

Think big, start small. Port Discovery Children's Museum in Baltimore embarked on a "small" journey in 2008 by stepping out of the comfortable confines of its traditional science offerings of weather, space and water. With the assistance of the NISE Network, (Nano Informal Science Education Network), Port Discovery moved into uncharted territories: the tiny and mysterious world of nanoscience and technology.

Port Discovery's Nanoscience Initiative goals were very basic, very small and developmentally appropriate.

1. Children will be introduced to nanoscience as the science of things that are really, really, really small...smaller than the eye can see.

2. Children will discover that when things become nano they behave differently.

3. Children will discover that STEM concepts are fun, and you are never too young to be a scientist.

During NISE Network conferences and workshops, museum staff learned about nanoscience and best practices for engaging visitors. Within a year, Port Discovery was offering solid nano programming, but they needed a partner to deepen the experience. Introduced by the Mid-Atlantic Region NISE Network Hub, Port Discovery and the University of Maryland's Materials Research Science and Engineering Center (UMD MRSEC) joined forces in 2009.

Established in 1996, UMD MRSEC is a cutting-edge research center committed to excellence in science and engineering education. Its service-learning approach capitalizes on the scientific and technical expertise of researchers (professors, post docs, graduate and undergraduate students) to provide out-



During the Small Wonders kiosk science programming, UMD MRSEC staff explain the tiny wonders of nano to museum visitors.

reach programming to the community on nanotechnology processes and techniques.

In 2008, MRSEC's pre-partnership collaboration with Port Discovery for the museum's first NanoDay demonstrated that MRSEC could become a key player in offering nanoscience experiences for museum visitors. MRSEC scientists and engineers worked well with museum educators, and through NISE Network support, new nanoscience programs blossomed at the museum. NISE Network-sponsored NanoDays became an annual spring break event. New NanoDay kits with a variety of nanoscience activities for children of all ages were provided annually. In spring 2011, the Small Wonders kiosk, developed through a mini grant from the NISE Network and the National Science Foundation (NSF), was installed on the museum floor allowing education staff and volunteers to use NanoDays kits with visitors anytime. Finally, MRSEC began conducting nano activities at the museum's Discovery Days for children with special needs.

Chosen for its young target audience, Port Discovery hosted a nanoscience mini-exhibit pilot entitled *Nano: Discover and*

Imagine a World You Can't See in the summer of 2011. This (tiny) twenty-square-foot exhibit, designed by the NISE Network at the Science Museum of Minnesota and funded by NSF, was the first of its kind for visitors ages three and up. *Nano* can now be found in science centers and children's museums across the country. Popular among kids of all ages and their parents, the exhibit explains the basic concepts of nanoscience and technology in an interactive setting. The exhibit was the big break for Port Discovery's nanoscience initiative,

opening up new possibilities to museum staff and partners including field trip and fee-based programs and a very successful afterschool program. During the spring of 2013, a five-week outreach version of the program served 360 children at eight different sites throughout Baltimore City.

Port Discovery's nanoscience initiative further expanded with the addition of the interactive mini-exhibit, *NanoFabulous*, developed and built by the UMD MRSEC with content feedback from Port Discovery. *NanoFabulous* includes five components that invite visitors to explore nanotechnology processes and instruments, including a cleanroom, a magnification table and a scanning probe microscope built from LEGOs. The exhibit is popular among families with children ranging in ages from four to twelve and with school groups grades two to five.

Benefits have accrued on both sides of the partnership. UMD graduate students provide special school group programming for third and fourth graders. Working with the public—especially the younger audience—in the museum offers a learning experience for the researchers. Since the installation of

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COMMUNITY PERSPECTIVE

Donna Hammer, MRSEC Associate Director & Director of Education Outreach Programs

MRSEC researchers wanted to design an exhibit that helped people understand how scientists discover at the nanoscale and create devices from nano-sized building blocks. The *NanoFabulous* team was made up of twenty-three members including MRSEC staff, faculty, research scientists, post-doctoral students, graduate and undergraduate students from the departments of physics, chemistry and engineering. The project engaged materials scientists in the design, fabrication, testing and installation of a hands-on museum exhibition that can be used as an innovative and effective

mode for giving scientists new tools and strategies for communicating materials science and technology to the general public.

Societal benefits of this outreach project simultaneously created an "inreach" project for developing new communication skills and societal vision in the MRSEC staff, with outcomes designed to positively catch the attention of the university leadership, museum audience, pre-college schools and government officials. The transition from installation to interacting with museum visitors using the exhibit pieces increased the quality of the researchers' en-

agement with diverse audiences, ranging from young children and the adults accompanying them, to museum staff and leadership, to the press, and to a member of the U.S. Congress.

From formative and summative evaluation assessments, the UMD MRSEC team who participated in the project indicated that the partnership exceeded their expectations regarding the stages of development, testing, implementations and programming. New perspectives on the role of collaborations between research institutions and cultural institutions were formed.

Strive staff work with communities to help expand or form cradle-to-career education partnerships using a time-tested framework, curriculum, tools and case studies. This endeavor is not a program, but a process in which a community comes together around a common vision and organizes itself to identify what efforts get results for children, improves and builds upon those efforts over time and invests community resources in ways that increase impact.

Strive helped Norwalk ACTS bring greater focus and intentionality to its efforts, and is helping the group to organize future work around actual data. Financial support from local funders underwrote the technical assistance from Strive that enabled Norwalk ACTS to advance from a group of committed organizations to a strong partnership that takes collaborative action to achieve results through collective impact.

After serving as interim anchor, in March 2013, Stepping Stones was selected by Norwalk ACTS to serve as its official anchor entity. The group is now formalizing its accountability structure, refining community level outcomes and indicators and inviting new organizations to join the partnership. Outlying communities are learning of Norwalk ACTS success, and early conversations are taking place about ways to connect future collective impact partnerships in Connecticut.

Rhonda Kiest is the executive director of Stepping Stones Museum for Children in Norwalk, Connecticut.

Farming For Fuels

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Center. The initiative also subsidized the outreach lessons and family events for the first two years. After that time, the project is expected to become self-sustaining, continuing at no cost to the DOE, and serve as a lasting legacy of the BESC project.

Farming For Fuels has been presented at more than a dozen conferences, including the Association of Children's Museums, the Association of Science-Technology Centers, the Georgia Educational Technology Conference and the National Science Teachers Association—reaching hundreds of teachers and museum staff. By 2015 Farming For Fuels will reach at least 100,000 individuals through person-to-person contact with an educational message about environmentally friendly, alternative and biofuels energy.

Wayne Robinson, Ph.D., is the biofuels coordinator at the Creative Discovery Museum in Chattanooga, Tennessee.

Coaching Creative Teachers

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In the year following the museum workshop, CCC professional development staff visit the teachers at their schools seven times for additional two-hour workshops that focus solely on application. New curriculum-building ideas are introduced; teachers learn from one another and from a dedicated online forum that serves as a resource for downloading facts to share with parents or sharing ideas or discussing issues with their community of practice.

By working with whole schools—all the teachers and administrators—the CCC is able to increase its impact on many children. Parents learn about the CCC research fact base at back-to-school night, through

The CCC is on the forefront of assisting teachers and schools with effective change in the instructional practice of teachers, creating “thinking classrooms” where risk-taking, creativity and play is encouraged and supported.

the CCC website and at parent-teacher events. In addition, these messages are communicated directly to broader audiences—including parents—through the museum's new speaker series.

In its pilot phase, the program's teachers have been partners in developing the best possible workshops for additional locations in the future. The program now boasts a 100% positive “Net Promoter Score,” a customer loyalty/satisfaction metric used by corporations, retailers and many museums to predict future attendance or participation. The CCC is currently working throughout the Bay Area to roll the program into more schools this summer and the next school year through a shared fee-for-service and contributed revenue model.

The museum was founded over twenty-five years ago by a group of parents who wanted to give kids a better start to life. CCC programs are only a year old, but the intent is similar: give kids a better start to education. Its programs for teachers and parents combine trends and opinions with research, mining science for practical tools that will have a positive impact on developing children's creative thinking

Elizabeth Rieke is the CEO and executive director of the Center for Childhood Creativity at the Bay Area Discovery Museum in Sausalito, California.

Nanoscience

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NanoFabulous, several new programs enable young visitors to interact with researchers and scientists. In Meet a Nanoscientist, Dr. Michael Fuhrer, a professor who focuses on the nano properties of graphene, described his research to the typical museum family audience. MRSEC brought its summer camp children to NanoFabulous. Camp surveys showed that NanoFabulous increased students' understanding of nanotechnology and the processes to study and develop nano devices.

The grand opening of NanoFabulous was extensively covered by local news stations. Port Discovery and UMD MRSEC have been recognized for their abilities to explain a difficult concept to a young audience. UMD MRSEC has shared the development process and outcomes of NanoFabulous with other research universities through professional society talks and NSF reports and with local schools. Port Discovery has shared stories of this successful collaboration throughout the NISE Network and at national meetings. Plans to include the mini-exhibition in NISE Network program catalog are underway.

Now the museum is blazing yet another “small” trail by expanding NanoFabulous to include a focus on nano's impact on society—specifically, adding exhibit pieces that allow visitors to think about the values (cost, attractiveness, cool factor and usefulness) employed when making a decision to purchase a product that contains nanotechnology.

Nora Moynihan is the director of education & community enrichment and Sarah Zimmerman is STEM program coordinator at Port Discovery Children's Museum in Baltimore.

Helping Hands

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The museum is committed to becoming a model of best practice for other museums and visitor attractions. Future plans include a national conference to showcase the Helping Hands project and suggest ways in which other cultural organizations can follow suit.

The final word, spreading through social media, belongs to the families:

“Loved Eureka! before, love it even more now” #inclusion

“We had a great time and it has made such a difference to visit a place where ALL the staff have been so understanding.”

Trizia Wells is the Helping Hands Project lead at Eureka! The National Children's Museum in Halifax, United Kingdom.