

New Skills, New Experiences - The Future of Learning - *Highlights of the ITEST 2005 Symposium*



ITEST Project staff and invited guests were riveted by the panel on the importance of IT & STEM learning

On February 8-10, 2005, Education Development Center's ITEST (Information Technology Experiences for Students and Teachers) Learning Resource Center and the National Science Foundation (NSF) hosted the Second Annual ITEST Summit in Washington, D.C. Premiering this year was a Symposium for ITEST Project staff and leaders from industry, youth development, formal education, government, and academia. The Symposium was organized as a venue for ITEST projects to exchange ideas with thought leaders on building the IT skills of students and teachers through experiential, learner-centered STEM (science, technology, engineering, and math) activities, and to explore effective ways to build awareness of science and technology careers in both formal and informal learning environments.

funds are used to promote careers in the high technology workforce... and ITEST builds on the history of NSF youth research programs such as Young Scholars, youth and community programs in ISE, and teacher professional development activities."

THE IMPORTANCE OF IT & STEM LEARNING: BEHIND THE ITEST AGENDA

The Symposium featured a freewheeling, insightful discussion of social, educational, and workforce dynamics that influence the development of the ITEST Program and have implications for the work of the projects. Presenters were asked to explore from their unique perspectives the following key questions:

- *How can ITEST have an influence on the workforce of the future?*
- *Why does our country need an initiative like ITEST?*
- *What does this work mean for Industry, Education, and Informal Learning?*

The speakers represented expertise in industry, workforce development, IT and higher education, and they were specif-

ically chosen to speak from the perspective of an outsider whose work runs parallel to and might inform the ITEST effort.

Key Dimensions of ITEST Projects' Work and Impact on Learning & Careers

- Experiential learning and the spirit of inquiry
- Modeling
- Mentoring
- Collaborative learning
- Cultural relevance
- Agents of change

Marjorie Bynum, VP of Globally Competitive Workforce at ITAA (Information Technology Association of America), kicked off the discussion. Ms. Bynum is a leading voice in the

training and development of IT workers. Her work at ITAA involves addressing the needs of IT employers for highly skilled workers, and expanding opportunities across the U.S. population for pursuing high-wage, high-skill IT careers. She confirmed the great need for ITEST—“College is too late to intervene”—and described the looming crisis in the form of a shortage in the IT workforce. While she recognized a growing concern for outsourcing of workers and international competition, she believes that the challenge for today’s educators is to prepare workers who have both minimum technical skill and maximum ability to adapt to an ever-changing work environment. This means cultivating non-IT skills, such as teamwork, project management, communication, etc.

“We need to hold onto and develop our competitive edge in R&D.”

— Marjorie Bynum

Internet software pioneer and leading venture philanthropist Mario Morino concurred that the current state of affairs with regard to the U.S. workforce looks bleak. He sees the real challenge for education is to reinvent itself to develop intellectually curious workers who possess more than a set of technical skills, but who in fact have essential creative and innovative ideas that can keep pace with the ever changing IT and global work environment. “Innovation comes from all areas, not just hard science,” he observed, “so concepts of and literacy with technology need to be integrated in all academic areas.” Helping young people develop a sense of inquiry and enthusiasm for STEM subject matter is far more important than IT training for specific job positions, recognizing that the latter still remains important to a range of technical entry-level positions in the workforce. He asserted that informal learning has a crucial role to play in this regard.

“Our next generation workforce needs to think globally, applying it to their local worlds; be bilingual; and have a greater awareness of the bioscience area as it will increasingly permeate our lives in this century as IT did in the 1960-2000 period.”

— Mario Morino

Dr. Kaye Howe is Director of the National Science Digital Library (NSDL) Core Integration group and is based at University Corporation for Atmospheric Research. The NSDL was created by the National Science Foundation to provide organized access to high quality resources that support innovations in teaching and learning at all levels of STEM education. The Core Integration group coordinates

and manages the core library and supports the NSDL community. Dr. Howe brought an educator’s perspective to Mr. Morino’s comments. She asserted that the problems formal education faces impact academia and higher education as well as the early grades. She posited that a reawakening needs to take place that would embrace the profound importance of personally motivated learners. For her, “the emphasis on informal learning is critical.” Further, she spoke about the importance of “empowering children and teens—showing them that they are significant.”

“You don’t have to teach people intellectual curiosity — you have to keep it from being beaten out of them.”

— Kaye Howe

Dr. Ralph Coppola, Director of Worldwide Education for PTC, developer of Product Lifecycle Management (PLM) solutions, shared his specific concern with regard to developing a skilled workforce for the present and future. His area of expertise—the aerospace and defense industry—requires highly skilled workers and, given the sensitive nature of the work, cannot be easily outsourced to foreign workers. The average aerospace and defense worker is aging rapidly (as of 2001, 53% were 45 years old or older and 33% were eligible to retire in 5 years), and this industry, which has historically been a major driver in the entire U.S. economy, is at great risk if a new generation of workers cannot be adequately prepared to serve its needs.

“Who will be the innovators of tomorrow?... The traditional candidate for STEM advanced degrees and careers is not enough — we need women and minorities in the pipeline to ensure innovation.”

— Ralph Coppola

Dr. Coppola asserted that, “We need to engage kids in non-traditional ways that infuse discovery and exploration into learning. An increase in the quality of the educational offerings and motivation to pursue careers in STEM need to be rooted in authentic real-life applications like design work. The goal should be to produce students that are highly skilled, innovative and adaptable.”

KEY DIMENSIONS OF ITEST PROJECTS’ WORK AND IMPACT ON LEARNING & CAREERS

Through a series of interactive sessions that engaged both ITEST projects and external thought leaders in dialogue, the Summit Symposium enabled all in attendance to

explore the ITEST Program's impact on IT learning and careers. Breakout sessions focused on the unique needs of teachers and students as learners, as well as such cross-cutting themes as community resources and collaboration, equity and diversity issues, inquiry-based learning strategies, and industry partnerships. Of the various methods and critical elements cited by presenters, six key elements, or *dimensions*, of the ITEST work emerged.

• Experiential learning and the spirit of inquiry

Throughout the Symposium, ITEST project staff emphasized the power and importance of hands-on, inquiry-based learning experiences to engage participants. **Mary Ann Steiner, Co-PI of MyBEST**, explained that through project-based learning there are multiple hooks—some participants are initially most interested in the creative side of telling a story and then begin to care about creating digital images and animated objects; other participants get interested because of the opportunity to use technology to bring a story to life. Either way, the critical point is that “kids are motivated by their passion.”

In the session on *Engaging Youth through Experiential STEM Learning*, **Dan Calvert of the Salmon Camp Research Team** advised colleagues to “develop effective curriculum that is fun and relevant for students. Hands-on engagement with GPS, for example, to collect data on water quality and then manipulate that data in the lab, helps learners develop deep comprehension of science concepts and program objectives. Field experience is important.” Such experiential learning empowers teachers as well as students. **Patty Watts, PI of DAMSALS²**, discussed the value of informal learning for their teacher participants: “We use field experience for engagement and exploration in the learning cycle.... The teachers bring the field learning to the classroom—and do small-scale data collection in the classroom.”

The centrality of the scientific process to the ITEST projects' work was reiterated by different teams. **Jeff Lockwood, Co-PI of Eyes in the Sky**, summed it up: “In scientific inquiry/authentic research: Teach the rules, process, and tools; model the process; let the teachers and students do it; then, gather and analyze the data.” In another panel, *Inquiry-Based Learning Approaches*, **Dr. Simona Bartl, PI of Inquiry-Based Marine Biotechnology and Bioinformatics**, explained their approach: “It's all from a scientist's point of view: inquiry and experimentation.... How do you pose a question? You must have a certain level of knowledge to begin, then work to formulate a question that can be answered by your investigation. Learners need examples.”

This emphasis on learners asking their own questions, and pursuing the answers for themselves, reflects a pedagogical philosophy that can be at odds with norms and practices in

school systems today. As **Chip Lindsey, PI of DesignIT Studio**, explained, “Our work is process-oriented—communicate, present, use media.” It's about the “right process vs. the right answer.” Bringing this learning process, this spirit of inquiry, into the classroom is challenging. As one participant in the inquiry-based learning session commented, “There's a tension in our project between inquiry-based learning and ‘standards’-based answers.” It was further noted that, “There are many social, cultural barriers to using inquiry-based methods in schools.” This climate makes the work and influence of the ITEST projects all the more important.

• Modeling

Several ITEST project teams emphasized the importance of modeling in both youth and professional development programs. In the session on *Building Teachers' Skills through STEM Experiences*, **Eric Klopfer, PI of New Mexico Adventures in Modeling**, argued that teacher professional development must reflect the learning style you want to teach: “The best way is to train teachers to go through the same process as the way youth learn technology.... teachers learn through working as their students would. Facilitators also play the role of learners.” This method, he explained, includes “modeling real scientific practice through simulated systems, modeling classroom practice (case studies), creating many ways to do this successfully in the classroom, creating a comfortable environment, and creating a community of learners.”

“Everyone models a new system and learns together — teachers and students as co-learners.”
— Eric Klopfer

Modeling, as well as mentoring, was cited as a powerful way to reach and engage young people directly. **Steve Moore, PI of Ocean Explorers**, asserted, “Role models are very important in showing students they can do IT.” To illustrate this point, he recalled an event at a Los Angeles high school: “Hispanic students were surprised to see Hispanic scientists.”

• Mentoring

Involving career professionals as mentors was reported to be a key strategy for ITEST projects in their efforts to promote STEM learning and careers. In the session on *Exploring STEM Careers*, **Diane Miller, PI of YES To Technology**, advised, “Give scientists who are involved in the program the list of SCANS skills (U.S. Departments of Labor and Education Secretary's Commission on Achieving Necessary Skills) and ask them to address these competencies” in their activities and conversations with students. These mentoring relationships can help sustain the interest and engagement

of ITEST participants. According to **William Sofer, PI of Bioinformatics: The Rutgers Initiative in Teacher Enhancement (BRITE)**, mentoring is “one of the great contributions that GE Healthcare brings to our partnership.... They advertised throughout the corporation in New Jersey for scientists to go into schools and help with the research project that the kids are pursuing. There's a tendency for us to lose touch with students during the school year; mentors are in schools regularly. Teachers can use them in a variety of ways.”



Patty Watts, PI of DAMSALS², presents for the session on Building Teachers' Skills through STEM Experiences

ITEST project staff noted that mentors within the participant groups also make a difference in the learning experiences and engagement of the rest. One comment was that the very motivated teachers do encourage and mentor the others either formally or informally—“you need a few of those to keep everyone else going.” Similarly, youth lean on and draw inspiration from each other, and it was recommended that project teams “develop young people as mentors—they can be very influential with their peers.”

• Collaborative learning

Cultivating a learning community and leveraging group dynamics for more powerful learning experiences underpin the philosophy generally embraced by the ITEST projects. For **Mary Ann Steiner (MyBEST)**, “learning how to support, listen, and learn from each other” are core values of their youth-based program. She elaborated: “Pausing to hear each other and to discuss what is being discovered about the challenges before them” sharpens participants’ observation and analysis skills and builds their confidence in stating their point of view so that the group can make thoughtful decisions. Ms. Steiner pointed to the evaluation, which reported this program as a “social/respectful/fun learning environment.”

Camaraderie can also help sustain the interest and commitment of teachers. **Steve Moore (Ocean Explorers)** noted, we have an “apprenticeship model, including team organization... teams get to know each other very well—this cohe-

siveness has greatly aided retention.” Moreover, he observed that, thanks to this “community of practice—where you run into the same problems and solve them together—teachers have really developed compassion for their students.”

A leading expert in the field of evaluating science education programs and a respondent for the *Building Teachers' Skills* panel, **Dr. Frances Lawrenz of the University of Minnesota** advocated cultivating a learning community in the form of communities of practice: “In order to get long-term effects from this work, you need to build communities of practice... Think about a structure to maintain continuous professional development. We know that teachers need time to implement, as well as ongoing learning, and opportunities for further exploration.”

• Cultural relevance

Being deliberate, not only about the structure of the learning community, but about the cultural context and the needs of various stakeholders, is another essential component of the ITEST projects’ work. In a panel devoted to community collaboration, **De Anne Stevens, PI of MapTEACH**, whose project team works collaboratively with members of the local Native American community, advised, “Ask what is important to them—elders don’t want technology to take over learning; they want to teach traditionally.” She reported that the MapTEACH team “had to develop unobtrusive ways of merging technology with tradition. Tribes welcome technology if it helps to document their land/environment—though some information is not to be shared outside of the tribe.”

Dan Calvert (Salmon Camp) articulated the value of being responsive to the cultural context, and, what’s more, leveraging these qualities to engage participants: “Tap into the unique sense of Native Americans’ identity and culture in the North West—cultural pride, awareness, elders, and history are important resources for the program. Try to channel this energy.”

This strategy of grounding their programs in the local culture and drawing on community assets emerged as a cornerstone of the ITEST projects’ work. Based in a rural environment, the **DAMSALS² project** encourages teachers “to think about how their learning is tied to the local environment—what high-tech job skills are needed by farmers in this tech society,” said **Patty Watts**. In the panel on industry partnerships, **Greg Drake, PI of IMMEX**, shared this lesson learned: “We had the first workshop, and invited partners... didn’t click. We had come up with partners and forced them on teachers. They didn’t know each other, and the content didn’t necessarily match. Partnerships are now generated by teachers—for example, parents of kids, relatives, insurance agents.”

In another vein, empowering participants and being inclusive is made much easier with modern technology tools that offer many ways to address special needs, noted **Mary Lester, Executive Director of the Alliance for Technology Access**. “In fact, many people in our society have disabilities and we don’t know it or recognize it. Oftentimes people think of disabilities *after* they think of all the other qualities that make people different, rather than thinking in an inclusive way from the beginning.”

• Agents of Change

Building the interest and capacity of participants to effect change in themselves, their communities, and ultimately, society at large is another key dimension in the work of the ITEST projects. This approach surfaced in the session on *Addressing Equity and Diversity*. “Develop self-efficacy in youth; this is about more than teaching technology skills,” observed **Sarita Nair, Co-PI of the ITEST LRC**, “it is also about youth development. Students need experiences that build self-esteem and strength to persevere and overcome obstacles in the ‘real’ world, and to be agents of change.”

Responding to the panel on engaging youth, **Pam Garza, Director of the National Youth Development Learning Network with the National Collaboration for Youth**, reflected, “We are in the work of being subversive, when we work with young people. We want them to be the active change agents in their own lives... Once you open the door of inquiry, you open the door to ask those harder questions and solve those harder problems, whether it’s through IT, math....”

“What was exciting about what I heard from all of you, is you are the models of inquiry.... It is a change of direction, to be a person of inquiry.” — Pam Garza

For **Jeff Lockwood (Eyes in the Sky)**, change starts within, at least in the case of promoting STEM careers to young people. He opened his presentation with this directive: “Ask for teacher change.” For another project team member, speaking at the panel on equity and diversity, agents of change should also be recruited to support learners in the STEM fields from outside the immediate stakeholder group: “Seek advocates from diverse backgrounds (e.g., have men as advocates of girl-focused programs).”

Insights into including and leveraging partners as agents of change were shared during the session devoted to *Industry Partnerships*. One project team member asserted, “Partners need to be engaged in doing things together—each working in the classroom, solving problems... building relationships, accountability. Partners need your success for their credibil-

ity. Give partners what they need to help you.” Speaking for industry, another participant commented, “As an industry partner, it can be disheartening to hear, ‘Well, no, that won’t work.’ We need to know what will lead to real changes.”

Addressing this stated need in her remarks, **Kavita Singh, Executive Director of Community Technology Centers’ Network (CTCNet)**, asserted, “Workforce development is not just about IT skills. It’s about how to *use* technology.... We want students to learn how to *do*, not just to memorize—these are education policy issues. Companies complain we aren’t preparing the workforce for tomorrow, but,” she continued, “if industry is really interested in effecting change, they need to focus on policy.”

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This first open forum on the results of the ITEST program to date illustrated how central and interconnected the themes are to a range of stakeholders. Formal educators recognize the importance of new skills and approaches that match the needs of the 21st century workforce. Youth development advocates and those in the informal sector understand how their historical focus in enriching, experiential learning can in fact be a necessary complement to the school day. And, young people can indeed be drawn to STEM if learning is engaging and relevant to their lives and needs. In the coming years, the ITEST projects and the LRC will continue to investigate and showcase these important emerging lessons and draw diverse stakeholders to champion these new learning strategies.

About ITEST

The Information Technology Experiences for Students and Teachers (ITEST) program was established by the National Science Foundation in direct response to the concern about shortages of IT workers in the United States. The ITEST program funds projects that provide opportunities for both school-age children and teachers to build the skills and knowledge needed to advance their study and to enable them to function and contribute in a technologically rich society. The ITEST National Learning Resource Center at EDC supports, synthesizes, and disseminates the program’s learnings to a wide audience.



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