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The Intel® Innovator

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Interested in Interactive Thinking Tools?

New Workshops Explain How to Use Online Tools

Teachers looking for ideas to use technology to extend and expand their students' thinking skills can take advantage of a new, free professional development offering in the United States. Intel® Teach to the Future Workshops on Interactive Thinking Tools use a proven professional development model to introduce teachers to online resources for engaging students in activities that develop higher-order thinking skills.

The first workshop focuses on two interactive, online tools and related resources available on the Intel® Innovation in Education Web site. *Seeing Reason* helps students investigate cause-and-effect relationships in complex systems. Using an online mapping tool and workspace, students create a series of graphic representations that capture their understanding over time. *Visual Ranking* is a collection of resources for ranking and comparing lists in the classroom. Teachers and students discuss and collaborate as they use higher-order thinking skills to evaluate lists and organize ideas. Both *Seeing Reason* and *Visual Ranking* create new opportunities for teachers to take learning to a deeper level.

The Intel Teach to the Future Workshop on *Seeing Reason* and *Visual Ranking* introduces teachers to these powerful tools for student learning. The workshop also addresses questions about effective instructional strategies and management of online student projects. In a 12-hour workshop led by experienced instructors, participants have time to get comfortable with the technology and develop project plans ready for use in their classroom.

***Seeing Reason* encourages discussion about cause-and-effect thinking.**

The Intel Teach to the Future Workshop on *Seeing Reason* and *Visual Ranking* is designed to help teachers:

- Prepare instructional strategies to increase opportunities for effective student collaboration, student-teacher interactions, and the inquiry process
- Understand the interactive thinking tools and their workspaces and how to manage a classroom project using an online environment
- Identify appropriate topics with which to use the interactive thinking tools in order to encourage discussion and understanding of complex ideas
- Create an instructional plan that will include one or more online projects that promote higher-order thinking skills, student learning objectives aligned to standards, and a strategy for assessing student work
- Return to the classroom prepared to effectively integrate the *Seeing Reason* and *Visual Ranking* interactive thinking tools into their classroom activities

A Proven Approach

The new workshops use the same professional development model that has made Intel Teach to the Future so successful. More than one million teachers worldwide have participated in the 40-hour Intel Teach to the Future Essentials Course focusing on effective technology integration to support project-based learning.

For Intel Teach to the Future veterans, the workshops allow for ongoing, follow-up professional development in technology integration. Teachers will recognize a familiar approach: hands-on learning in a technology lab, with Senior Trainers and Master Teachers leading their colleagues in a collaborative experience. Teachers develop instructional plans that relate directly to their classroom needs, including alignment with standards and assessment.

To learn more about signing up for Intel Teach to the Future Workshops on Interactive Thinking Tools in the United States, or to learn how to host a workshop in your community,

visit www.intel.com/education/teach.

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In Florida, Teachers Are Ready for Next Step

During the past two years, thousands of teachers in the School District of Hillsborough County have become more comfortable, confident users of classroom technology by participating in the Intel® Teach to the Future professional development program. Now, Master Teacher Mia Small says she has an answer for teachers who are eager to know, "What's next?"

Master Teacher Mia Small

With the launch of Intel Teach to the Future Workshops on Interactive Thinking Tools, Small says, "We have a stepping-stone for teachers who are ready to go to the next level with technology integration."

Research on professional development highlights the need for sustained, ongoing opportunities for teachers to expand their skills and instructional strategies. What's more, effective professional development relates directly to the activities of the classroom.

In Florida, teachers are looking for classroom resources that will help students develop higher-order thinking skills, Small says. "Teachers have expectations and benchmarks to address these skills. Continuing to implement your curriculum in an older fashion is not necessarily going to help kids make the learning gains they need to make. Having access to a Web-based thinking tool like *Seeing Reason* that makes use of causal mapping, and promotes higher-order thinking skills to investigate cause-and-effect relationships, is going to help teachers meet those learning goals."

The School District of Hillsborough County is the tenth-largest in the United States, with nearly 200,000 students. Its teachers can take advantage of a variety of professional development opportunities to help them integrate technology into teaching and learning. To learn more about the district's ambitious technology support program and its long-term collaboration with Intel Teach to the Future, visit http://www.intel.com/education/teach/mia.htm.

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In New Forum, Leaders Share Their Vision

One-Day Events to Focus on Supporting Effective Technology Integration

A decade ago, when William E. Powell arrived as the new superintendent of Strasburg School District, he toured the schools in this rural Colorado community. “We went to the elementary school and into a room called the computer lab. I turned on the lights and saw about 30 older computers piled on a table in the corner. Only one worked. Then I went to the junior-senior high school. There were a lot of computers sitting on tables in the computer lab, but not even half of them worked. I saw that we had a big task in front of us when it came to technology.”

Today, students, teachers, and school leaders in this community are using technology throughout the school day to meet learning goals. In a district with 900 students, there are now 350 networked computers. Technology supports a wide range of uses, including classroom learning activities, lesson planning, standards-based assessment, teacher collaboration, and ongoing professional development.

Superintendent William E. Powell sees the benefits of effective technology integration.

What has helped Powell realize his vision for effective technology integration? How has he leveraged resources to bring state-of-the-art equipment and professional development to his rural community? What can other school leaders learn from his hard-won victories?

New Forum for Leaders

Engaging discussions about these questions, along with similar topics facing school leaders in diverse communities, are an anticipated result of the Intel® Teach to the Future Leadership Forum. The forum is a new extension of the Intel Teach to the Future program. This face-to-face, hands-on session is designed to give school leaders an opportunity to discuss their experiences and spread their vision for effective technology integration. The Intel Teach to the Future Leadership Forum will begin to be offered this summer in select communities across the United States.

As a preview of the upcoming Intel Teach to the Future Leadership Forum, sponsored by Intel® Innovation in Education, Powell agreed to share some highlights of his leadership experiences in rural Colorado.

School leaders play a critical role when it comes to professional development. How do you support your teachers’ efforts to gain new skills and strategies that will help their students?

We have an ongoing staff development program for teachers in three areas: instructional strategies based on research, classroom management, and curriculum design. We help teachers integrate these areas by ongoing discussion in building-level Professional Learning Communities. We also provide ongoing training to teachers in areas such as math, writing, and integration of technology into the classroom.

How do you define effective professional development?

Research and common sense continue to demonstrate the most effective professional development happens if it is: **ongoing; hands-on training** (preferably in a teacher’s own classroom setting); and **facilitated by a competent, trusted mentor** available over time both to **model** and to **coach** a teacher in best practices. Areas for professional development focus are research-based instructional strategies; classroom management techniques; and the alignment of curriculum, instruction, and assessment. If all these elements are present in a trusting, caring environment, staff development is a powerful change agent.

In a small, rural district, how do you go about keeping your teachers connected with good resources and programs?

Networking resources (people, time, and money) is critical. We try to leverage our teacher pool talent by working through a consortium of schools to improve curriculum and instruction. We have students who move frequently from town to town in this rural part of Colorado. Four rural

school districts work together on a common I-70 Corridor Curriculum. We call this a “Living Curriculum” because it is updated frequently as teachers find new instructional resources and attach them to specific curriculum content and skill areas.

For example, when we aligned the I-70 Corridor Curriculum, we had 11 kindergarten teachers from all four rural school districts work together, instead of each district’s kindergarten teacher or teachers working alone. We were able to have more comprehensive vertical and horizontal curriculum alignment by networking all the kindergarten teachers together. We seek out good programs that we know will help teachers be more effective in the classroom.

What are you hoping the new Intel Teach to the Future Leadership Forum will offer school leaders?

The forum will help school administrators improve teacher effectiveness and student achievement by supporting and promoting the integration of technology. This will be done by introducing school administrators to the six standards in the ISTE National Educational Technology Standards for Administrators (NETS-A, www.cnets.iste.org/administrators*). This can be a helpful tool for school administrators to “inspire a shared vision for comprehensive integration of technology [in the classroom] and to foster an environment and culture conducive to the realization of that vision.”

Through the forums, school administrators can see the links between their leadership; teaching; student learning; and productive, ethical technology use at all levels. Many rural administrators are hungry for additional training and information on how to improve their leadership to support and enable effective technology integration in their schools to improve student learning.

What are leaders’ biggest needs for professional development in the area of technology integration?

Administrators (including superintendents, other administrative staff, and building principals) need to have a clear **vision** of what technology integration means for their schools. Then they need to have a clear, **written plan** on how to get there, which focuses on **improving teaching and learning**. They need to make sure there is support in place in terms of **hardware that works reliably**, **software that is relevant**, and **ongoing, quality staff development**. They need to make sure **evaluation of the plan’s implementation** is ongoing and honest. They need to **lead in finding the resources** (people, time, and money) to make sure the plan is implemented to the best benefit of the students. Ongoing training in technology is needed for teachers and administrators.

How can Intel Innovation in Education help meet your goals?

As a partner, Intel Innovation in Education can help school administrators understand more clearly their critical role in the integrating technology equation. Administrators are key partners in helping teachers define the future for tomorrow’s students.

To learn more about the Strasburg School District’s instructional technology program, including the district’s involvement in Intel Teach to the Future, visit http://www.intel.com/education/teach/bill.htm

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In India, Teachers Build Learning Communities

Instructional Leaders Meet Regularly to Share Ideas

Changing the culture of the classroom requires long-term, sustained efforts, according to experts like Michael Fullan, author of *The New Meaning of Educational Change*. Fullan's research shows that when teachers have opportunities to work together to improve student learning, they become ambassadors for change—not only in their own classrooms, but across the entire system.

That's exactly the scenario unfolding in India as an extension of the Intel® Teach to the Future program. More than 275,000 teachers across the country have taken part in the program to learn new strategies for integrating technology into learning. The instructional leaders who deliver this professional development meet regularly in local clubs for ongoing, collegial support and sharing good ideas.

India's 24 Master Trainer Clubs (MT Clubs) "grew directly out of Intel Teach to the Future," explains Paige Kuni, manager of K-12 programs worldwide for the Intel® Innovation in Education initiative. "These teachers want to continue meeting to talk about pedagogy, instructional goals, technology integration, and effective coaching." Because each trainer delivers professional development to hundreds of participant teachers, Kuni adds, "these instructional leaders have the potential to reach many classrooms."

Building Communities

Anjali Nichani, who manages the K-12 education program for Intel in India, says the MT Clubs are playing a pivotal role in supporting the Intel Teach to the Future program, to improve teaching and learning through effective integration of technology. "In many cases, the clubs have been successful in building communities of teachers," she says.

In Bangalore, for example, Jayanthi Paniraj serves as president of a local MT Club called Prerana. "We have a place for teachers to come together and share innovative ideas," she explains. "Teachers all over the world are redesigning curriculum to make learning more interesting for children. The Intel Teach to the Future program brought all of us under one banner and opened new vistas for us. Now, the master trainers need to take the lead and reach out to students."

Learning about effective technology integration is what first attracts many teachers to Intel Teach to the Future. However, technology integration is only one aspect of the program. Teachers also are introduced to a range of "alternative learning methodologies" that lead students to develop higher-order thinking skills, Nichani says. The learning methods include:

- Inquiry-based learning
- Project-based learning
- Student-centric approaches

Jayanthi Paniraj leads a MT Club in Bangalore.

At twice-monthly meetings, MT Club members can discuss these instructional topics and compare progress and challenges.

Clubs also use a variety of online methods to build and sustain a sense of community among members. They publish newsletters and host Web sites to provide members with forums for sharing ideas. Some clubs sponsor classroom competitions, and showcase winning project ideas. Club members also organize classroom visits so members can see each other's teaching methods in action.

Ongoing Support

Intel Innovation in Education continues to develop new tools and resources for teachers, such as online thinking tools and workshops. MT Clubs provide members with updates about new resources and opportunities for ongoing training.

Sashi Banerjee says MT Club members in Jodhpur have become "a force to reckon with on the educational scene."

MT Clubs also have helped “bridge the gap between teachers and principals,” says Nichani, by organizing seminars for school administrators. School leaders who understand the benefits of technology-enriched learning are more apt to be supportive of teachers’ efforts to integrate technology in their classrooms. Increasingly, she adds, school leaders are requesting training from the MT Clubs “to help them keep pace with the rest of the world.”

As a result of all these efforts, MT Clubs “create ambassadors who can expand the activities of the program,” Nichani says. “Schools where the principals are interested in innovations are adopted by the clubs, and training on the latest curriculum and tools of the program is provided for the teachers.”

If Master Trainers move or transfer schools, they can connect with the MT Club in the new community. “They are immediately taken into the fold of club activities, so that optimum learning and sharing happens,” Nichani explains. “There is no break in the continuous learning and sharing process.”

Member Response
What do members have to say about the value of MT Clubs?

“But for the existence of Master Trainer Clubs, the Intel Teach to the Future-trained teachers would have been rudderless boats in the vast ocean of technology,” says Tripta Goel, Master Trainer from Chandigarh in Haryana state. “The important anchor would have been missing in the absence of MT Clubs.”

In Jodhpur, Rajasthan state, Sashi Banerjee is president of the MT Club. She says, “With almost 200 club members spread across seven schools, we seem to have become a force to reckon with on the educational scene of Jodhpur.”

In the community of Chennai, Tamil Nadu state, MT Club member Lilly Tersa says changing conventional teaching methods means opening windows “for a new vista of learning and insights. It is a gradual process, and conventional ideologies may resist change,” she admits, “but the old air is stifling. The teaching community and learning community deserve fresh air. Can there be anyone who understands educational fraternity better than fellow teachers from Intel Teach to the Future?”

Teacher Lilly Tersa welcomes "new vista of learning and insights."

In India, Intel supports the MT Clubs by providing financial support to cover club expenses, and a resource support person who guides the clubs on training to effectively benefit the education community of the region. It also encourages MT Clubs in their endeavors by awarding the Best MT Club award annually.

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Ask an Expert

Researcher Margaret Honey Sees Global Initiative Efforts 'Going Deeper'

An international audience from the Intel® Innovation in Education program came together in Portland, Oregon, in February for a week of sharing effective ideas and discussing long-term opportunities. Dr. Margaret Honey, director of the Center for Children and Technology at the Education Development Center (EDC), was one of the education experts invited to address the group. She shared her insights about the state of technology literacy around the world and the important role that Intel is playing to improve teaching and learning through the effective integration of technology. She also took time to answer some follow-up questions for *The Intel® Innovator*.

As a researcher with a long view of educational technology, what do you see as the strengths of Intel® Teach to the Future as a global professional development program?

We know from the literature that the most effective professional development is sustained, deep, relevant, and focused on work teachers are actually doing in the classroom. What's unique about Intel Teach to the Future and other aspects of the Intel Innovation in Education Initiative is that you are doing this on a worldwide scale. And you're not just thinking about the numbers. You're constantly thinking about how to go deeper. So it's not just breadth, but also depth. That's impressive.

As Intel Teach to the Future has grown to reach more than one million teachers worldwide, how is it managing to meet the needs of such diverse audiences around the world?

Intel Teach to the Future has created a different paradigm around professional development. You don't see yourselves as providing a one-time service. You see yourselves as building a relationship with people who bring a lot of expertise to the table. Your programs work effectively where teachers are, within their existing comfort zones. You build on their knowledge base. And you walk in the door assuming you're encountering a lot of expertise and wisdom. You have developed a set of resources and a set of opportunities that you make available to educators around the world, but you're doing that in a way that makes sense, given local conditions, local needs, local priorities. The work is co-constructed, co-defined. That underlying respect is so important, and it is making a huge difference in the work you do.

At the local level, what factors need to be in place for professional development to generate real improvements in the classroom?

In ongoing research at EDC, we are looking at a range of factors, including leadership, time, resources, access to technology, and other supports. If those critical factors are in place, a program like Intel Teach to the Future will be able to take root and acquire depth sooner rather than later. When these supports don't exist, are there steps that can be taken to help local communities? That's a more complicated challenge.

You've talked about Intel Innovation in Education "going deeper." What do you mean by that?

Intel has laid a foundation—you already have a relationship with a million teachers. Now, how do you take it deeper? The online, interactive thinking tools—such as *Seeing Reason* and *Visual Ranking*—are a logical next step. These tools have the potential to create pathways into material that has proved difficult or challenging for kids to learn in other formats. Teachers want kids who are motivated, who are engaged. And of course they want kids to be able to master concepts that aren't always easy to master. One of the great benefits of the kinds of tools Intel Innovation in Education is developing is this potential to address a much more diverse set of learners and have those kids gain real mastery over what are hard-to-learn concepts.

The online, interactive thinking tools are designed to develop students' higher-order thinking skills. They present exciting opportunities for learning, but also require some new strategies for the classroom. What will teachers need in order to use these tools effectively?

If teachers have an experience where they use the tools to gain a whole new set of insights—and they see that their kids are having that experience, too—they're going to be that much

more willing to move forward. You will have your innovators, your early adopters, the teachers who gravitate toward these tools and do amazing things with them. But to reach a broader audience, you'll need a process to support them, to scaffold their learning. That foundation already exists. You've already modeled the professional development process. People are well-primed to take this next step. It's exciting.

EDC has been conducting evaluations of Intel Innovation in Education programs since 1999. What interests you most as a researcher?

The growth of the international work is fascinating to watch. There's an opportunity here to gain a global perspective on educational change, educational challenges, educational opportunities. It's unusual to think about education from this global perspective. The piece of it that Intel should never give up on is the anchored vision of what this program is all about—the integration of technology into effective teaching and learning.

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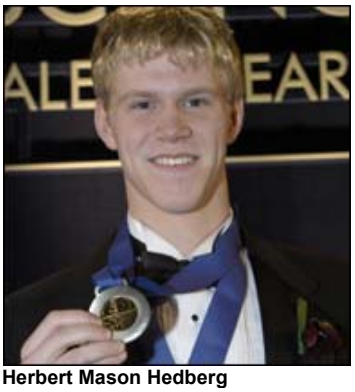
What Motivates Young Scientists?

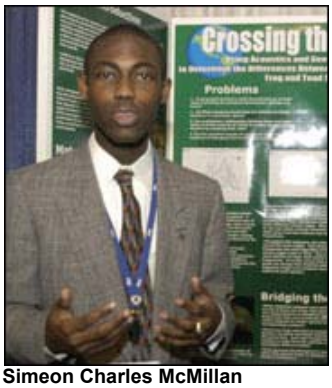
Intel STS Finalists Share Passion for Research

The 40 high school seniors who reached the finals of the 2004 Intel Science Talent Search (Intel STS) in March share a passion for science and a willingness to dig into independent research projects that aim to cure diseases, solve vexing mathematical problems, or somehow improve the world. What first ignited their interest in science? Many students can recall an early, influential experience.



Herbert Mason Hedberg

Herbert Mason Hedberg, who took first place and won a US$100,000 scholarship for his biochemistry research involving cancer, says when he was in fifth grade, he watched his older brother work on a junior high science fair project. “I couldn’t wait for a chance to do my own first project,” says the student from North Attleboro High School in Massachusetts.



Simeon Charles McMillan

Simeon Charles McMillan of Uniondale High School in New York credits “a supportive seventh-grade teacher who guided me to attend and compete in science fairs.” McMillan says “all those early experiences, good and bad,” helped him reach the Intel STS finals with a zoology project that used bioacoustics to analyze the choruses of green tree frogs. “Even if you lose, you learn perseverance.”

Rachael Collier, who attends Mediapolis High in a small Iowa community, remembers a key moment in second grade when the coordinator of a talented and gifted program “got me interested in asking questions. I used to wonder about things, but didn’t ask questions out loud. Later, she taught me I could go find out the answers myself.” Collier’s environmental science project involved examining the toxicity of common substances on Monarch butterfly larvae.

Rachael Collier

Bruce Halperin of Half Hollow Hills High School East in Dix Hills, New York, says the key is to “find your niche. Once you find an area that you enjoy learning about, it is as engaging as it needs to be.” For Halperin, number theory is the area that continues to fascinate him, despite “frustrating moments” in research. His approach for overcoming challenges in his computer science project that involved cryptology? “If you hit a wall, you need to explore some more along that wall. Eventually, you will find a door.”

To learn more about the 2004 Intel STS finalists, including the complete list of winners, project descriptions, and interviews with teachers who coordinate successful high school research programs, read about the Intel STS 2004 highlights.

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Award-Winning Teachers Share Strategies

Exchanging Ideas a Goal of Intel ISEF Excellence in Teaching Awards

Five exceptional high school science teachers from four continents came together in Portland, Oregon, in May to share classroom strategies and effective project ideas during the Intel International Science and Engineering Fair (Intel ISEF). Winners of the 2004 Intel ISEF Excellence in Teaching Award are from Argentina, Japan, and Ukraine, along with Colorado and Florida in the United States.

The winning teachers were eager to share their strategies with interested colleagues from around the globe. Fostering an exchange of ideas is a primary goal of the awards, which recognize outstanding teachers who use project-based learning to engage students in the study of science and mathematics.

Each teacher received an all-expenses-paid trip to Intel ISEF, along with a US$3,500 prize. In addition, each winner is invited to request up to US$10,000 in funding from the Intel Foundation for a proposal to replicate program ideas in additional schools.

In the Ukraine, teacher Paul Pshenichka created "a small academy" that unites student researchers with scientific advisors to support student research projects in physics, mathematics, computer science, astrophysics, ecology, economics, sociology, and linguistics.

Maria Adela Moyano de Burt teaches biological sciences at Escuela de Comercio Republica de Panama, a high school in Concepcion City, Tucuman Province, Argentina. She launched her program, Technological-Scientific Thought Challenge, 12 years ago with a multidisciplinary approach that involves a wide section of the community in improving the quality of life in Argentina. Students work with teachers, community members, and volunteers from universities and industry on research projects in the environmental and behavioral sciences. Recent projects have focused on creating specialized healthcare centers, establishing a drinkable water distribution system, and developing ecological dyes for fibers. A regional science fair celebrates student successes and showcases community solutions. Moyano de Burt hopes to develop and expand the program to other communities.

Akihiko Shindo teaches at Okayama Ichinomiya Senior High School in Okayama, Japan. In 2002, the school was named a Super Science High School by the Japan Ministry of Education for its development of integrated science and mathematics education. Shindo introduces tenth-graders to the fundamentals of scientific research during a four-day science camp with the theme of "harmony between scientific technology and nature." In eleventh grade, student teams design their own research projects. Finally, students present their research achievements at science contests and to academic societies. The effect, Shindo says, is an "overall improved motivation for learning," along with fostering creativity and originality. Shindo intends to exchange information and share his implementation strategy with other Japanese teachers.

Paul Pshenichka teaches physics at the Chernivtsi City Lyceum #1, in Chernivtsi, Ukraine. He established a Youth Scientific Society known as Quasar to unite student researchers with scientific advisors. The learning environment is like “a small academy,” Pshenichka says, with students able to pursue research projects in physics, mathematics, computer science, astrophysics, ecology, economics, sociology, and linguistics. Quasar has become “a powerful organizational and intellectual amplifier.” Students from the program participate in Ukrainian national and international scientific conferences and competitions. Pshenichka is coauthor of the physics textbook *Physics: A Step in the Next Century*. Through journal articles and conferences, he hopes to share the program with schools across Ukraine.

Roberta Tanner, who teaches physics at Loveland High School in Loveland, Colorado, developed a Microcomputer Projects class to allow students the chance to experience the world of engineering and electronics. Students design, build, program, and troubleshoot their own electronic projects, and learn mathematics, circuitry, and programming. Project complexity increases each year as students build on accomplishments from previous years. She reports that students at all performance levels experience success in her course. Tanner wrote her own preliminary textbook and hopes to make the refined textbook and teacher manual available as part of a professional development course for other teachers.

Wafa Khalil, who teaches science at MAST Academy High School in Miami, Florida, developed

an integrated science course and curriculum, Energy for Sustainability: Solar Energy and Alternative Resources. Students apply the scientific method, design and construct original prototypes, and investigate global energy consumption and the related socioeconomic and environmental implications. Khalil is writing a textbook for her course, which has been approved by the Florida Department of Education. She plans to replicate her program that encourages participating students to become more aware of their use of energy and other natural resources. (Read the next article for more details.)

To learn more about the strategies and programs used by these award-winning teachers, read about the highlights of 2004 Intel ISEF.

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Unique Course Promotes High-Energy Learning

In the Sunshine State of Florida, a former medical researcher has turned her interest in sustainable energy into a rigorous high school program focusing on solar power. Dr. Wafa Khalil incorporates scientific thinking, mathematics, independent research, and creative problem solving in her solar energy classes at MAST Academy, a public magnet high school in Miami.

Wafa Khalil (at left) joins students for annual solar celebration.

One of five winners of the Intel International Science and Engineering Fair Excellence in Teaching Award for 2004, Khalil is eager to see her innovative, project-based approach spread to other schools and communities. Developing her solar energy program, including state-approved curricula for two yearlong courses, has taken time and plenty of her own energy, she admits. “What makes it worthwhile is seeing the response of the students—their genuine interest, and how they want to explore ideas in more depth. They are in my classroom before school, during lunch, after school. There should be no boundary for learning.”

Khalil proposed the solar energy elective eight years ago when she joined MAST Academy. The magnet school, with an enrollment of 550 students in grades 9-12, takes advantage of its waterfront location and technology infrastructure to focus on maritime and science technology. It’s also a place where new ideas are welcome, says Khalil, who credits a supportive administration for helping get her solar energy class launched. The first year, she had 35 students. The next year, more than 100. Eventually, she developed a second-year program, Solar II, for students eager to continue with independent research projects and development of working prototypes for solar-powered products.

What strategies help make the program a success? “It’s hands-on learning, but I always put the minds on, as well,” Khalil says. “I don’t dilute the science because it’s project-based.”

The course integrates mathematics and science, and brings in “economics, politics, and effects of energy use on society. It’s a holistic approach,” Khalil explains, where students learn through “exploration and application.” Students begin with an analysis of long-term energy consumption patterns in their own homes and eventually go on to build solar collectors and design solar-powered products. They showcase their products in an annual event, Solar Celebration: The Sky Is the Limit. All students in the solar energy classes share their research and original thinking in student-conducted forums to discuss contemporary scientific issues with university researchers, energy company representatives, and interested community leaders.

Many of Khalil’s students enter their research and design projects in competitions such as Intel ISEF and the Intel Science Talent Search. Having such motivated, engaged students lets Khalil know she’s on the right track. “I don’t have to push my students to do their research. They want to be competent, to be knowledgeable. They love it,” she says.

And for Khalil, whose personal interest in solar energy goes back many years, there’s another source of satisfaction. She says, “This is where I can make change. I see students leaving my class saying they want to build a house that’s off the grid (using sustainable energy sources). At this age, students need to be exposed to many new ideas so when they reach the university, they will be ready to pursue their own interests.”

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A New Journey Begins

Coming Soon, Improvements to Popular Online Curriculum

An updated version of the popular online technology curriculum, *The Journey Inside*SM, goes live this fall on the Intel® Innovation in Education Web site.

This interactive, media-rich curriculum answers important questions about computers and the Internet through activities that help explain how technology works and affects society. The revised curriculum will retain the same self-paced, interactive approach while adding new information about recent technological advances. Classroom resources for teachers are getting refreshed, as well.

Since the free online curriculum was first introduced in 2000, advances in technology have led to the growth of wireless connectivity, faster processors, and new production methods. *The Journey Inside* has been revised to address these innovations with engaging new lessons and activities.

Other enhancements include:

- **New Interactive Lessons and Activities:** New lessons using the free interactive thinking tools available on the Intel Innovation in Education Web site help students better understand technology.
- **Improved Video Delivery:** The interactive elements of online lessons and videos have been optimized to run more smoothly on a greater variety of computers. Now, students and teachers will be able to take advantage of everything the site has to offer.

To learn more about the new and improved version of *The Journey Inside*, go to www.intel.com/education/journey.

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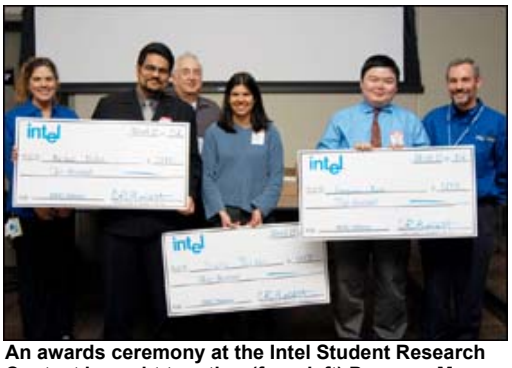
Undergraduate Researchers Display Inventiveness

U.S. Students Capture Top Prizes



An awards ceremony at the Intel Student Research Contest brought together (from left) Program Manager Kimberly Sills, third-place winner Ankur Kalra, Intel Senior Fellow Gene Meieran, second-place winner Sara Parker, first-place winner Eugene Lee, and Tim Saponas, manager of worldwide higher education programs for Intel® Innovation in Education.

Months of extensive research in computer graphics paid off this spring for a Cornell University senior who earned top honors and a US$5,000 prize in the Intel Student Research Contest (ISRC). For first-place winner Eugene Lee and the 18 other finalists from U.S. colleges and universities, the final round of the contest offered a chance to explain and defend their innovative research to a panel of technical experts from Intel during the two-day event in Oregon.

"The goals of the program are to stimulate student inventiveness and give students the experience of doing a small-scale research project," says Kimberly Sills, program manager for the ISRC. "It gives the students an opportunity to experience research, and possibly encourages them to pursue advanced degrees." Each student who reaches the final round of the contest is matched with an Intel technical adviser. Finalists also receive funding from Intel to support their research during the nine months leading up to the competition.

Lee's winning project, "Hardware Acceleration of the Edge-and-Point System for Interactive Rendering," tackles the challenge of producing high-quality, interactive rendering of sophisticated graphics, such as those used in movies or computer games. After graduating from Cornell with a degree in computer science, he plans to work for Microsoft and eventually pursue graduate studies. Lee's reaction to winning? "It's still somewhat of a shock," he said.

During the final round of ISRC, student researchers explained their projects to technical experts from Intel.

Second-place winner, Sara Parker from Cornell University, won US$3,000 for her materials science research, "Novel Light-Emitting Devices Utilizing Ionic Liquids." Her research focuses on a technology that could eventually replace liquid crystal devices (LCD) or overhead fluorescent lights. She plans to pursue graduate studies in materials science and engineering.

Third-place winner Ankur Kalra from Georgia Institute of Technology won US$2,000 for his computer science research, "Multi-Modal Capture of Complex Human Motion Using Video and Marker Data." His research focuses on overcoming the time-intensive challenges of creating computer-generated animation characters. He plans to pursue graduate studies and work in the field of ubiquitous and pervasive computing.

Now in its third year in the United States, the ISRC has expanded to include separate competitions for university students in India and the People's Republic of China. To learn more about the ISRC, go to www.intel.com/research/awards.

Eugene Lee's winning project tackled the challenge of producing high-quality rendering of sophisticated grap

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Across Arizona, Students Become Inventors

Pilot Program Builds Interest in *Design and Discovery*

As soon as students arrive for their first day of an after-school program at Sacaton Elementary School, they start to imagine themselves in a brand-new role: inventor.

Bill Carey, a longtime science and math teacher at this school in the Gila River Indian Community south of Phoenix, Arizona, is facilitating the enrichment course based on *Design and Discovery*. The free curriculum, developed by Intel® Innovation in Education and available online, aims to interest students in design and engineering.

Teacher Bill Carey gets students thinking about how things work.

Carey begins by picking up a pair of wire cutters from one of the tables and reminding students, “Somebody invented this tool. You’re going to become inventors, too. You’re going to explore different materials, find out how things work, and dream up your own plans. Once you get an idea for your own product, you’ll draw it, make it, and see if it works. By the end, you’ll all make something neat—something that’s your very own idea.”

In a nutshell, that’s how *Design and Discovery* works. Through an extended series of hands-on activities, students gain an understanding of design and engineering principles. They use the same processes that professional engineers follow to design, build, test, and improve working prototypes of new products.

Pilot Program

In Arizona, students in a variety of settings have recently started taking part in after-school and community-based enrichment classes that use the *Design and Discovery* curriculum. Eugenia Echols, Intel education manager in Arizona, organized the pilot program, including a two-day training session for prospective facilitators. She has recruited schools and community-based programs serving diverse student populations, located in both urban and rural parts of the state.

Echols says *Design and Discovery* “fits perfectly” with the learning needs of students who are often at risk of low academic performance in math and science, and who tend to be under-represented in engineering and technical fields as adults. “This curriculum is hands-on, inquiry-based. We know from a cultural perspective that children who are not encouraged to be vocal tend to express themselves with their hands,” Echols says, noting a long tradition of visual arts among the Native American tribes of the Southwest.

Echols, who has a doctorate in public policy and is well versed in educational research, says *Design and Discovery* meets multiple goals. “It supports math and science education. It reaches high-risk, diverse populations. And the portability of the curriculum means we can take it into communities that have not had extensive science programs. It doesn’t require a lot of equipment,” she points out.

Even more important, Echols adds, is the potential for getting students excited about learning. “It’s just a cool curriculum. I know in my heart that it will work,” she says. “It’s perfect for engaging the children we are eager to reach.”

Interest from teachers and community-based program leaders across Arizona has been immediate and enthusiastic, Echols says. “I sent out a brochure about *Design and Discovery* and announced a training session. Within a week, my phone and email were burning up. The response: We want it.” The two-day training session drew potential facilitators from local Boys and Girls Clubs, the Phoenix Parks and Recreation program, and schools that sponsor after-school and summer enrichment programs.

Appeal for Teachers

What do teachers like about *Design and Discovery*?

Carey is attracted by both the pre-engineering topic and what he sees as “a well-crafted, solid curriculum,” designed to build student understanding through a sequence of hands-on activities. Carey and his teaching partner, Tracy Brooks, are always looking for new ways to use the after-school hours to enrich students’ informal learning experiences in math and science. Currently, they attract about 100 students each week for a variety of science enrichment programs.

Funding for their after-school program comes in part from GEAR UP, a federal effort to increase the number of low-income students who are prepared for college. Joyce Baldwin, local GEAR UP director, was instrumental in bringing *Design and Discovery* to the tribal community. She first learned about the curriculum last year at the Intel International Science and Engineering Fair (Intel ISEF). Baldwin saw a presentation about *Design and Discovery* and thought, “This is it. I want it.” Baldwin sees the pre-engineering curriculum “as something to grab kids’ interest (in science and engineering) when they’re younger.”

Students at Sacaton Elementary are pursuing after-school activities that spark innovation.

In the Gila River Indian Community, after-school programs serve a big need. Recreational opportunities for children are limited in this rural area. What’s more, Baldwin points out, state mandates mean an intense focus on math and reading during the regular school day, but little time for science education in the elementary grades. She commends Carey and Brooks for being strong teachers who have been able to build interest in “an academic after-school program. They have to compete with sports. To draw 100 kids a week, as they do, says a lot about their program. They keep the kids coming.” *Design and Discovery* offers these teachers a ready-made curriculum that meets their students’ needs, Baldwin says. In the fall, she hopes to add a new *Design and Discovery* after-school class at the middle school.

Pipeline for Science Fairs

By encouraging students to showcase their invention prototypes, *Design and Discovery* also helps to build student interest in science fairs and competitions. In 2005, Intel ISEF will take place in Arizona. “With Intel ISEF coming here next year, we want to start getting teachers comfortable, and kids successful, with science projects,” says Echols. *Design and Discovery* teaches students good practices for developing a successful research project, such as keeping a design notebook and conducting user tests.

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