every medical student today will likely encounter a game or simulation

Gaming is becoming more accepted in education than ever before — recognized as an effective, if not essential, way for students to learn content as well as develop critical thinking skills and become more creative.

at some point. MBA programs are adopting them, too; about 80 percent of students will play a game or run through a simulation, says Aldrich, as will 40 percent of undergraduates and 20 percent of high-schoolers.

Aldrich compares classroom learning to learning to swim. Pools are scary and cold and dangerous to the uninitiated; you have to dip a toe first to get warm. As you get confident, you start to play: Marco Polo, maybe, or other games, which help you get comfortable and learn more about swimming.

"The reason why this works so well is that the play phase is biologically critical to how we learn," says Aldrich.[36]

Research has proven this. HopeLab and Stanford University released a study in May 2012 showing a direct connection between mental stimulation and game play. Study participants played a video game about killing cancer, called Re-Mission (piloting a tiny robot named Roxxi as she blasts cancer cells); the study showed students responded to the rewards built into the game — showing that games can help shift attitudes, emotion and motivation. Participants who only observed the action but did not play themselves did not show the same level of mental involvement.

"Active involvement in video game play sparks positive motivation in a way that watching and hearing information does not," says Steve Cole, Ph.D., vice president of research and development at HopeLab and professor of medicine at the University of California, Los Angeles.[37]

Gaming is a creative way to introduce students not only to specific concepts but also to develop the harder-to-measure skills needed in a 21st-century workplace: the ability to innovate, to think outside the box, to be intuitive.

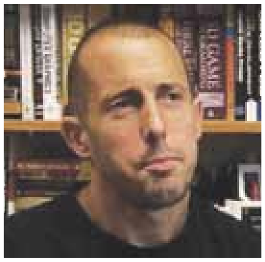
Incorporating Gaming in Education

Gaming principles can be used to help teach leadership, teamwork, innovation and other skills in a variety of ways.

Some schools have adopted curricula based entirely on gaming principles and lessons. Quest to Learn, for instance, is a Manhattan-based charter school that opened in 2009 (a second location opened in Chicago in 2011), with a "gamified" model of education.[38] Students design their own video games, act out historical scenarios, conduct hands-on science projects — but do all of this within the context of a game with levels and challenges, earning points as they would in a video game.[39]

GameDesk, a producer of educational games, began a school in Los Angeles in August 2012, supported by a grant from the Bill and Melinda Gates Foundation. The school opened with 80 students in sixth grade and plans to add students and grades in coming years.

Another way educational institutions can use gaming principles is to employ them in outside-the-classroom programs that can have inside-the-classroom impact. At the Rochester Institute of Technology, undergraduates in game design and new media can become more involved in campus life via a game-like program launched in October 2011 called Just Press Play. Students perform tasks such as visiting a professor during office hours, setting up a dinner party at an off-campus restaurant and organizing study groups, in



FACEBOOK/ANDY.M.PHELPS

"Ten years ago, people looked at you like you were nuts when you said you wanted to use games and focus on games in an educational way. We thought of games as being for kids and being trivial because they were centered around this notion of having fun. Over the last decade, we've understood games are a medium like any other artistic medium. … There is increasing awareness and understanding that there is real value in them."

— Andrew Phelps, Professor and Director, School of Interactive Games & Media at the Rochester Institute of Technology

SMALLab

Students learn in a SMALLab embodied learning environment.

exchange for collectible reward cards from their instructors that are turned in for achievement points.[40]

In one instance, participants were asked to raise the retention rate for students in a tough introductory programming course. Upper-level students volunteered to set up study sessions and became active mentors for freshmen, raising the retention rate from 85 to 91 percent. Students asked if they could continue mentoring without the achievement point reward; the activity had become intrinsically rewarding to them, said RIT Professor Liz Lawley in a presentation at a Games & Learning Society conference in 2012. RIT hopes to eventually make Just Press Play available as open source software to educators at other institutions.[41]

Educational institutions can also incorporate games into a more traditional curriculum, using types of games that vary in scope and methodology, with different uses depending on the subject area.

Serious Games

Serious games promote higher-order thinking and reasoning skills. These games often have a social purpose such as increasing awareness of hunger, war, nuclear proliferation and climate change. Examples of such games include "Stop Disasters," a game that helps players learn how to prevent and prepare for natural disasters, and "Operation Climate Control," a game that lets teams develop policy decisions to slow the rate of global warming.[42]

Educational Games

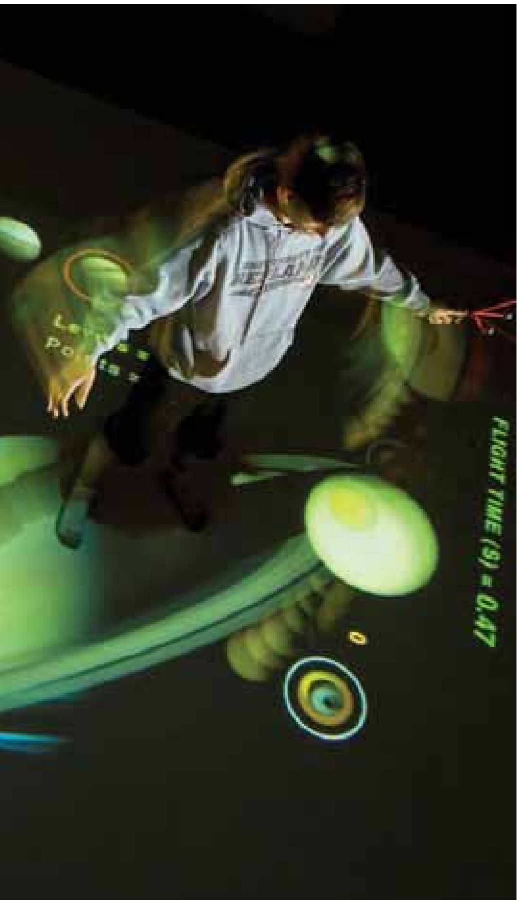
A wide array of games, puzzles and simulation apps are available as open source freeware or for purchase, covering a host of topics. Septris, for instance, is a game used by Stanford University to train medical professionals to treat sepsis. Students can role-play strategy games to stop hurricanes or pretend to fight dragons while — almost without realizing it — solving algebra problems.

Adapted Commercial Games

Rather than picking from a game designed specifically for the educational market, an instructor may want to adapt an existing commercial game for educational purposes.

At Suffern Middle School in New York, for instance, Instructional Technology Facilitator Peggy Sheehy guides an after-school World of Warcraft club in such activities as comparing characters in The Hobbit to the elves, orcs and other fantasy figures in the popular role-playing game. Students perform activities such as writing short stories.

Sheehy collaborates online with other instructors around the country in a group she co-founded — the Cognitive Dissonance WoW Guild, which explores the relationship between gaming and education; she also is part of the World of Warcraft in School Project, which develops



SMALLab

game-related activities in writing/literacy, math and other 21st-century skills.[43]

Educational Games Using Motion Sensors

Video games that use motion sensor technology are also being adapted for educational purposes. One for primary grades uses Sesame Street characters to interact with children: "Grover" and a child playing the game toss each other virtual coconuts, for example.

"Motion Play" is a SMALLab-based game using technology developed at Arizona State University. Students carry glowing balls or other peripherals atop a projected environment that recognizes their full-body 3D movements and gestures. Their steps can be charted instantly on a line graph projected beside them; arm motions create other changes on the projection. Or they can tap and swipe the projection to interact with it much the way a student does with an interactive whiteboard.[44] ■

Tips for Using Specialty Tools in the Classroom

Be prepared — know the technology.
Administrators need to try out technology before passing it on to teachers, and teachers need to get comfortable with it before using it with students. Courtney Hart, innovator at Lewisville Independent School District in Texas, notes that she tried one popular presentation app, thinking it would take her 10 minutes — and was still struggling with the program five hours later. "There are some things I've worked with that I wouldn't suggest to my teachers," she says.[45]

Be flexible if problems occur.
Computers crash, networks fail, power goes out. What to do if you are teaching a lesson that relies on Web-based technology? Have a plan B, C and D. "Technology never works exactly how you want it," says Hart. "A savvy teacher needs to be able to go with the flow. If it fails, you need to be able to transition to the next activity."

Courtney Hart, Coordinator of Assessment and Accountability, Lewisville ISD

Investigate resources to find new tools to use.
Any number of websites, wikis, message boards, interest groups (such as on Ning) and Twitter lists exist that can provide vetted links to tools, including standards-aligned software and other curricula. To find and rate open source resources, visit OER Commons.[46]

Train teachers with videos, workshops and modeling.
Hart recommends making tutorial videos for teachers to show them how to use tools, plus have tech-savvy fellow teachers model their use. At Lourdes Catholic High School in Florida, Principal Donna Witherspoon holds weekly tech workshops and sends emails with technology tips.

Find mentor teachers to help other teachers.
Administrators should keep their eyes out for teachers who have either expertise with a tool or the kind of open, try-anything attitude that will make them good learners of a technology, then use them to demonstrate and be a resource for others.

Share ideas.
Provide regular planning time for teachers to work together to share ideas for how to incorporate technology. This also works on an interdisciplinary level, too. Teachers in one subject area may find teachers in another area using a tool or technology that can be adapted to their own.

REVOLUTIONIZING RESEARCH

Supercomputers take research to new levels

Blue Waters — at the University of Illinois at Urbana-Champaign — is one of the world's most powerful supercomputers.

While computers used by the general public have grown faster and more powerful, the computers used by the nation's research universities and other major research institutions have grown exponentially so. These computers, rightly dubbed supercomputers, have speeds measured in "petaflops" (a thousand trillion floating point operations per second) and are so big (often as clusters of computers connected together) that they require their own, specially cooled buildings.

Research done by supercomputers can take months, even at those fast speeds, but is effecting some of the greatest problems facing the world today — climate change, disease, natural disasters and much more. What scientists can find from studying these problems can lead to innovations and new products; they are rightly considered to be engines of economic growth, and provide nations that have them competitive advantage in the global marketplace.

One big challenge, however, is finding enough people educated in STEM fields to be able to work with these computers or even to realize what type of research can be conducted by supercomputers in order to best take advantage of them. To that end, the National Science Foundation has been underwriting a number of projects aimed at increasing STEM knowledge as well as awareness of how to use supercomputers.

Mining Blue Waters for Supercomputing Gold

One of the most powerful supercomputers in the world is now online in a specially built home at the University of Illinois at Urbana-Champaign. Blue Waters — named for the large amount of water continuously flowing through pipes to keep its 300,000 chips cool — will have "computing power equal to about one million PCs," says Thom Dunning, director of the National Center for Supercomputing Applications (NCSA), also located at the University of Illinois.

"It will be the largest, most powerful supercomputing system that the National Science Foundation has ever deployed," says Dunning.

Research that would take years using ordinary computers can be done in hours or days on supercomputers. For example, Illinois Physics Professor Klaus Schulten plans to create a detailed, high-resolution simulation of the inner workings of a cell organelle — a project that he says would take years on older supercomputers, but only about two months on Blue Waters.[47]

Blue Waters has been booked already for research projects by more than 30 teams of scientists, says Dunning, as part of a multi-year, competitive review process overseen by the National Science Foundation (chief funder of Blue Waters). Among the projects Blue Waters will tackle, once it goes online:

- an atomic-level view of the process by which a virus, such as the polio virus, gets inside a cell;
- the modeling of severe storms in order to understand what kinds of conditions lead to tornadoes and hurricanes;
- an examination of the birth of the universe itself;
- earthquake modeling, with a focus on the southern San Andreas Fault near Los Angeles so that researchers, teamed with civil engineers, can figure out what will happen to buildings in the LA basin when the expected earthquake occurs; and
- a close look at the way infectious diseases spread as part of an effort to come up with the most effective strategies to mitigate their impact.

"One of the really exciting things about supercomputing is the range of science that is impacted," says Dunning. "The traditional use of supercomputing has been to simulate poorly understood physical, chemical and biological phenomena. But we are now finding that as our ability to handle large quantities of data has increased, there are other communities outside of the traditional engineering and science community that are taking a look at how they can more effectively use supercomputers."[48]

UNIVERSITY OF ILLINOIS BOARD OF TRUSTEES/NCSA

"Blue Waters will have computing power equal to about one million PCs. It will be the largest, most powerful supercomputing system the National Science Foundation has ever deployed."

— Thom Dunning, Director of the National Center for Supercomputing Applications (NCSA)

For example, a library and information science professor is looking at using supercomputers to analyze music composition, and humanists are comparing novels to determine whether the purported author is actually the author.

Research at NCSA and other supercomputer centers goes on around the clock, 365 days a year. "These are expensive resources; we are expected to help the community get as much out of them as possible," says John Towns, head of the Extreme Science and Engineering Discovery Environment Project (XSEDE), which is the National Science Foundation's cyberinfrastructure arm.

About 16 supercomputers are part of the XSEDE network, with time allocated by a peer review board that examines researchers' competing applications. Sometimes research time is segmented, with parts split among various supercomputers in the network, depending on accessibility and which computer is best suited for which task.

> "Supercomputing research is like driving a race car — and getting your license at the DMV is not good enough to be able to drive one."
>
> — John Towns, Head of the Extreme Science and Engineering Discovery Environment Project (XSEDE)

Other supercomputers, such as Blue Waters and a new supercomputer at the NCAR-Wyoming Supercomputer Center, fall under the purview of the National Science Foundation, which also allocates research time among competing applicants. The Department of Energy, as well as other government agencies, also support university-based supercomputer users.

Despite the number of supercomputers in the U.S., there are far fewer than are needed. "We are way short," says Towns. "We routinely see initial requests come in at three to four times what is available. After the peer review panel is done and has made its recommendation as to what should be allocated based on merit, it's typically at a factor of two to three times what's available."

Requests for Blue Waters' time exceed what's available by about a five to one ratio, adds Dunning. More money is needed to fund more supercomputers, say Dunning and Towns. Also needed: better coordination of the nation's use of supercomputers.

"The investments the federal government is making across agencies are uncoordinated," says Towns. "We simply don't have a clear national agenda and plan that would allow us to coordinate the programs supported by funding." Replication of efforts in some areas is also a concern.[49]

Educational Outreach Efforts

There is also a shortage of scientists who can run research on supercomputers, says Dunning. Education is a big issue: not only to attract students to careers in the field, but also to show researchers, especially those outside the engineering and science community, what they can do with supercomputers.

The Blue Waters Project and XSEDE are involved in a number of educational and outreach efforts to try to help remedy this, with about $3 million allocated to the cause.

Supercomputing research, says Towns, "is like driving a race car — and getting your license at the DMV is not good enough to be able to drive one."

Among approaches Blue Waters, XSEDE and others are trying in an effort to create more supercomputer "race car drivers": workshops, webinars, webcasts and online courses; year-long internships; in-person training; embedded training with partners; the production of a newsletter and use of social media to spread information; and the creation of a vetted materials repository. XSEDE will also begin offering certifications in 2013 for users and trainers.

Another related effort sponsored by the National Science Foundation and run by NCSA and the University of Illinois is the Institute for Chemistry Literacy Through Computational Science (ICLCS). The six-year-old project is focused on teaching high school chemistry teachers to better understand their subject and also learn new, innovative ways of teaching chemistry to their students.

With the ICLCS project, 124 science teachers at 119 mostly rural schools (often with only one science teacher in the entire school) attend intensive, two-week-long summer workshops for three summers, where they learn how to use computational modeling and visualization programs to make chemistry more engaging and real for their students.

The teachers use free programs such as WebMO and ChemSketch to create objects and simulations — a water molecule, for example, that students can view in 3D, twisting and turning it, rather than relying on a flat image in a textbook. The NCSA has used its computing engines to put the computational simulation program in the cloud, so teachers can continue to use it more easily after they are back at their schools.

Once in the classroom again, the chemistry teachers continue to connect with their University of Illinois instructors using a professional learning environment where they can ask questions or seek help with teaching problems. They can also connect with each other as part of a professional learning network.

Research has shown that the program has been successful at increasing the knowledge of chemistry teachers and students, has led to an increase in the number of AP courses offered at their schools and has increased student enthusiasm for the subject. NCSA hopes to take a similar approach to other STEM topics and to broaden the program beyond the state of Illinois.

One reason to educate more students in supercomputing-level science is to remain at the leading edge of scientific research — so that the U.S. doesn't fall behind other nations. While the U.S. still has half of the fastest 500 supercomputers in the world, other nations' supercomputing programs are better funded, more aggressive and better coordinated, says Dunning.

"Europe, China, India, Australia — all are laying out an agenda for developing supercomputing in their countries," he says. "What Europe and China are planning on doing is significantly more aggressive and better coordinated than what we are doing in the U.S."[50] ■

UNIVERSITY OF ILLINOIS BOARD OF TRUSTEES/NCSA

The NCSA's National Petascale Computing Facility.

Amplification technology can be used for hearing-impaired students to improve students' listening success.

FRONTROW CALYPSO LLC

Serving Students with Special Needs

Assistive technology brings students with special needs up to speed

Young people with special needs have a much higher rate of unemployment than others. A Government Accounting Office report found that as of February 2012, the employment rate for adults aged 20 to 24 with disabilities was half that of those without disabilities. If students with special needs can be better prepared to transition from school to the workforce, these numbers can no doubt be improved. In 2011, about 6.6 million students in the U.S. were identified as disabled, with the federal government awarding about $11.5 billion in grants to states to help such students.[51]

Disabilities can include physical deficiencies in sight and hearing, motor impairments, learning disorders and emotional conditions. A variety of technological aids, called assistive technologies, can help teachers mediate the effects of these disabilities (see sidebar "Examples of Assistive Technology Tools").

Animated, game-like programs — like these screenshots from The Social Express — help students with special needs learn social and emotional coping skills.

THE SOCIAL EXPRESS

"Assistive technology, or AT, is more important than ever in successful transitions to employment or higher education," says Marty Exline, former board chair of the Association of Assistive Technology Act Programs (ATAP). "The real key and challenge is to get the appropriate AT to a student as early as possible in the transition process."

Susy Woods, public policy and education liaison for the Illinois Assistive Technology Program, points to several challenges students and school systems face in using AT:

Funding. This is always a concern. Some states have device loan programs and K-12 schools must provide devices if it is written into a student's individual education plan, or IEP. If schools provide a device, after a student graduates, the equipment remains with the school. Colleges generally don't provide AT, viewing it as a personal service. "It is often necessary to become creative when looking for funding for AT and to know what options are available," says Woods.

Lack of knowledge. "Many times schools will back away from using AT because they don't know how to use it," says Woods.

Viewing it as an unfair advantage. Some teachers and professors don't understand why students need a particular type of AT, so educating the educators can be necessary.[52]

Despite the challenges, AT is extremely important for students to have, and new technologies are especially promising. For instance, tablets can be good tools for both academic and social needs.

Another example of the way in which technology can help in the educating of students with special needs is in the field of online speech therapy, made possible by improvements in the affordability and quality of videoconferencing technology.

Woody Gap School in Georgia is located in a remote, isolated area at the end of twisty mountain roads. If any of the K-12 school's approximately 70 students need services, it can take a speech therapist a full day to provide services and also make the drive there and back. With speech therapists in short supply already, Kristy Chapman, special education director of the Union County Board of Education in Georgia, decided to try another option — online speech therapy.

Now, students at Woody Gap, as well as others in the 2,600-student district, work with certified speech language pathologists using computers equipped with video cameras and headsets. Parents or other school personnel can log in to the session in real time or sessions can be recorded. The online speech therapist also attends a student's IEP meeting or other conferences virtually, if needed.

"I've had no complaints from parents and students," says Chapman. "Students have liked the one-to-one attention and the interaction they get."

Some students are doing so well that they are being dismissed from therapy, she says. Others are being paired with another student for sessions.

Online speech therapy won't work for all students, says Chapman; those with other disabilities or more severe conditions aren't necessarily good candidates. But for those with mild to moderate speech disabilities, it has helped greatly — serving as an additional resource to the three speech therapists her department already employs (about 10 students out of 100 are online). In-person speech therapists will always come first and be preferred, says Chapman, but online speech therapy can help as an adjunctive service.

"It was a little difficult for our speech therapists to accept at first," says Chapman. "I believe their fear was they were going to be outsourced.

But I see online speech therapy as supplemental and complementary to what we are already doing, and now they are on board."[53]

Online speech therapy is one type of assistive technology, but many others exist.

Game-like interactive tools. For example, children on the autism spectrum can learn social and emotional coping skills with interactive software tools. These animated, game-like programs depict situations a child might encounter and identifiable characters model appropriate ways to react. By learning how to identify emotions and coping strategies (such as taking deep breaths or using positive rather than negative phrases), children can calm themselves and thus better focus on lessons in class.

Another type of game uses biofeedback to help students learn to control emotions. Dojo is a martial arts-themed, challenge-filled game in which students are hooked to heart rate and other sensors. They can only rise to the next level if they stay calm.

> "Assistive technology, or AT, is more important than ever in successful transitions to employment or higher education. The real key and challenge is to get the appropriate AT to a student as early as possible in the transition process."
>
> — Marty Exline, Former Board Chair of the Association of Assistive Technology Act Programs (ATAP)

These types of games and tools can also be used by children with attention deficit hyperactivity disorder (ADHD), learning disabilities, anxiety disorders and other conditions, or even by children in the general population with social learning challenges.

Social networks. Students can take advantage of specialty social networks such as one geared for those with social learning needs; learning to connect with other children with similar interests can be especially helpful for students with special needs.

Digital individual education plan (IEPs). Web-based tools can be used to produce digital IEPs, written for special needs students and typically shared among a range of educational and support personnel as well as a child's parents. By making these accessible through a school's student information system, teachers and others can more easily access them during a school day. A teacher could quickly see what type of special assistance a student might need for a test or assignment. (Non-digital IEPs might be housed in a central office file cabinet, where a teacher would have to take time to search for.)

Another plus: Digital IEPs allow multiple users to make additions simultaneously in Web-based collaborative docs.

The digital format also allows for data-mining, letting school systems quickly figure how many hours students spend with therapists, which can be useful information for budgeting and planning. ■

EXAMPLES OF ASSISTIVE TECHNOLOGY TOOLS

FRONTROW CALYPSO LLC

Here are some AT tools you might find in tech-equipped schools and colleges today.

Audiovisual enhancements: sonar vision glasses, special headphones, Bluetooth microphones, screen magnification tools

Speech-to-text and text-to-speech tools: screen readers and assisted communication tablets

Braille instructional tablets and software: devices that translate into Braille; portable scanners that can convert text into Braille for use with Braille displays

Smart pens that record audio while a student takes notes; the student can then later click to a place in a lecture where he or she wasn't able to take notes fully

Eye-movement tracking devices that type words or pictures that a student focuses on

Apps that allow students to communicate through pictures such as symbol-supported word processors

Switches: alternatives to mice and keyboards for students with dexterity problems

Big-keys keyboards: enlarged keyboards for those with vision and motor difficulties

Dial-in interpreter services for the deaf that provide translation via mobile devices — texting the words a speaker is saying or "signing" before a camera so that a student can view via smartphone

Resources
Dell Assistive Technology Solution Configuration Tool: www.evas.com/eduplan/configurator.php

Specialty Technology Checklist

What you need to know before you buy

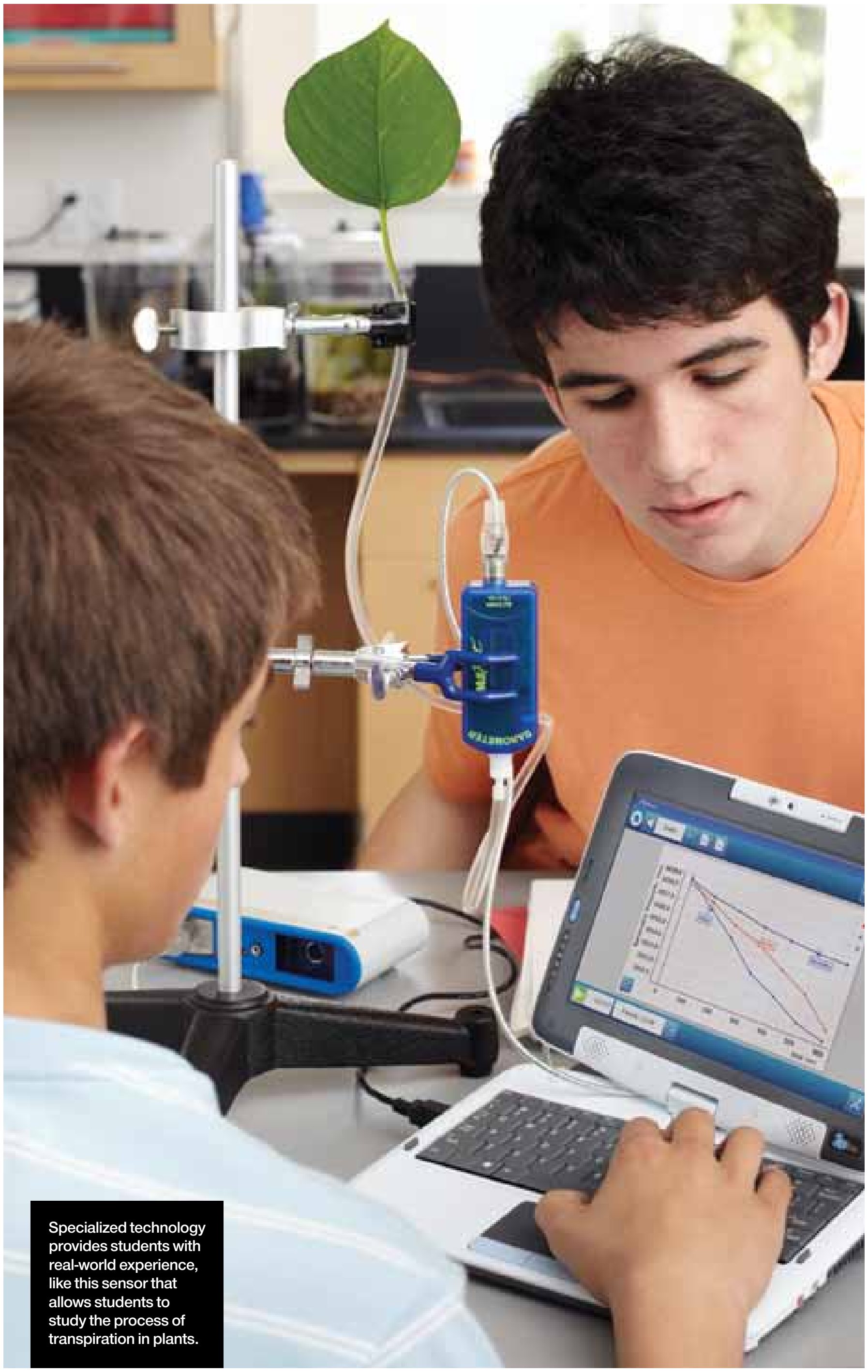
FRESH MEDIA

- ✓ Can your infrastructure support your new technologies? Do you have a strong, robust wireless signal that can handle large numbers of mobile devices simultaneously, especially during high-stakes testing or video streaming?
- ✓ Have you considered shifting to the new wireless 802.11ac standard, which promises a wider range and more speed and power? If so, are you prepared to invest in new wireless access points and routers to support it?
- ✓ Will the new technology present any security considerations?
- ✓ Do you have adequate tech support for faculty, staff and students who may need 24/7 support? Have you investigated remote management solutions?
- ✓ How will it be used? Is it teacher-friendly? Courtney Hart, innovator at Lewisville Independent School District in Texas, says administrators need to test out tools before giving them to teachers and need to make sure teachers aren't overwhelmed: "You can't say here are 35,000 resources — you need to pick 35. Pick the best and then be ready for suggestions from other teachers," says Hart.
- ✓ What is your teacher training strategy? Some educators suggest finding tech-savvy teachers to help mentor not-so-savvy teachers.
- ✓ Will this technology require teachers with special expertise, training or certification?
- ✓ Is this something that works for kids? Sometimes things seem great to adults but confuse or bore children.
- ✓ Can the technology be piloted first? Will the vendor provide a sufficient trial period to evaluate it or can a longer one be negotiated?
- ✓ What do other educational institutions that have used it say about it?
- ✓ Are there competitors in the field that can do the same thing — only better or less expensively?
- ✓ What is its shelf life? How soon will it be outmoded? What are the major trends in the field?
- ✓ What are the ancillary costs? For example, 3D printers might not cost so much upfront, but paying for material restocking can add up fast.
- ✓ Is this something students will use at home? Does it require online access? How will that be provided?
- ✓ Will it need to be filtered? Who handles that?
- ✓ How will you assess its effectiveness?
- ✓ How will it help students? What skills or knowledge will it impart?

How does the new technology fit into the curriculum? Is it teacher-friendly?

Conclusion

What is cool has now become critical



Specialized technology provides students with real-world experience, like this sensor that allows students to study the process of transpiration in plants.

PASCO

The critical need our nation faces to train students for jobs in STEM and other specialized fields is forcing us to rethink how we educate our students, and spurring coalitions among business, communities, higher education and K-12. STEMx, for instance, is a new national network that helps forge relationships among educators, business and industry in order to find new solutions to the STEM teacher shortage and to help encourage more students to consider STEM careers.[54]

Technology presents a way to bridge the gap between a teacher shortage and the need for students who are better educated — and more engaged — in math, science, technology, the arts and other specialized fields.

In this effort to retrain our nation's workforce and bolster our economy in the global marketplace, technology presents a way to bridge the gap between a teacher shortage and the need for students who are better educated — and more engaged — in math, science, technology, the arts and other specialized fields.

As we've shown in this Special Report, a whole new class of specialty technology exists that is already being used to revolutionize learning for students. It also offers the promise of readying today's students for the 21st-century workplace. ■

Samsung Chromebooks Make 1:1 Computing a Reality

THE SAMSUNG CHROMEBOOK expands 1:1 computing opportunities for every school district. The many advantages for $249 (plus tax):

- less than 2.5 pounds
- easy to use and to carry
- boots up in less than 10 seconds
- battery lasts up to 7 hours[1]
- files can be safely stored and backed up in the cloud
- full-size, Web-focused keyboard and large, multi-touch clickpad
- built-in security, including virus protection
- automatic updates of software and OS
- more than enough power (16GB SSD[2], 2GB RAM[3])

One computer per student — many educators think that is the future of education. We say the future has arrived, with the new Samsung Chromebook (XE303C12-A01US). This powerful, lightweight laptop costs just $249 (plus tax) — giving every school district the opportunity for 1:1 computing.

Tight budgets and small IT support staffs can hamper a school district's efforts to offer 1:1 computing for students. But the Samsung Chromebook makes $249 (plus tax) go a long way. It's fast, powerful, light and easy to maintain. It gives students new learning opportunities at a very low cost for purchase, maintenance and support.

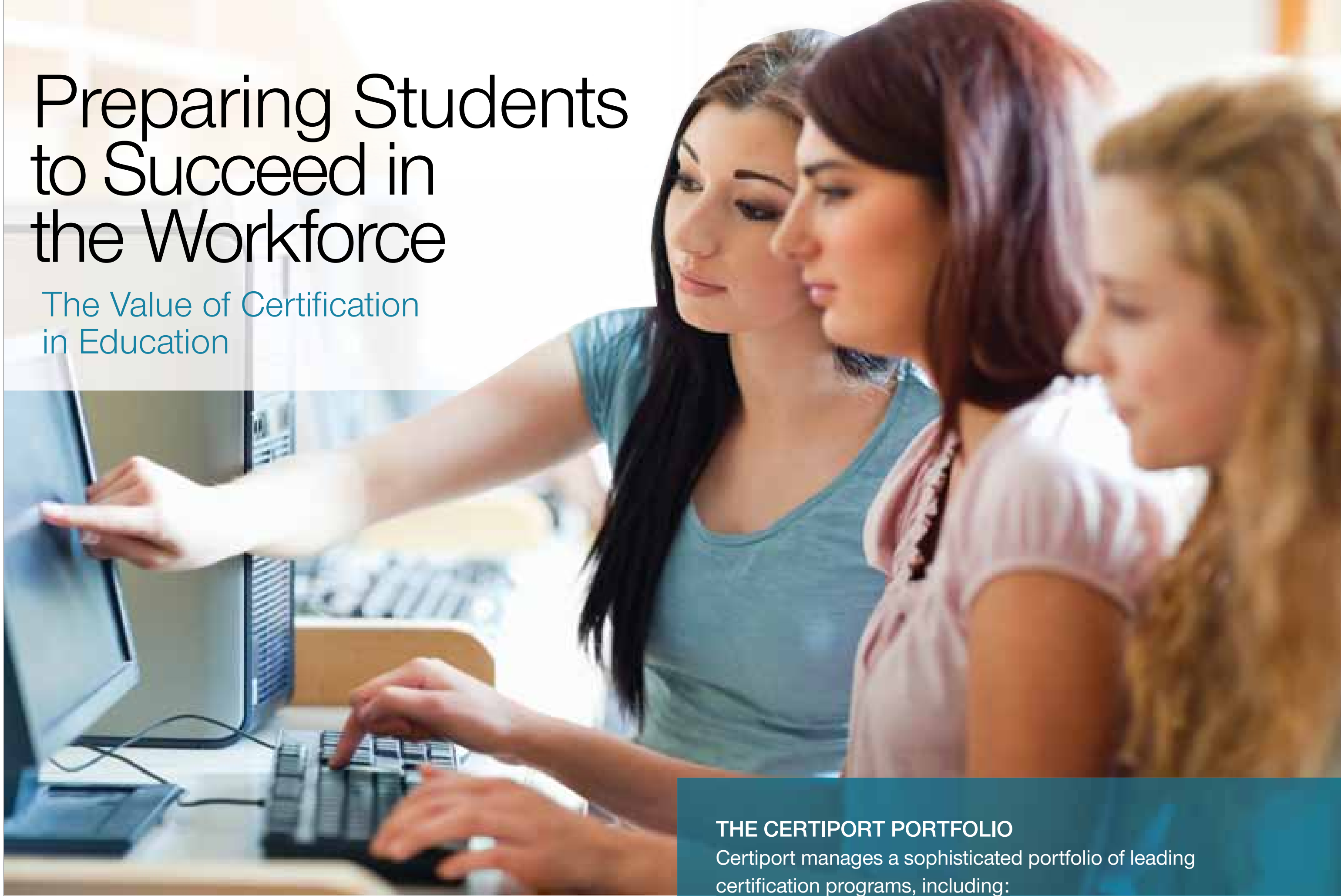
For $30 per device, Google provides schools the ability to manage users, apps and policies remotely across an entire fleet of devices. The Web-based management console provides easy control, and Google includes 24/7 support and a limited warranty. And the machines take care of themselves with automatic updates.

Built on the Google Chrome OS, the Chromebook gives students a wealth of online learning apps and tools. Affordable, fast and powerful, the Samsung Chromebook is an unprecedented opportunity for 1:1 computing.

1 Battery life will vary depending on the product model, configuration, power management settings, applications used and wireless settings. The maximum capacity of the battery will decrease with time and use. Test results based on independent Google Scenario tests. See samsung.com for further details.
2 Accessible capacity varies; GB = 1 billion bytes. Please note that a portion of the hard drive is reserved for system recovery, operating system and preloaded content software. Battery life may vary based on usage or other conditions.
3 Total amount of available memory may be less based on configuration.

Preparing Students to Succeed in the Workforce

The Value of Certification in Education



THE CERTIPORT PORTFOLIO

Certiport manages a sophisticated portfolio of leading certification programs, including:

- Microsoft Office Specialist
- Microsoft Technology Associate
- Adobe® Certified Associate
- HP Accredited Technical Associate
- CompTIA Strata™ IT Fundamentals
- Autodesk Certified User
- Intuit QuickBooks Certified User
- Internet and Computing Core Certification (IC3®)

Closing the Skills Gap

Knowing how to email and type doesn't cut it anymore in today's high-tech, competitive workspace. Employers now expect students to be able to effectively use advanced and specialized technologies when they graduate. Despite the high unemployment rate, it is proving difficult to find qualified candidates — leaving many jobs unfilled. To ensure students are prepared for careers in the global economy, educators must help to close the gap between the skills learned in school and those required in the workplace.

A Head Start with Certification

Certifying students in specialized programs prepares them with the digital skills necessary for a technology-driven future. Certification goes beyond teaching students how to type and provides essential workforce technical skills such as how a computer works and key applications from Microsoft, Adobe and other technology leaders. Students graduate with a validation of their real-world skills and resume-building credentials — giving them a head start in a competitive job market.

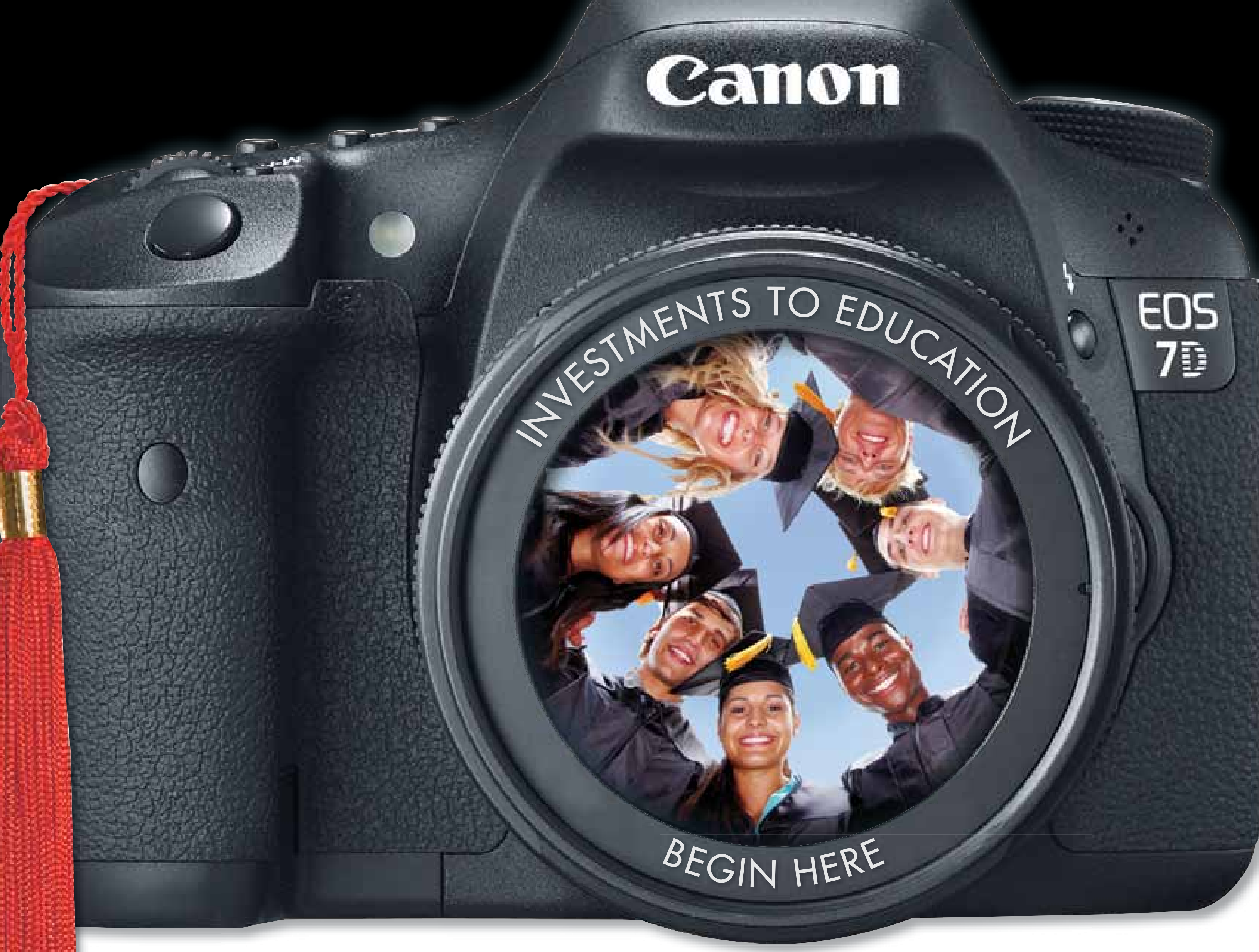
When Florida schools implemented technology-based certifications in accordance with the Career and Professional Education Act, they found that students with certifications graduate at a significantly higher rate (23%) than their peers outside of the career academies, have a higher GPA (17%) and typically enroll in college-level courses (61%).

Certifying with Certiport

Certiport currently delivers nearly two million certification exams each year in 158 countries and 27 languages. Certiport exams are performance-based and involve cutting-edge simulation development or live-application testing. The format tests students' abilities to use technology to their benefit, not their ability to memorize the answers to multiple-choice questions. With the help of Certiport, students can prove skills attainment and mastery and be better prepared for a career in today's digital economy.

CERTIPORT®

For more information, please visit **http://www.certiport.com**


Canon
EOS
7D
INVESTMENTS TO EDUCATION
BEGIN HERE

Sponsors:

At Samsung we create groundbreaking solutions that empower educators and students to embrace tomorrow's opportunities today. Our innovative offerings add value to any curriculum by giving instructors the tools they need to engage students, inspire imaginations, elevate learning and bring lesson plans to life. For more information ▸ 1-866-SAM4BIZ | www.samsung.com/education

Certiport, a Pearson VUE business, is the world leader in performance-based certification exams and practice test solutions for academic institutions, workforce and corporate technology markets, delivered through an expansive network of over 12,000 Certiport Authorized Testing Centers worldwide. For more information, please visit www.certiport.com.

"Certification programs help educators effectively teach and validate skills learned in the classroom while providing students with credentials that demonstrate real-world prowess to prospective employers. The value of certification is not just in a piece of paper, it is in the way it changes lives and opens doors for students."
– Ray Kelly, CEO, Certiport

From academics to administration, the Canon Education Sales Department is a one-stop solution for all of your imaging needs, with devices that range from Digital SLR cameras for photojournalism to HD camcorders that record events and movie productions. Additionally, Canon's multifunction printers can print, copy, scan and fax a variety of different media such as documents, books, photos or negatives. Network (IP) video cameras, for security and distance learning, and multimedia projectors are also available. For more information, please visit www.usa.canon.com/educationsales, email us at canonsales@sedintl.com, or call 800-344-9862.

Acknowledgements:

JOHN HALPIN is Vice President of Education Strategic Programs for the Center for Digital Education. As a veteran K-12 teacher, college professor and IT consultant, Halpin has been active in promoting the use of technology in education for over 25 years. He has led sales and marketing efforts for some of the largest technology companies and has written for various media outlets. In addition, Halpin is a frequent speaker on public sector technology issues for national professional associations, various state leadership councils and technology companies.

LORNA COLLIER has written about education and technology for the Chicago Tribune, THE Journal, Learning Solutions, the National Council of Teachers of English Chronicle, MSN Encarta, ATT.net, and many others. She is the former online editor for GetEducated.com, a website focused on distance learning.

THE CENTER FOR DIGITAL EDUCATION is a national research and advisory institute specializing in K-12 and higher education technology trends, policy and funding. Along with its research services, CDE issues white papers and conducts the annual Digital School Districts and Digital Community Colleges surveys and award programs as well as hosting events across the K-12 and higher education arena. CDE also supports the Converge media platform comprised of the quarterly themed Converge Special Reports, Converge Online, and custom publishing services.

1. www.bls.gov/jlt/
2. http://media.act.org/documents/CCCR12-NationalReadinessRpt.pdf
3. www.nytimes.com/2011/11/06/education/edlife/why-science-majors-change-their-mind-its-just-so-darn-hard.html?pagewanted=all
4. www.bls.gov/news.release/ecopro.nr0.htm
5. www.esa.doc.gov/sites/default/files/reports/documents/stemfinalyjuly14_1.pdf
6. www.zdnet.com/blog/igeneration/stem-careers-how-long-can-you-survive/15359
7. CDE interview with Babette Allina, Nov. 8, 2012
8. http://expspace.risd.edu/?about=nsf-epscor-at-risd
9. www.smartplanet.com/blog/pure-genius/q-a-john-maeda-president-rhode-island-school-of-design/7498
10. www.risd.edu/About/News/STEAM_Club_Mixes_Art_Science/?dept=4294968230
11. CDE email interview with Jenny Montgomery, Nov. 8, 2012
12. www.youtube.com/watch?v=hXCEOgghc-g
13. http://lancasteronline.com/article/local/307290_McCaskey-goes-high-tech-with-new-music-lab.html?page=all
14. http://docs.polycom.com/global/documents/whitepapers/music_performance_and_instruction_over_highspeed_networks.pdf
15. www.wacom.com/en/in-use/casestudies/donbosco.aspx
16. www.wacom.com/en/interests/featured-artists/sheldon-high-school
17. www.cadgis.lsu.edu/
18. www.insidehighered.com/blogs/hack-higher-education/virtualizing-science-lab-late-nite-labs
19. www.pwscc.edu/academics/creative-learning-in-a-virtual-wet-lab/
20. www.csus.edu/giving/Home-for-Nursing.htm
21. CDE interview with Jeff Taekman, Oct. 28. 2012
22. www.eschoolnews.com/2012/04/26/students-create-their-own-3d-content/2/
23. www.vrep.org/about/overview.php
24. www.eschoolnews.com/2012/09/27/embodied-learning-blends-lessons-with-student-computer-interaction
25. CDE interview with Denise Spence, Oct. 11, 2012
26. CDE email interview with Moses Ojeda, Oct. 23, 2012
27. http://blogs.edweek.org/edweek/rural_education/2012/07/rural_stem_initiative_sees_good_results_in_pilot_year.html?cmp=ENL-EU-NEWS2
28. www2.sdhc.k12.fl.us/boardagenda2010/Shared/CoverPrint.asp?AICS_ID=12819
29. www.pasco.com/about/why-pasco/21st-century-science-learning.cfm
30. www.themanufacturinginstitute.org/~/media/A07730B2A798437D98501E798C2E13AA.ashx
31. www.rrstar.com/news/x1217098401/RVC-shares-15M-grant-to-boost-manufacturing-training?img=3
32. CDE interview with Jessica Swanson, Sept. 20, 2012
33. www.dimensionprinting.com/successstories/successstoryview.aspx?view=73&title=High+School+Students+Use+3D+Printing+To+Design
34. http://news.ucsc.edu/2012/10/virtual-anthropology.html
35. CDE interview with Andrew Phelps, Oct. 17, 2012
36. CDE interview with Clark Aldrich, Oct. 15, 2012
37. www.prweb.com/releases/2012/3/prweb9293984.htm
38. q2l.org
39. http://insideschools.org/middle/browse/school/1622
40. www.dane101.com/current/2012/07/02/gamification_super_mario_and_stem_notes_from_the_gameslearningsociety_conference
41. http://events.mediasite.com/Mediasite/Play/dbebeb451f3a4332ab0f92a77189832a1d?catalog=4fc740c3-f691-4b2d-824f-6d7df99fee1e
42. http://blogs.edweek.org/edweek/global_learning/2012/03/gaming_leveling_up_global_competence.html?cmp=ENL-EU-VIEWS2
43. http://thejournal.com/articles/2012/10/04/wowing-language-arts.aspx?=THEEL
44. www.gamedesk.org/projects/motion-math-in-class/
45. All quotes from Courtney Hart from CDE interview conducted on Sept. 17, 2012
46. www.oercommons.org/browse/tag/STEAM
47. http://chronicle.com/article/In-University-Supercomputing/126979/
48. CDE Interview with Thom Dunning, Oct. 19, 2012
49. CDE interview with John Towns, Oct. 19, 2012
50. CDE interview with Thom Dunning, Oct. 19, 2012
51. www.gao.gov/assets/600/592329.pdf
52. CDE email interview with Susy Woods, Nov. 8, 2012
53. CDE interview with Kristy Chapman, Oct. 18, 2012
54. www.usnews.com/news/articles/2012/09/21/the-state-of-stem-and-jobs?page=3

Don’t miss any of the *Converge* Special Reports

Coming in 2013:

Smart Infrastructure for the Future of Education

Big Data in Education

Personalized Learning

Mobility and Cloud

Download past reports at:
www.centerdigitaled.com/reports/