Key Resources for Informal STEM Education

Dawson, E. Equity in informal science education: Developing an access and equity framework for science museums and science centers. *Studies in Science Education,* Vol. 50(2). pp. 209. Available at: http://informalscience.org/research/ic-000-000-010-054/.
While many ISE projects aim to reach diverse learner populations, there has been relatively little scholarship on equity in ISE practice compared to 'formal' science education. This paper proposes a framework to address equity in ISE, drawing from theories of social justice, social reproduction and pedagogy.

House, A., Llorente, C., & Leones, T. *Navigating the Future of Afterschool Science: Afterschool Science Networks Study Recommendations*. Available at: http://informalscience.org/research/ic-000-000-010-008/.
This is the final report of a five-year study on afterschool programs in California. The report makes recommendations for program staff, administrators, funders and policymakers, and researchers. While the study took place in California as a representation of a population with strong afterschool program networks, the recommendations may be applicable to afterschool programs more broadly.

McCreedy, D., & Dierking, L. *Cascading Influences: Long-Term Impacts of STEM Informal Experiences for Girls.* Summary report, March 2013. Available at: http://informalscience.org/research/ic-000-000-008-414/
In this study, a researcher from Oregon State University partnered with the Franklin Science Center in Philadelphia, PA to study the impacts of STEM programs on girls' STEM interest and career outcomes; interest, engagement, and participation in science-related hobbies and pursuits; and perception of who can do, and does, science. The team examined six girl-serving STEM programs that met their research criteria (such as being established at least 5 years prior to the study initiation, and had access to high-school aged women who had participated 5 or more years ago). The study involved three investigations—in-depth interviews with program participants, a web-based questionnaire, and a convening that included prior study participants and leaders of girl-serving programs. Findings spanned a broad range of personal experiences and outcomes for individual participants that were grouped under common themes including memories of program experience, personal identity and social capital, and STEM learning.

Linnett, P., Kaiser, D., Durant, J., Levenson, T., & Wiehe, B. *The Evolving Culture of Science Engagement.* Report of findings from September 2013 Workshop, July 2014. Available at: http://informalscience.org/research/ic-000-000-009-888/.
The *Evolving Culture of Science Engagement Initiative* was a two-day workshop that explored how the forms, settings and cultural sensibilities of science engagement are changing. Participants were selected for their culturally innovative approaches to science

engagement—including comics, citizen science, blogging, filmmaking, etc. The workshop generated eight "dimensions of change" in science engagement: storytelling; humor; mystery and the unknown; informality/science as part of everyday life; artistic expression; participatory engagement; emotion; and power, barriers and belonging. Workshop participants evaluated these approaches for both their risks and rewards. The findings from the workshop represent a "moment of experimentation" in science engagement that educators and others can leverage to reach audiences in innovative ways.

National Research Council. *Guide to Implementing the Next Generation Science Standards.* Washington, DC: The National Academies Press, 2015. Available at: http://informalscience.org/research/ic-000-000-010-416/.
The Next Generation Science Standards (NGSS) represent a new vision for science learning in classrooms across the U.S. Educators will need to devise new strategies for teaching science, and state governments and community organizations will need to develop new ways to support educator professional development. This Guide outlines recommendations for effectively implementing the new Standards. For museums and other informal learning organizations, the Guide emphasizes partnering to create community supports around supporting inquiry-based teaching and learning practices (which are emphasized in the Standards).

Sacco, K., Falk, J., & Bell, J. Informal Science Education: Lifelong, Life-Wide, Life-Deep. *PLOS Biology*, 12(11). Available at: http://informalscience.org/research/ic-000-000-010-191/.
Natural and physical scientists may not be aware of the depth and breadth of opportunities available to communicate and engage publics in research questions and topics through informal learning environments. This article outlines basic definitions and examples of "informal science education" and provides an introduction to scientists who may be looking for new ways to communicate their research to the public.

Traill, S. & Traphagen, K., *How Cross-Sector Collaborations are Advancing STEM Learning.* Available at: http://informalscience.org/research/ic-000-000-009-264/How_Cross-Sector_Collaborations_Are_Advancing_STEM_Learning STEM learning ecosystems harness unique contributions of educators, policymakers, families, and others in symbiosis toward a comprehensive vision of science, technology, engineering, and math (STEM) education for all children. This paper describes the attributes and strategies of 15 leading ecosystem efforts throughout the country with the hope that others may use their lessons to deepen rich STEM learning for many more of America's children. The paper was key to informing the STEM Learning Is Everywhere convocation convened by the National Academies in 2104, the report from which is available at: http://informalscience.org/research/ic-000-000-009-276/STEM_Learning_Is_Everywhere

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Ten Most Accessed Research & Reference Resources from InformalScience.org 2014-2015

Report that addresses findings from a 3-year project designed to better understand current practices in bilingual exhibitions and Spanish--speaking visitors' uses and perceptions of bilingual exhibitions- http://www.informalscience.org/research/ic-000-000-008-339/Bilingual_Exhibit_Research_Initiative_Report:_Institutional_and_Intergenerational_Experiences_with_Bilingual_Exhibitions

CAISE white paper by the Public Engagement with Science Inquiry Group that describes how public engagement with science (PES) in the context of informal science education can provide opportunities for public awareness of and participation in science and technology- http://www.informalscience.org/research/ic-000-000-001-938/Many-Experts-Many-Audiences-Public-Engagement-with-Science

CAISE white paper by the CAISE Public Participation in Scientific Research Inquiry Group that describes how public participation in scientific research (PPSR) through informal science education can provide opportunities to increase public science literacy- http://www.informalscience.org/research/ic-000-000-001-937/Public-Participation-in-Scientific-Research

Guide to Implementing the Next Generation Science Standards that provides guidance to those charged with developing a plan and implementing the NGSS as they change their curriculum, instruction, professional learning, policies, and assessment to align with the new standards. For each of these elements, the report lays out recommendations for action around key issues and cautions about potential pitfalls- http://www.informalscience.org/research/ic-000-000-010-416/Guide_to_Implementing_the_Next_Generation_Science_Standards

Survey results that suggest that the planetarium community's goals and beliefs are at odds with the current model of passive planetarium production and that the frontline professionals would support opportunities that support their ability to actively engage their audiences- http://www.informalscience.org/research/ic-000-000-008-814/Survey_of_the_Goals_and_Beliefs_of_Planetarium_Professionals

Report of the summit proceedings, A Call to Action from the 2014 Coalition for Science After School Summit, that focuses on 11 areas to continue to advance the STEM in out-of-school time field after CSAS sunsets its operations on June 30, 2014- http://www.informalscience.org/research/ic-000-000-009-440/A_Call_to_Action_From_CSAS_Summit

Report from the third Making Meaning Symposium at the New York Hall of Science that takes a critical look at describing and documenting learning that takes place when young people "make"- http://www.informalscience.org/research/ic-000-000-002-029/Making_Meaning

National Academies consensus volume that is a foundational guide for program and exhibit designers, evaluators, staff of science-rich informal learning institutions and community-based organizations, scientists interested in educational outreach, federal science agency education staff, and K-12 science educators- http://www.informalscience.org/research/ic-000-000-002-024/LSIE

Presentation shared at the 2014 Association of Science-Technology Centers (ASTC) annual meeting in Raleigh, NC. It describes how proposers can submit competitive proposals to the National Science Foundation (NSF) Advancing Informal STEM Learning (AISL) program- http://www.informalscience.org/research/ic-000-000-010-064/Submitting_Competitive_NSF_Proposals_2014

Document from a Joint Committee from the National Science Foundation and the Department of Education that seeks to provide a broad framework that clarifies research types and provides basic guidance about the purpose, justification, design features, and expected outcomes from various research types- http://www.informalscience.org/research/ic-000-000-007-930/Common_Guidelines_for_Education_Research_and_Development

Center for Advancement of Informal Science Education (CAISE) Research Landing Page- **http://informalscience.org/research**

Ten Most Accessed Evaluation Resources from InformalScience.org 2014-2015

Summative Evaluation of "PlanetMania" Mobile App in Maryland Science Center's "Life Beyond Earth" Exhibit -http://www.informalscience.org/evaluation/ic-000-000-003-551/_Summative_Evaluation_of_PlanetMania_Mobile_App_in_Maryland_Science_Center_s_Life_Beyond_Earth_Exhibit_

Visitor Demographics & Motivation for Visiting the Henry Art Gallery - http://informalscience.org/evaluation/ic-000-000-007-449/

Milwaukee Public Museums Ancient Worlds Gallery Front-End Evaluation - http://informalscience.org/evaluation/ic-000-000-010-421/Ancient_Worlds_Front_End_Formative

Great Lakes Teacher Badging Evaluation Report - http://www.informalscience.org/evaluation/ic-000-000-008-941/Great_Lakes_Teacher_Badging

Youth Astronomy Apprenticeship - An Initiative to Promote Science Learning Among Urban Youth and Their Communities - http://informalscience.org/evaluation/ic-000-000-003-462/

Cosmic Questions Summative Evaluation Report - http://www.informalscience.org/evaluation/ic-000-000-003-554/Cosmic_Questions_Summative_Evaluation_Report

A Closer Look at the Visitor Experience: An Analysis of Visitor Comment Cards - http://informalscience.org/evaluation/ic-000-000-003-340/

Final Report: Pathways to Brighter Futures Through STEM Careers - http://informalscience.org/evaluation/ic-000-000-008-533/

Summative Evaluation: Art Gallery - http://www.informalscience.org/evaluation/ic-000-000-003-290/Summative_Evaluation_Art_Gallery

WolfQuest Summative Report - http://www.informalscience.org/evaluation/ic-000-000-003-244/WolfQuest_Summative_Report

Center for Advancement of Informal Science Education (CAISE) Evaluation Resources Landing Page- **http://informalscience.org/evaluation**

CAISE ISE "Evidence Wiki"- **http://informalscience.org/research/wiki**

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