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Tools and Resources for Educators Winter 2005

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Featured Story

Design and Discovery Gets an Update

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Design and Discovery, available at no charge on the Intel Innovation in Education Web site, has just been updated with new features and real-life examples of student projects—including the story of Taylor's prize-winning invention, a motorized storage device engineered to keep her necklaces from tangling.

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Spotlight Story

Learning to Be a Scientist in Two Worlds

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Focus on Education

Ask an Expert

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Design and Discovery Gets an Update

Online Curriculum Expands With New Resources

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Taylor and her mentor work together on a prototype.

New Features

Some of the updates are designed to make the comprehensive curriculum easier to navigate. For example, a new Web structure allows users to navigate through the 18 sequential sessions by clicking on labeled tabs. A new project index helps users find specific information. A downloadable, sortable shopping list has been added to help facilitators gather what they need for implementing the hands-on activities.

Along with these functional improvements, the content of *Design and Discovery* has been fine-tuned in response to user feedback and observations. For example, the curriculum now outlines a 10-step design process that is better aligned to professional engineering standards. Directions have been made clearer for some of the activities, such as a session where students invent their own mechanical toys.

Variety of Settings

Design and Discovery is being used with success in a variety of settings, including after-school programs, summer camps, and formal classrooms. An update to the implementation section of *Design and Discovery* includes strategies for effective instruction and examples of successful programs.

For example, in Portland, Oregon, *Design and Discovery* is used in two-week summer day camp programs geared for girls in middle school. By the end of program, each girl has developed a model of a product or invention that she has designed. The program continues throughout the school year with interested girls gathering once a month, on a Saturday or after school, to continue the curriculum and ultimately to develop prototypes. Students continue working on their projects and meet with mentors who assist them with their project development. A new addition to *Design and Discovery* provides a nuts-and-bolts look at how these popular summer programs have been implemented.

Design and Discovery has also been used in formal education settings, such as JFK Middle School in Hudson, Massachusetts. Math teacher Peggy Temple decided to use the curriculum as an introduction to independent inquiry, something she knew her students would be doing more frequently as they moved through middle and high school. Temple says the curriculum allowed her to be successful teaching engineering and design. "I didn't know anything about engineering or design, and it opened my eyes up to a whole different way of presenting projects to kids." She realized that her students would take to *Design and Discovery* when she introduced the first activity, involving the design of a paper clip. "Students worked on this for a long time. All of their ideas were unique. I was amazed," says Temple. By the end of the school year, students had developed prototypes of their own ideas to enter in their local science fair. Several went on to compete at regional and state-level science and engineering fairs.

Lightbulb Experiences
Ruthe Farmer, who has organized *Design and Discovery* programs in Portland, says the curriculum provides students with a "lightbulb experience in design and engineering." Students become invested in their projects, Farmer adds, "because the projects are based on their experiences and derived from their lives, as opposed to challenges issued by adults."

To learn more about *Design and Discovery*, go to www.intel.com/education/design.

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Learning to Be a Scientist in Two Worlds

At Intel ISEF, Native Student Presents Aquaponics Research

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Travis's engineering project involves both aquaculture and hydroponics.

"I want to bring to my community a new method of farming that will be low-cost and efficient," says Travis, who builds on the agricultural heritage of his ancestors.

It is no accident that Travis chose a project that involves agriculture, water, and nutrition. His home, the Gila River Indian Community, lies about 40 miles south of Phoenix. It is a vast, arid landscape in the Sonoran Desert, with little rain and summer temperatures that reach 115 degrees Fahrenheit. It is also an economically poor community, with a high unemployment rate, low incomes, and diet-related health problems such as diabetes.

Innovative Mentoring Program

Travis's promising future as a scientist—and his strong motivation to attend university—is due largely to an innovative mentoring program initiated six years ago at Sacaton Public Schools, a district scattered across the 600-square-mile Gila River reservation.

GEAR UP (Gaining Early Awareness and Readiness for Undergraduate Programs), funded by a U.S. Department of Education grant and the Intel Foundation, is designed to reduce the number of high school dropouts and prepare young people for college with a rich array of after-school and summer enrichment activities beginning in grade 4 and continuing through the college years.

"When I first started here, no one was even thinking of going to high school, much less college," says Joyce Baldwin, GEAR UP director and lead investigator in Sacaton. "For most students, the transition from a small tribal school to a public high school or boarding school off the reservation was just overwhelming. Six years ago, only 39 percent of our students made it through the ninth grade. Now we run between 79 and 80 percent, and quite a number are talking about going to college. That's a real change."

For Baldwin, a research entomologist who worked at the University of Arizona for 15 years before coming to Sacaton Public Schools, science was a priority in her new job. "The first thing we started was a community science fair, which I used as an evaluation tool. I discovered that there wasn't much science being taught in our tribal schools."

The project quickly "geared up" with math and science tutoring, clubs, mentorships, computer classes, job shadowing, and summer internships.

Now an Intel *Design and Discovery Club* introduces young people to engineering through design, using the online, inquiry-based curriculum available from Intel® Innovation in Education. Intel engineers from nearby Chandler volunteer as judges at the community fair. To examine the *Design and Discovery* curriculum, go to www.intel.com/education/design.

"Providing strong role models, particularly Native Americans, is the key to success with our students," says Baldwin. "That opens up their eyes to possibilities."

Travis, the oldest of five children, began with GEAR UP in grade 5 and "grew up with the program," Baldwin continues. After several community science fairs, he went on to compete at the University of Arizona Science Fair and the Intel Arizona American Indian Science and Engineering Fair, where he won the Grand Prize and the Herbert Hoover Young Engineering Award. From there it was on to Intel ISEF in Portland where he competed in the engineering division with his project, "Comparison of Hydroponic vs. Aquaponic Systems."

Turning Point
A turning point for Travis came a year ago when he was accepted for a 10-week summer internship at the University of Arizona in Tucson. In the Environmental Research Lab of the College of Agriculture and Life Sciences, he worked with Dr. Kevin Fitzsimmons, who is world famous for his work in aquaculture.

In two 800-gallon tanks, Travis set up a "closed," recirculating aquaponics system in which he raises fresh water prawns and tilapia, both high in protein, and vegetables. Waste from the fish provides nutrients for the roots of the vegetables, which, in turn, filter the water that returns to the fish tank.

"The experience of working in the university laboratory helped me better understand my project and where I was going with it," Travis says. Every two weeks, he travels to the lab in Tucson to record his research data. An Intel grant pays Travis for the time he spends on his science research, working with his tutor, or helping teach younger children through the GEAR UP mentoring buddy system.

Travis isn't yet certain which area of science he wants to study in college. It might be botany, he says. But his sights are set on enrolling in the American Indian Studies Center at UCLA.

Meanwhile, Intel ISEF is coming to Phoenix in May 2005, and Travis has a new aquaponics project to prepare for competition.

To see the *Design and Discovery* curriculum, go to www.intel.com/education/design .

To learn more about *Intel ISEF*, go to www.intel.com/education/isef.

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New Resources for Handhelds

Web Site Features New Ideas for Learning With Handhelds

Using handhelds with your students? New online resources on the Intel® Innovation in Education Web site include expanded project ideas and improved usage models to help you maximize the potential of this technology in your classroom.

Learning With Handhelds now includes updated information to introduce handhelds to new users. Whether you are a teacher with classroom management questions or an administrator wondering how best to tap the power of handhelds in your school, you will find what you need to start using handhelds effectively.

Teachers looking for project ideas that integrate handhelds will find expanded lesson plans. Lesson ideas that incorporate handhelds now follow the same design used for unit plans featured elsewhere on the Intel Innovation in Education Web site. Handhelds lessons feature essential questions, modeling the use of questioning as an effective instructional strategy.

In addition to the new content, *Learning With Handhelds* has been redesigned to enable users to get to the information they want more quickly—and with fewer clicks.

To learn more about *Learning With Handhelds*, go to www.intel.com/education/handhelds.

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Celebrating Three Years of Innovation

An Innovation Odyssey Starts a New Year

Since *An Innovation Odyssey* was launched in January 2002 to showcase teachers who use technology to enhance student learning, the online collection has grown to include nearly 400 stories from more than 25 countries on six continents.

Celebrating its third anniversary in January, *An Innovation Odyssey* continues to deliver a daily dose of inspiration. In the months ahead, readers can look forward to seeing new stories from Europe, Africa, and across the United States.

Odyssey Story 369 features a digital expedition in Russia.

Some of the newest stories highlight teachers from exceptional schools, such as the winners of the 2004 Intel and Scholastic Schools of Distinction Award. Other stories showcase teachers who are developing projects designed to engage students in higher-order thinking by using online tools available from Intel® Innovation in Education. New stories from Russia, Germany, South Africa, and other countries highlight innovative teaching ideas around the globe.

To help readers find ideas that interest them most, a story finder feature allows readers to search the collection according to grade level, subject area, or type of technology used. Technologies range widely, from handhelds to digital music labs to classroom animation studios. The stories are also sorted into themes that appeal across subject areas and grade levels, such as Making Sense of Data, Learning From the Past, or Communicating Ideas.

What's new and exciting in the world of teaching and learning? Find out by visiting *An Innovation Odyssey* at www.intel.com/education/odyssey.

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Ask an Expert

Kate McNeill: Making Your Case

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Kate McNeill sees educational value in argumentation.

Why is making a sound argument a skill worth learning? What kind of support do students need to be successful at argumentation? Kate McNeill of the University of Michigan has been considering these questions in her doctoral research in science education. Recently, we spoke with her about the higher-order thinking skills involved in making a good argument.

How did you get interested in the educational value of argumentation?

Before graduate school, I spent three years teaching sixth- and seventh-grade science in Pittsburgh, Pennsylvania. As a teacher, I definitely saw students struggle with producing claims and supporting those claims with evidence. Often, students want to write as few words as possible, and it can be difficult to support students in elaborating on their responses. Also, in doing science research, students come across different data. It's hard for students to understand what are the appropriate data to use in order to support their claims. What evidence can they disregard because it's not valid? What valid counter-evidence do they need to consider? How do they construct a rebuttal for an argument? If students are used to rote memorization, it can be hard for them to use more complicated reasoning skills. I'm interested in finding ways to scaffold students in science inquiry practices, including argumentation.

What kind of support helps students develop more complex reasoning abilities?

As a teacher, you can model the kinds of practices you want students to perform. You can show them what a good argument looks like, both orally and in writing. It's also valuable to compare weak and strong arguments, and help students think about how they could make a weak argument stronger. Another kind of scaffolding is to make the rationale and framework behind arguments explicit for students. You can bring examples from real life into the classroom, such as from the newspaper, magazines, or the Internet. Then you can examine these arguments to help students see the components of evidence, reasoning, and counter-evidence that they need to consider.

"Once you connect science with the world outside the classroom, students see why they may actually need to understand this. It has real-world applications."

Do the real-life examples take learning deeper?

One of our goals is to help students become more scientifically literate. They may be confronted in the media with debates about cloning or genetically modified foods. As a teacher you can help them step back and ask: Are these so-called experts making a strong argument? Can they make a case for what they say is true? Students will also start to realize that, a lot of times, there isn't one right answer. It's not right or wrong. By understanding that there are different ways of making arguments, students will start to bring their own understanding and perspective to anything they are confronted with in the news. Once you connect science with the world outside the classroom, students see why they may actually need to understand this. It has real-world applications.

Sounds as if this goes beyond scientific literacy?

Absolutely. Argumentation can be applied across almost any domain-history, English, mathematics. What counts as evidence? What is strong backing going to look like? In all domains, people are making cases for something. They're making a claim and trying to support it. By teaching the inquiry process across domains and giving students a framework for making arguments, you are giving them a different way of approaching questions. They can see how this kind of thinking applies to their everyday life.

How will our newest thinking tool support this learning process?

It will help teachers and students see how this general framework—for making a sound argument—cuts across all different disciplines. Teachers can use the tool to encourage looking at different types of evidence. How does the evidence support students' claims? What is the strength or value of that evidence? As students use the Internet for research, this tool can give them a frame for thinking about how different data points fit into a larger argument. It will also help them assess what they find on the Internet. How valid is the information? The flexibility of this tool is one of its strengths. You can use it with a range of ages and across a variety of disciplines. As students move from middle school to high school, they can learn to build more complex arguments in any subject area. Over time, the tool can help students become more adept at complex problem solving, both in school and in their everyday lives.

To learn more about the suite of thinking tools available from Intel Innovation in Education, go to www.intel.com/education/tools.

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South Korean Teachers Form Network to Share Ideas

National Associations Foster Ongoing Collaboration and Support

In South Korea, teachers are accustomed to having good access to technology. By 2000, a national educational technology initiative had provided all schools with Internet access and up-to-date computers. But with the infrastructure in place, educators have faced a new challenge: How to integrate technology to foster more student-centered learning and prepare students with Twenty-First Century skills? These are new challenges for educators accustomed to a more traditional classroom structure.

For many teachers, new classroom strategies are now starting to take shape through their participation in Intel® Teach to the Future. Endorsed by the South Korean Ministry of Education, the professional development program that focuses on the effective integration of technology has involved more than 18,000 teachers.

Teachers are learning new approaches for integrating technology

One unique outgrowth of the program in South Korea has been the development of a national association, designed to provide teachers with ongoing support when they complete Intel Teach to the Future and return to the classroom.

Jay Lee, Intel education manager for South Korea, explains, "Upon completion of training, teachers are highly motivated and confident in applying the new method with students. However, changing old practices takes continued efforts, time, and new strategies. Intel is helping teachers by providing opportunities to collaborate through various teacher workshops, seminars, and showcases. In this way, they can go on to be better teachers."

Indeed, international research shows that teacher support, including professional development is an essential condition in order for classroom innovations to take hold. "Technology, Innovation, and Educational Change" a 2003 report of the Second Information Technology in Education Study, cited support both within and outside of school as factors that help to sustain new ideas in the classroom. The study also concluded that having an "innovation champion" can help teachers embrace new teaching approaches.

National Network

The Korea Teacher Association Preparing for Future Education is a voluntary organization, endorsed by the Ministry of Education. It includes a national-level association and six branches, serving Seoul, Kyonggi, Inchon, Kangwon, Ulsan, and Chunbuk provinces. The more than 2,000 members are all graduates of the Intel Teach to the Future program.

South Korean educators enjoy the chance to

Members meet regularly for official association events, and also connect more informally with their colleagues. "Teachers say it's helpful to continue their efforts to improve the teaching and learning in the classroom," Lee says. "This gives them opportunities to work as a team, share their projects, consult with one another, and offer encouragement."

Master Teachers, who receive special training to lead Intel Teach to the Future sessions for participants, also use the association to network and exchange ideas. During 2004, more than 20 Master Teacher Forums took place in South Korea, with more than 200

collaborate. Master Teachers participating and exchanging effective ideas for the classroom.

"Master Teachers do not hesitate to travel one or two hours after work to meet and discuss ideas," says Lee. "They are very enthusiastic." Many Master Teachers have taken a lead in recruiting new participants for Intel Teach to the Future. "They feel empowered to lead," Lee says.

Hyun Kyong Shin, a primary teacher at Seoul Metropolitan School and president of the National Teacher Association Preparing for Future Education, sees the associations as an extension of Intel's professional development program. "Intel didn't stop with the trainings, which changed our mind set, but kept urging us to network, to share, and to lead the others. We become very proud school leaders and hope Intel will continue to be with us."

In 2004, the national network was recognized as an excellent teacher association, Lee adds. "It ranked second overall among various associations promoting strategies for effective use of educational technology in Korea."

For teachers, the association supports ongoing efforts to improve education. Explains Jeon Yong Kang, secondary teacher in English in Kyonggi province, "We believe what Intel Teach to the Future program believes in: effective use of technology combined with project-based learning can really help the way we teach and [how] our students learn. We are here together to lead and to promote these themes to more schools and classrooms."

According to Seung Ku Woo, secretariat to the Minister of Education in Korea, "it is amazing [that] Intel is working hard toward changing the system of education by providing worldclass teacher training and ongoing support for the trained teacher. This will bring the learning back to students," Woo says, thus adding an important human dimension to the hardware and software.

For more information about Intel Teach to the Future, go to www.intel.com/education/teach.

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African Teachers Exchange New Ideas

Intel® Teach to the Future Sparks Innovation and Collaboration

As the Intel® Teach to the Future program has taken off in South Africa, with more than 13,000 teachers participating in the professional development program, benefits are extending in new directions. Many teachers are changing their approach for integrating technology into project-based learning, and some are starting to share new teaching ideas with colleagues across the continent.

Instructional technology has become "everyone's interest."

Shirley-Ann Oldnall teaches instructional technology at Brooklyn Primary in Pretoria, South Africa. "When I started teaching computers, I was frustrated and bored with 'educational' programs that were being used," she relates. "The students seemed to do nothing more than count and press 'enter,' and appeared to be learning very little about how to use computers for research, presentations, and so on."

Oldnall volunteered to become a Master Teacher through the Intel Teach to the Future program. Through the extended, hands-on professional development sessions, she began to see new ways to use computer technology to assist teaching, "so the computer skills do not become the end in itself but the means to an end. This is the first time I have been shown how to make use of this medium for teaching."

She began introducing technology-rich projects with her students. For example, one project involved extrapolating written information on the process of manufacturing paint, and then translating this to an eight-step flow diagram. Students mastered new technology skills almost without effort as they solved a real-life problem. "This is the most meaningful way to teach instructional technology, in an integrated way," she says. "I have not seen anything that even begins to compare."

When it came to introducing her colleagues to technology integration strategies, however, Oldnall met with resistance. "When I first approached the principal he was lukewarm and could not see the value of innovation at that time. He was protective of the other staff members-some of whom were particularly resistant to any suggestion that computers could be a useful tool in teaching and who felt they were already overburdened with work. To his credit, he did allow me to make a presentation to the staff." Six teachers volunteered to take part in Intel Teach to the Future, with Oldnall as their Master Teacher.

"Everyone's Interest"

The success of that first group has sparked a change in attitude throughout the school. In the year since she offered the first session, she has seen teachers carefully structuring projects that use technology, focusing on assessment standards, and making rubrics—all of which are part of the Intel Teach to the Future curriculum. Instructional technology is now "everyone's interest," she says. Oldnall finds more teachers coming to the computer center to set up "very thoughtful and integrated projects for students as young as Grade 2."

Teacher collaboration—another strategy reinforced by Intel Teach to the Future—is also on the rise, Oldnall says. For example, a Grade 6 class was doing a section on democracy and the teacher asked Oldnall to help her expand the project, using resources in the computer center. "We found a great Web site with recordings and news clips from about 1910 to 2004. The students used these in presentations to celebrate 10 years of democracy in this country."

Eventually, three teachers from Brooklyn Primary had their portfolios chosen as exemplary plans, to be used as models of technology-rich units for other participants in Intel Teach to the Future in South Africa. "My teachers were especially keen to show the quality of their work," Oldnall says.

The Brooklyn Primary teachers were invited to present their portfolios at an Intel® Innovation in Education Conference in Cape Town. "It took some persuasion to get the school to support our travel of more than 1,000 miles to the south of the country," Oldnall admits. "With the assistance of various project team members, we canvassed the support from the Board of Governors. Our school has come full circle when it comes to using technology for teaching, with the principal right behind any technology initiative."

New Connections

At the conference, Oldnall attended a presentation by a teacher named Dinah Nakabuye from Ntare Boys School in Uganda. "She was riveting—the tales of trials and tribulations at the computer center, how children blew on the lightbulbs when the generator 'played up,' how Dinah put the monitor on two chairs on her desk so everyone could see, but most of all, her determination to make it work. The Brooklyn delegates could identify with Dinah's story," Oldnall relates.

After the conference, Oldnall and Nakabuye continued corresponding through email, and Oldnall sent unit materials she had developed through Intel Teach to the Future to her new colleague in Uganda. Nakabuye invited Oldnall to visit Ntare Boys' School and share her experiences about technology integration with the teachers in Uganda. In preparation, Nakabuye spent her own holiday time training her fellow teachers in basic technology skills, so that they would be well-prepared for Oldnall's visit.

In the months since that successful visit, the schools have continued to "network and build bridges," Oldnall says. "Brooklyn School has now booked a school tour to Uganda for next July and will then host Ugandan students the following year. Suddenly, we are leaping out into our continent—swapping teachers, pupils, and ways to best use technology in teaching."

For more information about Intel Teach to the Future program, go to www.intel.com/education/teach.

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The Art of Opportunity

Brazil's New Social Laboratory Offers Creative Place to Learn

In the Favela do Sapo area of Sao Paulo, Brazil, a young graffiti artist is busy at work, a can of spray paint in hand, and a dozen more in a box at his feet, blanketing the walls of the neighborhood's new Social Laboratory with patterns of intense color and vibrant images. He has painted looming mushrooms on one wall, a sphinx on another, and a remarkably realistic underwater seascape, complete with dolphins, sea turtles, angelfish, and seahorses, on yet a third. And he has permission to do so.

Vibrant murals bring color, creativity to Brazil.

In fact, Eriton Tiago dos Santos, the 21-year-old artist, was invited to decorate the new facility, a community technology center ideologically based on the Intel Computer Clubhouse in the city's center, reports Thiago Sugahara, an Intel intern. The Sao Paulo Intel Computer Clubhouse is part of an international network of clubhouses providing high-tech equipment, professional software, and the guidance of adult mentors to youth in economically disadvantaged communities around the world.

The establishment of the Social Laboratory was Sugahara's idea. Sugahara visited the Sao Paulo Intel Computer Clubhouse last year and was impressed with the resources it brought to youth in the city's center. When Intel's Brazil office replaced its employees' computers as part of a technology upgrade early this year, Sugahara suggested donating the old equipment—15 laptops, some printers, a Web camera, and a scanner—to create an additional computer lab for youngsters living in slums on the outskirts of the city. With the support of Intel Brazil management, help from the Sao Paulo Intel Computer Clubhouse coordinators and volunteers, and assistance from community leaders, the Social Laboratory was born.

As the group worked to create an atmosphere where youngsters would feel comfortable and inspired, Sugahara says, the idea of enlisting Santos's talents came up.

Leaving His Mark

Santos started out like many graffiti artists, leaving his mark on the walls of the city, often without purpose, says Sugahara. But as he grew older, he became more serious about his art and realized he could lend his talents to beautifying the slum. His art drew the attention of loca community leaders who asked for his assistance with a recycling campaign. To help with the effort, Santos created murals to educate people on basic sanitation procedures and on ways to preserve the neighboring forest.

Impressed with the artist's work on the recycling campaign, Social Laboratory organizers asked him to lend his creativity to their project.

Santos was thrilled to help, says Sugahara, because he saw the value of the initiative for neighborhood youth. The artist reportedly told Sugahara that if he had had access to such a place as the Social Laboratory, a place where he could have learned about art and technology when he was younger, he would have been there all the time. Santos is now working to learn computer graphics to expand his skills as an artist and perhaps find professional work as an illustrator.

Already, area youth have been inspired by Santos's art, contributing some of their own bits of graffiti around the facility—a buzzing bee here, a ladybug there—and learning to create graphics on their new computers. On some days volunteers report there are as many as 50 children gathered around the lab's 15 computers at the same time.

"The computers are available for all," says Sugahara, "and [Santos's] art makes the space

more comfortable."

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