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Our World Is Changing. Are We Ready?

By
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This past year, global competition, especially from China and India, has been in the news a lot, causing many Americans to worry that we are in danger of losing the tremendous lead, and earning power, we have had over other countries for the past 50 years. To see the future of a country, or a state for that matter, it's a good idea to begin by taking a look at what is happening in the schools. After all, the future workforce is already there for us to see.

To Look Ahead, Start by Looking Back

In 1999, only 41 percent of U.S. eighth-graders had a math teacher who had majored in mathematics at the undergraduate level or even studied the subject for teacher certification. Since our subject is global competition, it is important to know that at the same point in history, the international average of qualified math teachers was 71 percent. Let's face it, it's hard to share a passion for a subject you are not trained or qualified to teach. Admittedly, this is only one factor that might affect student learning, so I decided to take a look at the latest statistics to see if this factor might "logically" have an impact on student learning. In recent tests of general knowledge in mathematics and science, U.S. 12th graders performed well below the international average for 21 countries. In addition, an advanced mathematics assessment was conducted in 15 countries of students who were taking, or had taken advanced mathematics courses. The same assessment was conducted of U.S. students who were taking, or had taken pre-calculus, calculus, or advanced placement calculus. Eleven of the 15 countries outperformed the U.S., and four scored similarly. It should be noted that none scored significantly lower than the U.S. In other words, we were at the bottom of the barrel with a few others. Last year, more than 600,000 engineers graduated from institutions of higher education in China. In India, the figure was 350,000. In America, the figure was 70,000.

There are several reasons this should be of concern, but to me one of the biggest is the fact that for the cost of one chemist or one engineer in the U.S., a company can hire about five chemists in China, or 11 engineers in India. You don't need an advanced degree in mathematics to know what that means. At this point, I know what you are thinking. The U.S. still has the best schools for higher education – our graduating chemists and engineers are better. In response, I would like you to consider a couple of things: 1) many of the functions businesses need chemists or engineers to do, can be done by average engineers and chemists, and 2) the rest of the world is rapidly upgrading their universities to close the quality gap of education standards with the U.S. While we are on the subject of chemists, last year 70 chemical companies in the U.S. closed their doors for the last time and 40 more are scheduled for closure in the near future. It might sound like the need for chemical plants is on the way out, yet there are 120 new chemical plants being built around the world with a price tag of 1 billion or more. Fifty of those plants are being built in China and one is being built in the U.S. One last statistic I think you

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might find interesting. In 2001, U.S industry spent more on tort litigation than on research and development. Is the U.S. ready for global competition in the near future? After this brief look, it doesn't look good. However, Americans have a long history of doing amazing, and even seemingly impossible things when we accept the new facts and focus our collective minds and efforts on taking action. There is an old saying: If you're not part of the solution, you're part of the problem.

TECHNOLOGY NEWS HIGHLIGHTS

ANYWHERE, ANYTIME ACCESS TO YOUR HOME TELEVISION PROGRAMS

A new service gives you access to the television programs you watch in your homes – be it cable, satellite, or DVR programming – while using your PDA, smart phone, or laptop from anywhere that you have access to a broadband connection. The new service, called Slingbox™, connects to your home network and a broadband Internet connection to "placeshift" live streaming TV so you can watch your favorite shows or your hometown local news even if you're halfway around the world. SlingPlayer™ software installs on the receiving device to provide remote control of all source system functions including television channel selection, recording, and playback.

For information: Sling Media, Inc., 901 Mariners Island Blvd., Suite 300, San Mateo, CA 94404; phone: 650-293-8000; fax: 650-378-4422; Web site: www.slingmedia.com

IMPLANTING NANOROBOTS

Implantable nanorobots may someday be used to monitor and record a person's vital signs, according to Robert Freitas, Jr. in his book, *Nanomedicine, Volume 1*. His book describes just how these miniature monitors would operate. Mobile and stationary nanosensor robots located throughout the body would be connected to nanodisplays. The tiny nanodisplays would be embedded just underneath the skin and would be powered by glucose from the patient's blood. These sensors would be used to measure a variety of physiological parameters including heart activity, blood chemistry, temperature, etc. When switched on, the displays emit photons, creating a display screen that is visible through the skin. The microscopic medical devices and under-skin displays would allow patients, as well as emergency medical teams, to check their own condition on demand.

For information: Robert A. Freitas, Jr., Institute for Molecular Manufacturing, Box 605, Pilot Hill, CA 95664; email: rfreitas@rfreitas.com; Web site: www.rfreitas.com

INCREASING THE SPEED OF WI-FI

Today's single-antenna WiFi routers are capable of up to 54 MB per second, but a new technology will offer up to ten times the speed and up to three times the range of current networks. The new MIMO (multiple input-multiple output) device uses several antennas that simultaneously transmit streams of data. It's part of the 802.11n WiFi standard due to be finalized in 2007, and companies are already applying it to existing networks to increase speed by up to 600 percent.

For information: Airgo Networks, Inc., 900 Arastradero Road, Palo Alto, CA 94304; phone: 650-475-1900; fax: 650-475-1708; Web site: www.airgonetworks.com

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HYDROGEN GENERATOR FOR GAS POWERED CARS

An after-market add-on for SUV's and other gas-guzzling vehicles could reduce fuel consumption by up to 40 percent and lower emissions by 50 percent. Called the H2N-Gen, the device boosts efficiency by pumping hydrogen into the intake manifold. Because it's more flammable than gasoline, it ignites the fuel more readily. The hydrogen is produced by passing current from the car's battery through a solution of potassium hydroxide. Because the gas is produced at low pressures, the risk of explosion is virtually nil. As a safeguard, however, the device is encased in a plastic bladder capable of withstanding up to 6,000 pounds of pressure. The devices are due to be released in March of next year.

For information: Joe William, CEO, Innovative Hydrogen Solutions, Inc., Unit #190, 117 King Edward St. East, Winnipeg, Manitoba R3H 0Y3 Canada, e-mail: info@ihsresearch.com; Web site: http://ihsresearch.com

SMOOTH SAILING

The Anti-Rolling Gyro (ARG) keeps boats upright, even in heavy seas. But unlike other stabilizer technologies, which only work when water is moving over them, the ARG will keep the boat from rocking while you're anchored as well. A flywheel is mounted in the center of the boat and is controlled by a motor to keep the craft from rotating when traveling up and down the waves.

For information: The Ferretti Group, Via Ansaldo, 5/7, Forli, Italy; Web site: www.ferrettigroup.com

GOING PERPENDICULAR

As we approach the storage limits of traditional magnetic recording devices, the next direction for hard drives is going to be – perpendicular. Current drives store data by aligning magnetic bits horizontally, or end-to-end. However, as the magnetic bits become smaller and smaller (to increase memory capacity) they begin to interfere with one another, corrupting data and rendering the devices unreliable. Perpendicular recording arranges bits vertically, or on-end, to fit more storage into the same space. Using this technique, manufacturers have been able to achieve densities of up to 230 gigabits per square inch. Within a few years, you can expect the majority of hard drive manufacturers to transition to perpendicular technology.

For information: Toshiba Corp., 1251 Avenue of the Americas, Suite 4110, New York, NY 10020; Web site: www.toshiba.com Hitachi Global Storage Technologies, 5600 Cattle Rd., San Jose, CA 95193; Web site: www.hitachigst.com

MIND-CONTROLLED PROSTHESIS

Mind and machine have finally merged to create a prosthetic limb that can be controlled by thought. The Neuro-Controlled Bionic Arm intercepts residual nerve impulses in an amputee's limb. It then relays the impluses to a computer in the forearm, which controls six motors that coordinate hand, elbow and shoulder movements. Sensors in the hand also allow the wearer to gauge pressure. A commercial version of the bionic arm is scheduled to be ready by 2008.

For information: Jesse Sullivan, Rehabilitation Institute of Chicago, 345 E. Superior St., Chicago, IL 60611; phone: 312-238-1000; Web site: www.ric.org

PREDICTING HURRICANES

Researchers in Britain have developed a new model for predicting hurricane strikes that may improve forecast accuracy from the current 40 percent level to 65 or 70 percent. Unlike the techniques widely used today that rely

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on historical record and complex mathematical models, the new method correlates hurricane development between August and October with wind anomalies present over North America, the Eastern Pacific, and the North Atlantic during July. The researchers noted that variables such as sea-level atmospheric pressure and overlying wind patterns can favor or hinder the later development of big hurricanes, and may be more reliable predictors for the big strikes.

For information: Mark Saunders, Dept. of Space and Climate Physics, University College, Gower Street, London WC1E 6BT, UK; phone: +44 20 7679 2000; Web site: www.ucl.ac.uk

MICROSCOPIC ROBOT "INCHWORM"

Researchers at Dartmouth College have developed a robot so small that swarms of them could someday be used to repair circuits in computer chips. The tiny inchworm-like slivers of flexible silicon (about 20 of which could fit on the end of your finger) contain two bits of memory and two actuators. When placed on an electrically charged grid, the silicon flexes so that the "tail" makes contact with the surface. The front "legs" then push forward, propelling the robot along the surface. By varying the electrical charge at different points on the grid, the robot's speed and direction can be controlled. The tiny mechanical inchworms are capable of taking up to 20,000 steps per second – traveling at a whopping speed of 200 microns per second. The next step will be to create "teams" of the miniature robots that can perform more complex operations.

For information: Bruce Donald, Dartmouth College, Computer Sciences Department, Hanover, NH 03755; phone: 603-646-2206; email: bruce.r.donald@dartmouth.edu; Web site: www.dartmouth.edu

BRINGING DOWN THE COST OF RFID

Many companies are looking to radio frequency identification (RFID) tags to replace bar codes for tracking virtually any item, but current silicon-based technologies are too costly for any high-volume applications. Now, a new process has been developed that may bring the manufacturing costs down. Using plastic chips and special printable inks containing organic semiconductors, dielectrics, and conductors, one startup company hopes to get the per tag price down to less than a penny. The passive devices, which will operate at around 13.56 megahertz, are expected to hit the market in two to three years.

For information: OrganicID, 422 E. Vermijo, Suite 409, Colorado Springs, CO 80903; phone: 719-219-6522; fax: 303-723-8775; Web site: www.organicid.com

CREATING STEM CELLS WITHOUT DESTROYING EMBRYOS

Research by two independent groups of scientists may soon bring an end to ethical debates over the use of stem cells to treat disease. Both teams have found ways to create the valuable cells without destroying the embryo. The first procedure involved removing one cell from an eight-cell mouse embryo. The single cell was mixed with other previously obtained stem cells, which coax it to transform into a stem cell by secreting chemical signals. The isolated cell subsequently morphed into a variety of cell types. The original embryo was able to develop into a normal fetus when implanted into a womb. The second approach utilized a gene called *cdx2*, which has been shown to be instrumental in creating the tissues needed for embryos to be successfully transplanted into the womb. When nuclei of mouse skin cells containing active *cdx2* were transplanted into unfertilized eggs, and prompted to divide, they were able to produce all the types of cells normally present in the body.

For information: Robert Lanza, Advanced Cell Technology, 381 Plantation St., Biotech V, Worcester, MA 01605; phone: 508-756-1212; Web site: www.advancedcell.com Alexander Meissner, Whitehead Institute for Biomedical Research, Nine Cambridge Center, Cambridge, MA 02142; phone: 617-258-5000; Web site: www.wi.mit.edu

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