intel innovation in education

The Intel Innovator

Tools and Resources for Educators Spring 2004

Elementary and Secondary Education

Tapping the Power of a Good Question

Teacher Resources Promote Probing and Prompting

It's no accident that questions are at the heart of classroom resources provided by Intel® Innovation in Education. "Questions offer an invitation for students to pursue important learning," explains Jane Krauss, a veteran teacher who helps to develop online resources for the Intel Innovation in Education Web site. "Getting teachers to ask better questions, and getting students to ask each other questions, helps students think through their understanding."

Intel Innovation in Education promotes effective questioning in a variety of ways. In face-to-face professional development, Intel® Teach to the Future models the use of essential questions to frame the design of classroom projects. Similarly, more than 50 exemplary unit plans available online begin with questions intended to help teachers open the door for student learning.

In Cell-to-Cell, one of the 50 unit plans, high school students explore the function of cells.

Seeing Reason and Visual Ranking, online tools available from Intel Innovation in Education, also support the use of questioning as a classroom strategy. Both tools prompt students to use higher-order thinking skills. *Seeing Reason* encourages students to think about and discuss cause-and-effect relationships in complex systems. *Visual Ranking* encourages students to analyze, compare, debate, and negotiate as they go about making ordered lists.

"Our tools do a good job of changing discourse in the classroom," Krauss says. Both tools include an online workspace where students create visual representations of their thinking. Explains Krauss, "Your thinking is laid bare by these tools. That leads naturally to questions and discussions. Having students work in teams also generates more questions, student to student and student to teacher."

Questions Worth Asking

Grant Wiggins, author of *Understanding by Design* and a well-known expert in curriculum design and assessment, suggests that teachers begin planning a new project by asking themselves some key questions. In an approach he calls "backward design," Wiggins encourages teachers to consider: What do you want students to know and understand? What will it look like when they have that knowledge and understanding? Starting with the end in mind helps the teacher plan a road map for student learning.

In the classroom, teachers can make skillful use of questioning to take student understanding deeper. According to the National Research Council, "A question robust

and fruitful enough to drive an inquiry generates a 'need to know' in students." In addition to igniting students' curiosity, good questions help them build new understanding onto what they already know.

Research about classroom discourse has focused attention on the way ideas are exchanged in the classroom. "We know from research that teachers ask more questions than students, and that most of those questions relate to procedures and facts," says Krauss.

To shift discourse to a more active model, the National Council of Teachers of Mathematics (NCTM) encourages teachers to consider the flow of conversations in their classroom. NCTM suggests paying attention to: Who talks? About what? In what ways? What do people write, what do they record, and why? What questions are important? How do ideas change? Whose ideas and ways of thinking are valued? Who determines when to end a discussion?

Teachers interested in promoting deeper thinking might start by asking more probing questions. For example:

- What do you notice?
- What can you conclude?
- Can you tell me more about this?
- How is this different from what you expected?
- Why is this important?

Promoting Deeper Thinking

What does good questioning look like in practice? Middle school teacher Theresa Maves was recently introducing a unit on invention and design. She asked her students to use the *Visual Ranking* tool to rank 10 inventions according to their impact on society.

As student teams explained the reasoning behind their rankings, Maves noticed that nearly every team ranked radios near the bottom of the list. "We talked about this and why, and I asked students if they thought having more information about the inventions would affect their ranking." Students conducted research in the technology lab, then taught their classmates mini-lessons about each invention's history.

"Students then went back into their original groups and re-ranked the 10 inventions. This was a fascinating process," Maves relates. "Radio made its way to the top of several lists once students understood its purpose besides listening to music and its rich history of communication during wars and for mass entertainment. The process also brought up much evaluative thinking about ranking an invention's impact. I was completely impressed with the natural thinking process taking place. Also, it was fascinating to the students to see how their thinking compares to another group and how all that can be translated into numbers (using the correlation feature of the *Visual Ranking* tool). It was a great debate starter as we compared two different groups that now were armed with knowledge to support their thinking."

Among students' conclusions, Maves notes, was this keen insight: "You can learn from other people's thinking, and their thoughts help spur more thinking that you wouldn't have done otherwise."

To learn more about *Seeing Reason*, *Visual Ranking*, or the exemplary unit and project

plans available from Intel Innovation in Education, go to www.intel.com/education.

Elementary and Secondary Education

Hands-on Training at Heart of Professional Development

Chicago Embraces Intel® Teach to the Future Program

Chicago Public Schools (CPS) is one of the nation's largest and most diverse urban districts, with more than 400,000 students attending some 600 schools. Access to technology varies widely across the sprawling district. Teachers also cover the map when it comes to their abilities to use technology as a tool for enhancing teaching and learning.

In neighborhoods all over the city, teachers are finding new opportunities for building their own technology skills and improving their students' learning experiences. Intel® Teach to the Future has become a cornerstone of the district's innovative approach to delivering effective professional development.

Tina Below is responsible for training Master Teachers in the Chicago region for Intel Teach to the Future.

Sharnell Jackson, now the chief e-learning officer for CPS, remembers her reaction when district leaders first asked for an opinion about the Intel Teach to the Future professional development program. "My initial assessment was: 'Thumbs up!' I told them we should leap at the opportunity to utilize such a high-quality, technology-integrated training program to enhance literacy skill development," Jackson says.

Her positive feedback took into account the program's successful track record. Launched in 2000, Intel Teach to the Future has trained more than one million teachers in 30 countries. Even more importantly, says Jackson, "I could see that this program has a strong pedagogical foundation. It starts with addressing standards-based curriculum instruction, assessments to identify desired results, and use of essential questions to guide instruction that leads to conceptual understanding of content. I realized this is exactly what we were looking for."

Jackson also liked the train-the-trainer model used to deliver the 40 hours of hands-on training in a technology lab. CPS is organized into 24 smaller areas, each with its own area instructional officer and technology coordinator. The coordinators become Master Teachers through the Intel Teach to the Future program. That means they deliver the training for their fellow teachers, right in the teachers' home neighborhoods. "We use the train-the-trainer model to build our capacity," Jackson explains, "It's a fabulous model for empowering teachers to become leaders."

During the hands-on training, participating teachers learn to develop detailed plans for projects that integrate technology. Because the training is tailored to meet local needs, Jackson explains, "Teachers create data-driven projects that are specific to their

instructional literacy and mathematics needs."

Chicago district priorities are especially focused on literacy, human capital, and creating more learning opportunities. "Our teachers want to know, how do I do all of that while creating coherence and alignment?" Jackson says. Using the Intel Teach to the Future model, teachers create projects that will enhance learning goals in key areas focused on student needs, she says.

Project-based learning is not a new strategy for most Chicago teachers. "What's new is showing teachers how to address standards-based instruction through project-based learning," Jackson says. "This training gives them a model for building a project using standards-based curriculum as the basis, and time to create their own digital-age, interactive learning projects."

A Leader Emerges

Tina Below was one of Chicago's first Master Teachers trained through the Intel Teach to the Future program. During the 2002-03 school year, she delivered eight training sessions to her colleagues.

"She just took off with the Intel Teach to the Future training," says Jackson. "She's a mentor to other teachers. She has such a passion for enhancing teaching and learning through the use of technology."

Together, the district and Intel have nurtured Below's leadership skills. She underwent additional training to become a senior trainer for Intel Teach to the Future. Now part of the office of e-learning, she is responsible for training Master Teachers in the Chicago district. So far, 48 Chicago teachers have qualified to become Master Teachers.

Word of mouth is attracting many new participants. Below also recruits at the office of technology services showcase events called Tech Talks, delivered in local areas to help teachers stay aware of resources, support, information, and professional development opportunities. "Teachers flock to Tina's sessions," Jackson says. "They are clamoring to be part of this."

Teachers receive no compensation for participating in the 40 hours of professional development. However, participants earn credit toward recertification. It's a hefty investment of their time, Below admits, but she says teachers are motivated "because they want to be able to integrate technology in their classes."

Participants come with a range of backgrounds. They include elementary and secondary teachers, including some health, art, and physical education specialists as well as experienced technology coordinators. "They all say they learn something new," Below says, "no matter how much experience they have had with technology. They like the idea that they are creating a project they will be able to share with their students and with other teachers."

Jackson sees great value in a program that nurtures teacher leadership skills. "The teacher-to-teacher training makes a big difference. A teacher like Tina has been a primary teacher. She has been a technology coordinator. She has been a Master Teacher. This is a person who understands the issues of the classroom. That's how you make an impact, when you have that credibility."

In hindsight, Jackson can see it was a critical decision to rely on local teachers to deliver

the technology training. "We rely on our own teachers who understand Chicago schools, the priorities and the challenges." And once teachers complete the advanced training necessary to become Master Teachers, Jackson adds, "they get to go out and teach their peers. That's powerful."

A New Model

As part of overall school improvement efforts, Chicago is continuing to strengthen its professional development offerings, combining technology integration to enhance literacy, math, science, and social sciences. A new professional development continuum identifies five levels of proficiency. The Chicago Online Skills Assessment helps teachers identify their basic skill proficiency levels and prescribes course work tailored to meet their needs. As they master new skills, teachers advance along the continuum from an introductory level to the highest level of proficiency, where they share experiences and mentor their colleagues while receiving hardware and software incentives to apply what they have learned in classrooms with students.

"This approach to professional development is comprehensive," Jackson says. Already in the planning are empirical studies to track the impact on teaching and learning. Jackson is convinced the district is on the right track, adding, "Intel Teach to the Future came along at a key time and helped us create our technology integration continuum. Now we're taking technology-integrated professional development to a new level."

Elementary and Secondary Education

Mentors Help Student Researchers Shine

Teachers Can Help Match Students With Expert Adults

Students who tackle challenging science research projects, such as participants in the Intel International Science and Engineering Fair (Intel ISEF) and Intel Science Talent Search (Intel STS), tend to share certain habits of mind: curiosity, persistence, and creativity in solving problems. Many also know when to seek help. Working with a mentor can be a powerful strategy for success.

Making a Difference

Ryan Patterson of Grand Junction, Colorado, knows firsthand what a difference a mentor can make. When he was still in elementary school, Patterson was asking questions about electricity that stumped his parents and teachers. His favorite toys were extension cords and screwdrivers. A teacher in his gifted education program recruited John McConnell, a retired particle physicist from Los Alamos Laboratories, to mentor the inquisitive young student. For the next seven years, the two spent nearly every Saturday together.

Ryan Patterson (center) with his father (right) and mentor John McConnell (left)

"He helped me get a foundation in science," Patterson explains. They did hands-on activities, such as building electronic circuitry, that helped Patterson understand the basics of electrical engineering. They also talked about what it means to be a scientist, engaged in the process of asking questions and seeking answers. "Once I got to high school, I was ready to move into doing research independently," Patterson says. "When you know basics, you can go on and teach yourself more. But without that foundation, you wouldn't know where to even start."

Patterson went on to win top prizes and scholarships at both Intel ISEF and Intel STS for his engineering research project, a glove that converts American Sign Language to written text on a laptop or portable display. At the awards ceremonies, McConnell was Patterson's guest of honor, wiping his eyes while he watched his protégé reach the pinnacle of achievement. Now a student at the University of Colorado, Patterson has used some of his prize money to outfit a state-of-the-art laboratory to continue his research. He has traveled the world as a result of the science competitions, which he credits with "changing my life." But when he's home on vacation, he always visits his mentor. "He's become like a grandparent to me," says Patterson.

McConnell admits he was initially skeptical about spending his retirement hours as a

mentor. But from his first meeting with Patterson, he saw a passion, a focus of attention, and a spark for learning that he found impossible to ignore. "I started him with transistors. By seventh grade, he was doing a better job, technically, of putting stuff together than my technicians at Los Alamos. We just clicked," McConnell says of Patterson. "It was a perfect match. In mentoring, one of the secrets is to find both a mentor and a student who share the same interest."

McConnell's positive experiences as a mentor have inspired him to launch a K-12 math and science education center in Grand Junction, the Western Colorado Math and Science Center. In a 5,000-square-foot space made available by the local school district, fledgling young scientists come from more than 100 miles around to work alongside adult volunteers and "get their wings so they can fly on their own."

Making a Match

How do other students find mentors willing to share their time and expertise? Often, teachers play an important role in helping students connect with mentors and make the most of the experience.

Watch for Highlights

Watch the Intel® Innovation in Education Web site for highlights from the 2004 Intel Science Talent Search (Intel STS) and the Intel International Science and Engineering Fair (Intel ISEF). Coverage will highlight this year's winning projects and showcase the strategies that support student success.

Intel STS takes place in Washington, D.C., in March. Intel ISEF takes place in Portland, Oregon, in May. For more information, go to Intel STS and Intel ISEF.

Dr. Robert Pavlica teaches a science research class at Byram Hills High School in Armonk, New York. Many of his students have gone on to compete at Intel STS and other competitions, and Pavlica was a finalist for the Intel ISEF Excellence in Teaching Award in 2003. He also directs a professional development program, called Authentic Science Research in the High School, to support teachers in developing inquiry-based science research programs.

One of Pavlica's instructional strategies is making sure each student finds an adult mentor who specializes in the field the student is researching. Some students work face-to-face with mentors, while others communicate via email or telephone. Often mentors can provide access to cutting-edge laboratory equipment or to other research opportunities at their university, organization, or lab.

In Pavlica's program, the teacher guides students in their search for a mentor. But first, he makes sure his students find research topics that capture their interest and become their passion. Then by doing Internet research and reading journal articles, students figure out who the experts are in the field that interests them. Within that pool of experts, they find their mentors.

Pavlica describes the next step: "You have the student write the expert a letter: 'Dear Professor, I realize you wrote 37 articles. I have read all your abstracts and studied two of your articles. I'm very interested in your topic and would like very much for you to be my mentor.'" Adds Pavlica, "Now, what is this professor going to say? Here's a high school kid in love with his work. It's like the son or daughter you never had who's fascinated by your research. How can you say no?"

The New York area is home to leading researchers—and potential mentors—in a wide

range of fields. Pavlica encourages teachers in less-populous areas to think creatively to recruit potential mentors at universities, government agencies, private companies, and other locations. "Of course, your students cannot do DNA research if there's not a DNA lab nearby. But there's probably a department working on environmental issues in most communities," he says, where students might find experts. He suggests using email to overcome geographic challenges. Students may also find summer opportunities to work with mentors at more distant locations.

Pavlica recalls one student who wanted to research how primates communicate: "For whatever reason, she loved chimpanzees. She found researchers in Washington State who work with primates. She started writing to the researchers. They told her they only work with college students and graduate students. She wrote back and asked if they would recommend something she could read. They did, and she wrote back again with her reactions. Then they told her that their chimps use sign language, so she put herself through sign language school. Finally, they asked her what she was thinking of researching. She suggested a spin-off of their research and convinced them to let her come out for a summer and work with them. She followed her dream."

A Variety of Opportunities

Patterson knows that his long-term relationship with McConnell is an exceptional example of mentoring. But the young man adds, "There are a lot of different circumstances where a mentor can help."

One of McConnell's best lessons had little to do with electrical engineering. In fact, the student wound up knowing more about engineering and computer science than his mentor, whose expertise is particle physics. What McConnell taught him was how to overcome the obstacles that can get in the way of innovation, regardless of the field.

As Patterson explains, "In Grand Junction, there are not a lot of technical things and opportunities. There weren't people there for me to consult. But John taught me what a scientist does if he gets stuck: research, read books, and consult experts. John taught me I could email experts, like the people who make chips or circuit boards, and ask technical questions. I operated as if I was an independent company, working on an invention. I used the same cycle that a professional engineer would. And John taught me all that—how to do research, how to get my questions answered."

"Probably instinctively, I taught him the way you go after a problem," McConnell says, "the way you work and look at things. Everything doesn't come easily. Some of the circuits we put together didn't always work. But I'm from that old school—I'm gonna fix this thing. I think he picked up on that, too. He has the tenacity to dig and dig and dig."

Running into a technical challenge "can feel like hitting a concrete wall," Patterson admits, "but once you get past it, your confidence grows." It was that drive that first impressed his mentor. "John saw that drive in me the first time we met," Patterson says, adding, "Of course, he didn't tell me that until much later."

Elementary and Secondary Education

Ask an Expert

Designer Matthew Brown Discusses the Value of Online Learning Tools

A decade ago, Matthew Brown was teaching history to middle school and high school students. He left teaching to earn a Ph.D. from Northwestern University's learning sciences program, and now works as a lead designer at Inquirium, an educational technology firm. He is part of the team of experts contracted to develop new software for Intel® Innovation in Education's suite of online thinking tools. The newest tool, *Prove It*, is expected to be available later in 2004 on the Intel Innovation in Education Web site. Recently, Brown took time to describe how interactive learning tools like *Prove It*, grounded in cognitive science, are changing the classroom experience.

Matthew Brown of Inquirium

When you were in the classroom, did you have access to the kinds of resources you're developing today?
There was absolutely nothing like this available. Like many teachers, I was at a school that was attempting to bring in technology. A lot of effort went into buying equipment, but very little conversation was happening about what we intended to do with this technology from a curriculum standpoint. That's why I left the classroom, to do what I'm doing today. You have to begin with the learning goals in mind.

What do you mean when you talk about "learning tools" or "thinking tools"?
Think of a microscope. It can sit there and do nothing, or it can do some pretty amazing things if you know what to do with it. The kinds of technologies that we design as a company—and that Intel is investing in as Web tools—are like that, too. Thinking tools available on the Intel Innovation in Education Web site, like *Seeing Reason* and *Visual Ranking*, are elegantly open-ended. Each supports a particular type of thinking and learning, but teachers use them in a bunch of different ways.

Do new tools mean new strategies for teachers?
New technologies involve some changes in practice. You always have to engage teachers where they are and build on their existing practices. The most effective situations happen when teachers latch onto something they're already doing. They take a problem they're trying to solve and see how a technology can help them address that. They integrate the technology within an existing practice, but use it to do new things.

What gives teachers the confidence to try new approaches with their students?
The most important thing to remember is that teaching is a learning process for the teacher. If you can provide an environment where teachers feel comfortable doing some exploring, they're going to feel more willing to experiment. The kinds of tools we're

developing with Intel will accommodate teachers who are less comfortable with technology, as well as those who are ready to improvise, trying to push the envelope.

What else helps promote successful learning experiences with a new tool?
There are many different levels of newness in the classroom when you are trying out a new technology. There's the newness of the technology itself—the clicks and buttons. There's the newness of the classroom dynamics. To use the technology, maybe students are now working in small groups or in a computer lab. And there may be newness of ideas and concepts you're dealing with, because the technology is helping you push on new aspects of learning. We try to help teachers limit the number of uncertain variables.

How does that work in practice?
A great way to overcome the newness of the actual tool might be to create structured worksheets that students can use as a stepping-stone. Worksheets can eliminate uncertainty about how the technology works. You can be working with one group of students, and the others will still know what to do. Providing a model for how to use the technology allows you to focus on the other aspects of teaching—the new concepts, maybe even the new instructional dynamics that are going on. Later, once students are more comfortable with the software, it's possible to eliminate some of that structure. Then students are ready to use the technology for more of the open-ended inquiry, to which we aspire. You can apply this same analogy to other aspects of newness. You could start with a concept or idea that the students are already comfortable with, and then jump into the technology that way. They're not focusing on a new idea and a new technology at the same time. The biggest issue is finding balance between what's accustomed in the classroom and what's new.

This sounds like a great model for learning in general.
We use the term *scaffolding*, or *cognitive apprenticeship*. It's about recognizing that there's a progression in learners' development and understanding of new ideas and new concepts. It's possible to support that development through decreasing levels of structure over time. You start by supporting it significantly with a lot of scaffolding. As you get more familiar, you remove some of those supports. Over time, as they develop more competencies, students pick up more of the responsibility for their own learning.

Does this model apply to teachers as well as students?
Everything I've said about students can also be applied to teachers. Providing teachers who are new to using a technology with structured context will help them feel more comfortable exploring it. Over time, they develop their own ideas and begin to innovate and improvise and adapt materials to accommodate their own ideas.

When teachers are using these learning tools effectively and with confidence, what are the potential benefits for students?
More than ever before, these new learning tools give students the potential to actively construct knowledge, build things, and create things in a way that no other media have been able to support in the past. Books, by comparison, are a decidedly one-way form of communication. Technology offers the opportunity both to convey ideas and to allow for the construction of ideas. That's a huge opportunity.

Can you give us a preview of what's in development?
The tools I'm most excited about support students and teachers in doing the same kinds of inquiry that professionals engage in, in fields like science or history. While it's great to use the activities of professional historians or scientists as a model, you also have to

recognize that you're dealing with learners who have developmentally particular needs and abilities. For example, scientists do a lot of data analysis with large data sets. A scientist may be able to look at a spreadsheet, plug data into a graphing program, and do some complex statistical analysis. Students may not yet be able to do that, but technology can support them. Technology can make some of these steps invisible so that students can go ahead and develop the larger skill of developing a hypothesis.

So, the tools in development will provide some of that scaffolding?
Prove It offers a good example. One of the things that learners have a lot of difficulty with is constructing well-reasoned, well-supported arguments that have clear claims and use evidence to support those claims. *Prove It* came out of discussions with a group of teachers and developers at a Web Tools Forum sponsored by Intel Innovation in Education. Researchers from Inquirium and Intel have worked together to develop a tool to provide support in an area where students typically need help by making the structure of an argument visible. It encourages students to articulate certain things, like: Who is the author of this evidence? What is the reliability? Adults or more experienced practitioners do these things automatically when they make an argument and support a claim. But you can't ask students to investigate complex problems and engage in authentic, open-ended inquiry without providing them with support in one of the key elements, which is developing an argument.

Does the tool capture what students are thinking?
This is where the learning meets the teaching. A tool like *Prove It* makes student thinking visible in a manner that is teachable and learnable. A key learning goal is to help students determine the reliability of a piece of evidence, so we've built in the ability for teachers and other students to provide feedback about a claim. It's one thing to capture their thinking, and it's another to provide opportunities to actually work with it.

Are you eager to see how teachers use this tool?
I can't wait. By developing these kinds of tools, we are providing the opportunity for teachers to do what they do best. You have to have faith, as a designer, that if you give teachers an opportunity, they're going to do something great with it.

Elementary and Secondary Education

TV Show Takes Students on Math Adventures

Intel Sponsors Multimedia Project

Young viewers tune into *Cyberchase**, a popular television show on PBS (Public Broadcasting Service) Kids, for a chance to watch animated heroes solve crimes in cyberspace. But this is no idle entertainment. Each episode, geared for children ages 8-12, comes packed with big ideas in mathematics.

Intel is sponsoring the program as part of its efforts to improve math and science education. "Education with an emphasis on mathematics and science is a critical focus area for Intel," says Wendy Hawkins, Intel director of education. "Sponsoring 'Cyberchase' allows Intel to help provide a quality program that teaches children the importance of mathematics in everyday life and makes it fun."

In addition to the action-packed television episodes, *Cyberchase* includes a multimedia Web site, complete with activities for students and lesson plans and instructional strategies for teachers. The online resources show how *Cyberchase* addresses the standards of the National Council of Teachers of Mathematics (NCTM) for grades 3-5. The show also models mathematics as an active process, useful in everyday life.

Cyberchase includes a multimedia Web site, complete with activities for students and lesson plans and instructional strategies for teachers.

For example, one episode shows the young heroes using logic to unlock a vault and rescue a city from a villain's plot. The adventure reinforces algebraic thinking, and demonstrates that patterns can be used to make predictions. The heroes of the show often have to try and try again to solve each mystery. That underscores the value of persistence as a problem-solving strategy.

Each episode and related lesson plan addresses specific NCTM standards. A search feature of the *Cyberchase* Web site lets teachers find the episodes and lesson plans that match their learning goals in areas such as graphing, algebra, geometry, or fractions.

The overall goals of the show are to:

- Foster a positive attitude toward mathematics
- Ensure that children remain engaged with mathematics during their school years
- Provide opportunities to develop skills in mathematics reasoning and problem-solving

- Demonstrate the usefulness of mathematical thinking
- Motivate children to approach mathematics with enthusiasm, confidence, and competence

> *Cyberchase* models mathematics as an active process, useful in everyday life."

Daily television episodes feature a cast of animated heroes who use mathematics to solve crimes in cyberspace. Each episode is 22 minutes long and addresses one of the big ideas of mathematics, such as measurement or data analysis and probability. The series features the voices of Christopher Lloyd as "The Hacker" and Gilbert Gottfried as "Digit," with guests including Jane Curtin, Jasmine Guy, Al Roker, and Bebe Neuwirth.

A three-minute segment at the end of each show shifts from animation to the real world. Young stars named Harry and Bianca apply the same math concept that was featured in the animated segment to solve an everyday problem. The fast-paced segments encourage viewers to try using problem-solving strategies themselves.

Thirteen/WNET New York and Nelvana produce "Cyberchase," with major funding provided by the National Science Foundation, Public Broadcasting Service, and the Corporation for Public Broadcasting.

To find out about upcoming episodes or resources for the classroom, visit http://pbskids.org/cyberchase*.

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Finding Ideas That Fit

New Story Finder Helps Teachers Navigate *An Innovation Odyssey*

If you're a classroom teacher looking for inspiration, how do you find an idea to match your specific interests? *An Innovation Odyssey*, an online collection of more than 350 stories shared by teachers from around the world, offers a wealth of ideas for integrating technology into the classroom. A new Story Finder makes the global online collection easier to navigate.

Story 118—Space Studies: **Malaysian students build water rockets to learn about physics**

The Story Finder allows for searching the collection by grade level, subject, and type of technology. For example, if you're a fifth-grade teacher looking for a math project that uses handhelds, or a high school teacher interested in digital music ideas, you can narrow your search to locate just those kinds of stories.

Story 110—Making Sense of Data: **Irish students connect with U.S. geologists**

Another way to browse the large collection is to sort by learning themes, such as invention and design, planet earth, or learning from the past. The Story Finder allows teachers to browse all the stories in a particular theme.

Now in its third year, *An Innovation Odyssey* showcases teachers who use technology in innovative ways to support student learning. A different story from the collection is featured every weekday.

Visit *An Innovation Odyssey*, an online project of Intel® Innovation in Education, at www.intel.com/education/odyssey.

Higher Education

Inside the Digital Home

Intel Researcher Shares Insights on Campus

From personal computers and digital cameras to high-definition televisions and entertainment systems, "everything in the home is going digital," says Mark Abel, director of solutions architecture and innovation in the Intel Desktop Platforms Group. The challenge for technologists is figuring out how to connect all these different devices and create seamless home networks for sharing information in new ways.

Abel's group at Intel is involved in advanced development to make the digital home a reality. The topic is also proving a popular draw on university campuses, where Abel has visited through the Intel Technical Lecture Series.

"The digital home is a new area, a different way of looking at a set of problems and how we address them. It's a broad, solutions-oriented look at solving problems for real people."

"Students are searching for the next big thing," Abel says. "They're wondering what they should work on, what kinds of problems industry cares about. The subject of the digital home is exciting. It's a new area, a different way of looking at a set of problems and how we address them. It's a broad, solutions-oriented look at solving problems for real people."

All that makes the digital home an ideal topic for the higher education lecture series, which fosters collaboration and intellectual exchange between Intel and select universities. Leading Intel engineers and researchers are available to cover a range of topics, from wireless technologies to manufacturing issues to new applications of technology in fields such as home healthcare.

Innovation at Home

In the digital home arena, Intel's long-term goal is to promote innovation, Abel explains. Intel is a founding member of the Digital Home Working Group, a collaborative effort launched in 2003 by 17 industry leaders from the fields of consumer electronics and personal computing. The group is developing industry standards that will enable digital devices to connect and share information.

Today's homes typically have two clusters of digital technology. Abel explains: "There's the entertainment cluster where people listen to music, watch movies or television. And then there's the data cluster, where you have the personal computer with printers and other peripheral devices. Those clusters are becoming more connected."

Already, Universal Plug and Play (UPnP) standards are helping to make the digital home possible. Developed in part by a team in the Corporate Technology Group at Intel and by Abel's Desktop Platforms Group, the standards make it possible for devices to communicate and exchange capabilities.

"Imagine a wireless PC peripheral that sits in your living room. It allows your television, DVD, and stereo system to become networked. Now this becomes a window for the Internet and for all the information you have stored on your PC. You can distribute data around the home very easily."

The new standards "will help make sure all of that stuff works well together and is relatively easy to use for people who are not technologists," Abel says. Ease of use is not the only goal for this platform of interoperability. "Innovators will start seeing new product opportunities in the digital home," he predicts. "Look at what's happened with the Internet. It started with a foundation of a few simple protocols, and has allowed people to create companies, create products, and innovate. We're trying to make sure that happens in the home."

Researchers see the personal computer playing a critical role in the digital home. "We want to make sure the personal computer has a really solid role here," Abel says. "Of all the devices in the home, the PC has the best processing power, the most storage, the best networking capability."

On Campus

Abel has delivered lectures about the digital home on U.S. campuses, such as the University of Illinois, University of Michigan, and the University of Southern California, and in other countries, as well. Last year, he spoke to Chinese audiences at Shanghai Jiao Tong University and ZheJiang University.

Typically, he sets the stage by recapping ethnographic studies conducted by the Intel People and Practices Research Group. Social science researchers have developed usage models to describe "the kinds of things people want to do with technology in the home, but can't yet," he says. "From there, we break it down into what kinds of technologies are required. What kinds of things are missing to make this vision a reality?"

For example, Abel's group has driven industry development of a device called the digital media adapter that can be used to bridge the PC-consumer electronics connection. "Imagine a wireless PC peripheral that sits in your living room. It allows your television, DVD, and stereo system to become networked. Now this becomes a window for the Internet and for all the information you have stored on your PC. You can distribute data around the home very easily." For instance, users can display digital photos or video clips on their large-screen televisions or play music downloads over their home stereo systems.

Before long, Abel predicts, applications will move beyond home entertainment. "The goal is to allow a broad range of usage models around the home. We're starting with entertainment," he says, "but we'll certainly extend this to other areas of the home eventually."

The Buzz

When talking to university audiences, Abel knows he is speaking with some of the innovators of the future. "These folks eventually will be our customers, our partners, our employees. We want these people to know about the technologies we're working on." It's common for students to linger after a lecture ends, asking follow-up questions or inquiring about career opportunities.

Benefits extend beyond the lecture halls. When Intel researchers are on campus to deliver a guest lecture, they also make time for informal conversations with professors. Those

discussions might lead to research proposals that Intel will consider funding. On the lecture circuit, Abel adds, "you spend most of the day talking to people, making connections you didn't have before."

The Intel researcher also enjoys the chance to learn something new himself. "When I go to campus, invariably I learn or see something new just by being there," he says. A few years ago, he happened to talk to people at the University of Michigan just as a brand-new program was taking off in popularity. "It was called Napster. It was the buzz on campus, and Intel was not yet aware of it. A lot of times, things happen on college campuses first, and it's not always from a professor doing research."

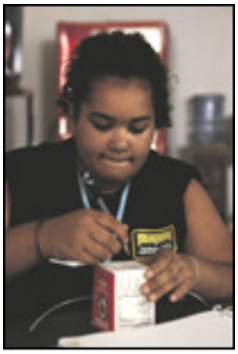
To learn more about the Intel Technical Lecture Series, go to www.intel.com/education/lectureseries.

Community Education

Design and Discovery Adds New Resources

User Feedback Leads to Additions for the Hands-on Curriculum

Design and Discovery, a multimedia curriculum for teaching students in the middle grades about design and engineering, has just been updated to provide additional instructional resources. The most recent additions are the result of user feedback and interviews with facilitators who have held *Design and Discovery* programs during the past year. The inquiry-based curriculum is now being used in a variety of formal and informal settings, including summer camps, after-school programs, and regular classrooms.



In Session 1, Jump Into Design, students carefully examine the form and function of standard paper clips.

One new session of the curriculum includes a series of activities about materials engineering, expanding the Engineering Fundamentals section. As students take part in the hands-on activities, they learn to apply the strategies used by materials engineers and scientists. While testing samples of metals, ceramics, polymers, and composites, students also learn about important concepts in physical science. Knowing more about the properties of different materials proves helpful later in the curriculum, when students go on to design and test their own working prototypes of new products.

In Session 5, *Making Machines*, students makes a rolling toy

Also new to *Design and Discovery* are Key Concept pages to introduce the first 12 sessions in the sequential curriculum. Supporting information is provided for facilitators on concepts emphasized in the session, such as how electrical circuits work, what product research involves, or how simple and complex machines work. *Design and Discovery* also includes short video clips for facilitators to watch before they lead some of the hands-on activities, such as making a mechanical toy or lighting up an LED display. Links to other Web sites are included, providing additional information for further study.

New features designed for students' use include short profiles of working engineers from a variety of disciplines. By reading about a mechanical engineer who designs ships or an environmental engineer who works on cleanup projects at industrial sites, students get a sense of the varied career opportunities in engineering.

To help students get excited about pursuing their own projects, *Design and Discovery*

also includes three short video clips featuring students who have gone through the curriculum. They describe the process they have used to develop and test their own inventions, and display the pride that comes with creative problem-solving.

As students take part in the hands-on activities, they learn to apply the strategies used by materials engineers and scientists.

It's no accident that *Design and Discovery* continues to evolve. Curriculum developers from Intel® Innovation in Education are following the same cycle of invention, testing, and making improvements that *Design and Discovery* teaches.

The complete curriculum is available online from Intel Innovation in Education at www.intel.com/education/design.

Community Education

Clubhouse Network Continues to Grow

Detroit and South Africa Are Latest Expansion Sites

The Intel Computer Clubhouse Network continues to grow, bringing access to technology and new opportunities to youth in all corners of the world. The latest additions are four Clubhouses in Detroit, Michigan, and two Clubhouses in South Africa.

The Detroit Clubhouses opened in October 2003 through a collaborative effort between Intel and the City of Detroit. Mayor Kwame Kilpatrick called the city's new Clubhouses "a rich, extraordinary opportunity for the young people of Detroit." The technology-rich Clubhouses make multimedia resources available for informal learning and self-expression in areas such as music, art, and filmmaking. Adult mentors volunteer to help young people become confident, self-directed learners.

The Detroit-area Clubhouses are sponsored by the Boys and Girls Clubs of Southeastern Michigan (Holden and Diehl clubs), Latino Family Services, and the Northwest Activities Center.

In South Africa, two new Clubhouses opened in 2003, a year after the first Clubhouse on the continent was launched in Newton, Johannesburg. The second Clubhouse is located in Etwata Township, and the third is in Soweto. Intel has worked with the South African Association of Youth Clubs to identify communities that would most benefit from new programs.

A young man named Mandla Njokwane spoke at the first anniversary of the Clubhouse in Newton, describing what the program has meant in his life:

"Because of the hardships and difficulties that many young people like me go through, I left home in 1996 to live in the streets of Johannesburg. Life in the streets is very difficult and nobody cares about you. I came across the Clubhouse and asked if I could also be allowed in. To my surprise, I was more than welcome and was told access is free. The Intel Computer Clubhouse was my new home and family, and I met with very warm people. I attended every day and mastered all the technologies. I was then promoted to become a mentor." Njokwane went on to win the Africa ICT (information and communication technology) Achievers Award for Innovation in 2003. He added, "My future is very bright."

To learn more about the Intel Computer Clubhouse Network, including future openings, visit the Intel® Innovation in Education Web site, www.intel.com/education/icc.