

Formal and Informal Learning Intersections Cohort



Participants



- ▶ Nicole Temple – Houston Museum of Natural Science – Vice President of Education
- ▶ Cheryl McCallum – Children's Museum of Houston – Director of Education
- ▶ Elizabeth Mulkerrin, EdD – Science Olympiad – CEO
- ▶ Lindsay Milner – 2inspire + others – Educational Designer, R&D
- ▶ Amanda Daniels – Melissa ISD – GT Coordinator
- ▶ Jill Hedndrickson Lohmeier, PhD – Umass, Lowell – Department Chair, Professor, Research and Evaluation in Education School of Education
- ▶ John Loehr, PhD - Science Olympiad - Vice President, STEM Education

Key Questions

The cohort began by gathering information as a group to determine what the areas of dis/agreement were. The questions asked were:

- How do you define equity, well-being, belonging, informal education, formal education?
- What are the most effective and ineffective things you have seen in addressing equity in in/formal education?
- What do you perceived as the barriers in accessing informal education opportunities?
- What might you want quantified through additional research?
- In the intersection of equity, well-being, belonging, and in/formal education, what are you most curious about?
- In the intersection of equity, well-being, belonging, and in/formal education, what is the biggest struggle?

The results of this initial survey allowed us to understand that we had no universal agreement on any of the answers and it was determined we needed a larger sample size to provide sufficient direction for future project directions.



Key Findings

- ▶ Created a larger survey to get additional feedback with a goal of 75 respondents for statistically significant findings. 116 Respondents (3 Countries (USA (vast majority), Canada (3), Germany (1))
 - ▶ Primarily middle-school educators, but good mix across ages for sample set.
 - ▶ ~ 2/3 work in formal education and ~2/3 worked in informal education. ~1/4 - 1/3 of participants deal with both
 - ▶ ~1/2 had partnerships with informal institutions/programs. These programs overwhelmingly seem to focus on STEM and bringing kids to science, but there were other programs listed for sure, like nature centers or zoos. (Also sidenote, the LEGO Foundation Playful Learning Museum Network seems like it would be a hoot, that someone listed as a partnership)
- ▶ Defined areas of interest for further research and projects:
 - ▶ Both in/formal and informal educators found collaboration/communication & impact as what they felt they wanted help to work effectively with the other side of education but with some slight difference in order.
 - ▶ Formal educators listed in order: Teacher support, Impact, Collaboration/communication
 - ▶ Informal educators listed in order: Collaboration/communication, Educational support, Impact
- ▶ In response to "How can we overcome barriers for informal opportunities", respondents indicated:
 - ▶ **The most and least effective things are very dependent on your location, population, etc. There was no one-size fits all solution.**
 - ▶ Answers were phrased in terms of equity and building relationships, especially when it has to do with resources, like scholarships/pricing, transportation.
 - ▶ Audiences need most help with equitable access to opportunities, financial barriers, and transportation.
 - ▶ Specific significant barriers to opportunities include: Cost , time of participation , language access , transportation/ location , Lack of Accessibility , Ineffective communication/ notification regarding opportunities , Lack of feeling of belonging for participants , socioeconomic issues
- ▶ In response to "what do learners/audiences need the most help with", respondents indicated (in order):
 - ▶ Equitable access to opportunities, financial barriers, transportation (rural needs, geographic issues), feeling a sense of belonging or comfortable in spaces of learning, support of formal educators

Priorities for the Future

If we were to hand the baton to another group to further the project, what would our recommendations be for them to pursue?

► Survey participants indicated:

- Most wanted workshops or resources on specific related topics as a practical resource.
- Felt these specifically were lacking in research:
 - how informal staff and formal classroom teachers can work to communicate
 - what is the impact on student learning in out-of-school time activities.
- Often had wide ranging ideas in how in/formal educators can work together better - which is indicative of the potential issues with communication between the two groups

► Requests for practical suggestions included:

- clear outreach programs/activities that could work onsite at the informal institutions or in the classroom
- being aware/helping with resources/admin barriers like time, busses and cost of program
- understanding the possibilities/capabilities of an informal program (seeing that both sides are so silo-ed)
- communication/relationship building, especially in how/where informal education can improve or collaborate with formal education

► Most commonly requested methods of dissemination of information were (in order):

- Workshops, webinars or resources on specific related topics (potentially virtual)
- Activities/curriculum for informal settings
- Potential funding toolkit
- Resources for inter-organization communication, such as a list of tips and resources for in/formal educators to work together to promote equity through STEAM
- Additionally requested outside the survey -A justification letter or slide deck with supporting educational research showing the value of STEAM in terms of equity and education. This could be used by in/formal educators to get support for STEAM initiatives, partnerships, and professional development opportunities.

► Suggestions for further research/promotion of current research included:

- How informal education staff and formal classroom teachers can work to communicate and collaborate better in order to support learners with the STEAM mindset?
- What impact on student learning in out-of-school time activities/programs?

Case Studies

Case Study 1

Aramco Biodiversity iExplore



The Houston Museum of Natural Science has paired with Galena Park ISD and Aramco to bring students to the Museum for a program focusing on biodiversity. The program includes a live animal presentation, a trip to the Cockrell Butterfly Center, and guided curriculum for the permanent exhibit halls. To gauge the effectiveness of the program, students are required to take a 10-question pre and post-test that indicates knowledge of science topics related to biodiversity as well as their personal science identity and comfort with science. For a majority of students, this field trip is a first visit to a Museum and may be a first trip from their city. 74% of participating students were considered at risk, 39% were enrolled in bilingual and English language learning programs, and 60.8% were economically disadvantaged.

Key Outcomes:

- ▶ Ongoing results from the program demonstrate an average of ~20% increase in correct answers for questions correlated to the state standardized objectives after students attended a field trip at HMNS.
- ▶ Students who attended the program were less likely to feel nervous about science after the program and were more likely to identify science as something they could participate in.

Case Study 2

Girls Exploring Math and Science (GEMS)



GEMS is an annual festival-style event hosted by the Houston Museum of Natural Science. The event is comprised of three parts: Community Booths, Student Booths, and an overnight event. This event began as a partnership with the Girl Scouts of San Jacinto but, due to staffing turnover, HMNS has been the sole host for several years. The event begins with the overnight in which girls and their mothers participate in various STEM activities before sleeping in an exhibit hall. In the morning, they wake up, eat breakfast and are then the first participants to join the festival portion of the event. In a public area, Community Booths interact with guests. The interactions can consist of demonstrations, activities, crafts, etc. but must be STEM-related and free to participants. These activities are intentionally in a public space to reduce a barrier to participation. Additionally, student led booths are essentially performing the same function, but the Community Booth participants are asked to judge the student booths, and a cash prize is awarded to the top three. The primary criteria for judgement is did the students do the work themselves and how well are they able to discuss their topic with the public. The primary focus is on increasing science literacy and communication in the students.

Key Outcomes:

- ▶ The event requires very minimal financial support and is one of HMNS's most well attended events annually. Average attendance between 9am and 1pm is 1000+.
- ▶ Both the students and community partners have expressed a true enjoyment of the event.
- ▶ The entire event signals the museum's commitment to STEM education, particularly for girls, and equity in science education.



Annotated Bibliography

1 in 5 survey respondents indicated they did not know about current literature.

- ▶ Barnum, Matt. "Wealthier Students Benefit from Art, Music over Summer While Poor Kids Miss Out." *CT Mirror*, 30 May 2018.
- ▶ "Crystal Bridges Museum of American Art & University of Arkansas Department of Education Reform Announce Results of a Study on Culturally Enriching School Field Trips." *Crystal Bridges*, 16 Sept. 2013, crystalbridges.org/news-room/crystal-bridges-museum-of-american-art-university-of-arkansas-department-of-education-reform-announce-results-of-a-study-on-culturally-enriching-school-field-trips/.
 - Completed a study where half of the students at a particular school were able to go on a field trip to Crystal Bridges as the museum opened. No students saw the space before the opening. After the field trip, all students were given a test about critical thinking and observation skills, including those who did not go to the museum. They found that the kids who went on the field trip had higher critical thinking and observation skills than those who did not, and this was even more true for rural/low-income kids.
- ▶ *Early Learning in Museums: A Review of Literature. Smithsonian Institution's Early Learning Collaborative Network and Smithsonian Early Enrichment Center (SEEC)*, 2012. pp. 1-27.
 - A compilation of articles regarding when and how children learn in museum. A bit out of date, but an excellent resource.
- ▶ Falk, John H. *Free-Choice Science Education: How We Learn Outside of School. Teachers College, Columbia University*, 2001. pp. 3-20.
 - A compilation of studies and articles about how we learn science outside school. The intro, cited here, discusses the benefits of going to science museums.
- ▶ *Learning Science in Informal Environments: People, Places and Pursuits*. Edited by Philip Bell, et al., *The National Academies Press*, 2009.
 - museums and other informal learning environments have been shown to be really good at encouraging excitement about science/natural , asking questions, testing theories, encouraging people to think of themselves as scientists, & more.
- ▶ MUSCO, MIRIAM Ed.D. . "Disparity of Informal Education Between Low- and High-Income Neighborhoods." *Theory and Practice*, vol. 1, 2018, https://articles.themuseumscholar.org/2018/06/04/tp_vol1musco/.
 - A discussion of the disparity in informal education between lo-and-high income neighborhoods and attitudes about and availability of informal education spaces for low-income individuals. Includes several interesting sections about what low-income individuals thought about museums as well as expectations/reality.
- ▶ Swan, D. W. (2014, April). *The Effect of Informal Learning Environments on Academic Achievement During Elementary School*.
- ▶ Vergeront, Jeanne. "Creativity and Museums." *Museum Notes Blog*, 30 Mar. 2013. <https://museumnotes.blogspot.com/2013/03/creativity-and-museums.html?m=1#:~:text=Museums%20are%20exceptionally%20well%20positioned,artists%2C%20inventors%2C%20and%20innovators>.
- ▶ Mulkerrin, E.A., and Hill, J.W. (2013). Relevance, Rigor, and Relationships: Student Perceptions Following Participation in an Integrated Experiential Zoo-Based Academic High School Science Program. *Creative Education*, 4, 287-297.
 - In this journal article the authors study the importance of providing opportunities for students to experience and apply science and math concepts in real world situations. The source is valuable because the research shows why formal and informal education should collaborate and provide experiential learning opportunities for all students.
- Mulkerrin, E. A. (2012). The Effect of a Zoo-Based Experiential Academic Science Program on High School Students' Math and Science Achievement and Perceptions of School Climate. Doctoral Dissertation.
 - This article is more evidence of the importance of collaborating.
- Woodruff, K.A. 2022. Connecting educators through equitable and reflective practice. *Connected Science Learning* 4 (3). <https://www.nsta.org/connected-science-learning/connected-science-learning-may-june-2022/connecting-educators-through>

- ▶ Benjamin Krause Recchia & T.J. McKenna (2024) Field Trips to Zoos and Aquariums: Solving Pedagogical Challenges Using the Next Generation Science Standards, *Connected Science Learning*, 6:1, 25-32, DOI: 10.1080/24758779.2023.2300497
 - In this article journal article, the authors developed a guide to introduce informal science organizations as key educational resources. The study shows the explored the meaningful connections to curricula, creation of active learning activities, differentiation and scaffolding strategies, and assessment for both students and field trips. The source is valuable for demonstrating the importance of informal and formal educators collaborating to provide dynamic learning environments.
- ▶ C. Schaben, C. Cutucache, N. Grandgenett, E. Mulkerrin, R.J. Hougham (2016) SUPPORTIVE STRUCTURES FOR SUCCESSFUL SCIENCE TEACHERS' PROFESSIONAL DEVELOPMENT, *ICERI2016 Proceedings*, pp. 4653-4662.
 - In this article, the authors developed a professional development model to introduce K-12 educators to informal science organizations through place-based exploration. The findings showed educators developed a better understanding of content and curriculum connections while developing scaffolding strategies for diverse learners. The source is valuable for professional development providers to design safe training environments for educators to make content connections and develop equitable learning strategies.
- ▶ Diane Marie Vrobel (2024) Creating Equity for Black Science Students, *Connected Science Learning*, 6:1, 2-4, DOI: 10.1080/24758779.2023.2296746
 - In this journal article the author studies how Black students perceive science classes and what keeps them from enrolling in advance science classes. The study uses the community of inquiry to identify barriers students are facing. From this work the author develops a plan on how to remove these barriers. The source is valuable because it gives us a research model to put into practice to diversify STEM programs.
- ▶ Domenici, V. (2022). STEAM Project-Based Learning Activities at the Science Museum as an Effective Training for Future Chemistry Teachers. *Educ. Sci.* 2022, 12(1), 30; <https://doi.org/10.3390/educsci12010030>.
 - In this journal article the authors assess a STEAM based approach to explore teaching strategies while developing STEAM lab activities to be utilized in the classroom, out-of-school programs and in science museums. The preservice teachers take chemistry concepts and design STEAM activities based on project-based learning. The source is valuable because of the research-based STEAM based professional development model used to train preservice teachers.
- ▶ Marilyn Rowell, Megan Ennes & Brian Abramowitz (2024) Co-Development of a Museum-Based Scientist-Teacher Partnership, *Connected Science Learning*, 6:1, 8-16, DOI: 10.1080/24758779.2023.2296751
 - In this journal article the authors study the importance of collaboration between formal and informal organizations to develop relevant experiences for students. The key to this model is incorporating the scientist into the program. This approach adds a third dimension creating more rigorous and relevant student opportunities. The source is valuable because it is another example of demonstrating the importance of collaboration between informal and formal education.
- ▶ Mulkerrin, E., Leising, A., and Sykes, T. (2018). On the Job: Job Shadowing and Internships Open Doors to STEM Careers. *The Science Teacher*, July, 31- 37.
 - In this journal article, the authors talk about the importance of formal and informal science educators developing opportunities for students to apply content knowledge to real world applications in a business setting. The article explains how providing opportunities for students to apply their knowledge and learn about diverse STEM careers opens the doors to diversifying the STEM profession. The source is valuable to demonstrate formal and informal education working together to provide equitable opportunities for all students to explore STEM careers.
- ▶ Mulkerrin, Elizabeth. (2016). Zoo Academy: Effective Collaboration Between Local School districts and Omaha's Henry Doorly Zoo and Aquarium Creates Unique Opportunities for High School Students. *Connected Science Learning*, 1, 1-6.
 - In this journal article the author explains the importance of formal and informal education creating a collaboration to create equitable opportunities for students to make relevant connections to STEM curriculum. The source is valuable to demonstrate formal and informal education working together to provide equitable opportunities for all students to make relevant connections to science concepts.