Reinventing the Role of Museums in Science Education

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Abstract

In order to prepare the next generation to actively contribute to a global society that is being shaped by science and technology, the Museum of Science and Industry (MSI) in Chicago, IL, USA established a new vision which aims to inspire and motivate our children to achieve their full potential in the fields of science, engineering, technology and medicine. To meet the challenge of this vision, MSI has reinvented the role informal learning institutions must play to improve the quality of science education in our communities and to build a scientifically literate citizenry. MSI has developed and launched a long-term strategy that provides a comprehensive suite of science education programs focused at their center on engaging underserved youth in science learning, but also their influencers – the communities, families and schools – who support them. This paper outlines the components of a comprehensive model for using the resources of informal learning institutions to strengthen science learning both in and out of the school setting. It explores multifaceted program strategies that target students, teachers, community organizations, and families at a community-wide level, using practical and effective approaches that aim to raise interest and participation in science by students during their middle- and high-school years; influence youth to choose careers in science, technology, engineering and medicine; sustain a supportive community climate for science engagement; and facilitate high-quality science teaching and learning in schools.

1. Introduction

Science museums and other informal learning institutions play an important role in promoting science for all learners. Informal learning environments can spark student interest in science and provide opportunities to broaden and deepen students’ engagement. They can reinforce scientific concepts and practices, while developing an appreciation for and interest in the pursuit of science in school and in daily life. Research shows that learning science is a rich, complex, ongoing process that builds over a lifetime [1], [2]. Opportunities to learn science occur throughout the day and year, in a wide variety of settings, and through a range of experiences [1]. Recent reports emphasize the important role of learning science in informal environments and provide clear evidence that these experiences can promote science learning and strengthen and enrich school science [3], [4], [5]. Informal learning has also been shown to provide important and unique opportunities to engage students who come from communities historically underrepresented in the sciences [4], [6]. As a result, science museums and other informal learning institutions have the opportunity to play a key role in improving the quality of science education for all learners.

2. Changing the Museum Context

Since 1933, the Museum of Science and Industry (MSI) in Chicago, IL, USA has presented innovation in science and technology on a grand scale by displaying exhibits which, through their sheer size and presentation, create awe and wonder. As the first and largest science and technology museum in the Western Hemisphere, the Museum welcomes between 1.5 and 2 million guests each year. During the past five years, more than 1.5 million school children came through our doors and were inspired by our exhibits and programs. While serving large audiences as a tourist and field trip destination plays an important part in fostering an interest in science, MSI made a strategic decision to strengthen its commitment to education.

In 2005, the Museum launched Science Rediscovered, a $205 million campaign to help realize its vision for the future: to inspire and motivate children to achieve their full potential in science, technology, medicine and engineering. Through this campaign, nearly every exhibit, façade, and public space was enhanced, transforming over 90% of the Museum’s facility. Beyond the physical presence, the Museum’s vision led to the development of the Center for the Advancement of Science Education (CASE). CASE leverages the Museum’s unique offerings and is dedicated to fostering
more and diverse future scientists, increasing public science literacy and improving science learning in our schools. Through CASE, MSI has reinvented the role informal learning institutions must play to improve the quality of science education in our communities and to build a scientifically literate citizenry. MSI has developed and launched a long-term strategy that provides a comprehensive suite of science education programs focused at their center on engaging underserved youth in science learning, but also their influencers – the communities, families and schools – who support them. Figure 1 depicts the relationships between these important audiences and serves as a model that guides the Museum’s educational efforts.

**Figure 1. Center for the Advancement of Science Education (CASE) Model**

3. Program Areas

CASE programs are designed to extend the content of the Museum’s exhibits through strategies that empower teachers, engage families and their communities, and excite students. The resulting programmatic framework is based upon an approach that is multifaceted and targets students, teachers, community organizations, and families at a community-wide level. The education programs aim to raise interest and participation in science by students during their middle- and high-school years; influence youth to choose careers in science, technology, engineering and medicine; sustain a supportive community climate for science engagement; and facilitate high-quality science teaching and learning in schools.

This work is accomplished through three program areas:

- Science Teacher Education
- Student Experiences
- Community Initiatives

3.1 Science Teacher Education

Supporting improved teaching and learning in our schools is a central focus for MSI, bridging the formal and informal education communities. The Institute for Quality Science Teaching was developed to improve science instruction and boost student achievement in the middle grades (4th-8th grade) by providing sustained and comprehensive science teacher coursework. A primary focus of this work is the Chicago Public Schools, the third largest school district in the United States, serving over 400,000 students in nearly 700 schools. Courses are designed in accordance with state and national science education standards, and focuses on middle grades teachers who are new to or struggle with science content and teaching strategies. Teachers receive continuing education units through state education agencies and they can elect to earn graduate credit through partnerships with local universities.
MSI teacher coursework goals include:

- Improving teachers’ science content knowledge
- Increasing teachers’ use of hands-on and inquiry-based strategies in the classroom
- Building teachers’ use of external resources (i.e. how to use resources such as MSI, other informal learning institutions, web-based experience, etc. to improve their science teaching).

MSI currently offers two courses per school year (6 sessions each) and two courses per summer (5 sessions each), with an emphasis on serving teachers from high-needs schools. Since its inception in 2006, the Museum has served over 600 teachers through these sustained programs, and has trained middle grade science teachers from over 25% of the Chicago Public Schools.

### 3.2 Student Experiences

MSI Student Experiences extend and deepen the educational impact of the exhibits, providing students and teachers with meaningful learning experiences that begin in the classroom, center on Museum exploration and illuminate areas for further science engagement back at school. Programs are designed in accordance with state and national science education standards and provide support for quality science teaching. By narrowing the scope of the field trip experience to focus on specific curriculum areas connected directly to the classroom, Student Experiences:

- Increase student content knowledge in specific science subject areas
- Engage students in the scientific process and build scientific habits of mind
- Provide insight into real-world applications of science and introduce students to science-related careers

Learning Labs, the foundation of Student Experiences, address a range of topics including life, physical & environmental science. Labs and associated resources extend the learning beyond the field trip event - helping teachers to engage and prepare their students ahead of time, provide them with focus at the Museum, and draw conclusions and identify areas for further investigation following their Museum visit. Labs also provide professional development for teachers as Museum staff model effective and engaging hands-on science instruction teachers can replicate in their classrooms.

### 3.3 Community Initiatives

MSI has pursued a long-term strategy for engaging targeted and diverse youth from underserved communities in the Chicago area. By establishing partnerships with local community-based organizations, schools, and other social service agencies, the Museum has tapped into existing community networks to better understand and meet the needs of local audiences who have been traditionally underrepresented in STEM fields. By engaging children, youth, families, and community-based organizations in science learning, both in the community and in the Museum, MSI is positioned as a true community resource. MSI Community Initiatives are designed to:

- Engage youth in science learning and college/career readiness experiences that prepare them to become the next generation of science and innovation leaders
- Build a presence for science in communities through a growing network of community-based out of school time programs
- Promote family learning through increased parent involvement and targeted family science engagement

MSI’s Community Initiatives are designed to provide opportunities for youth and families to participate in science learning outside the school setting and beyond the traditional school day. These programs support and build the capacity of a vast network of community partners to integrate science as a regular component of their programming. The learning experiences focus on fostering an interest in and an appreciation of science, while constructing the core knowledge and practices that constitute science literacy. These programs offer opportunities for participants to make relevant connections between the content and the world around them, pursue post-secondary education, and consider science-related careers.
4. Conclusion

The work accomplished at the Museum of Science and Industry represents a step forward in the evolution of science and technology museums. By establishing a core focus on advancing science education, informal learning institutions are well positioned to play a greater role in the broader science education arena. Through strategies that extend learning beyond the walls of museums, expand access and opportunities for youth and families, and support improved science teaching and learning in our schools and communities, informal learning institutions can inspire and motivate the next generation to:

- Prepare a competitive and capable workforce equipped with the technical and quantitative skills to succeed in the global marketplace.
- Invent the creative solutions to the most pressing issues facing our world—climate change, energy independence, health and safety, etc.
- Make fundamental discoveries about our world and ourselves and develop the technological innovations that will shape the future.

References