



What Is a STEM Learning Ecosystem?

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What Is the Issue?

If we think of STEM engagement and learning as taking place only within specific contexts—such as school classrooms or limited time-frame programs—we create a distorted view of how people learn. Research clearly demonstrates that people’s interests, understanding, and commitments develop across multiple settings and times. Many communities are adopting a “STEM learning ecosystem” approach to identify and map those settings and time frames, to enrich and reinforce opportunities within them, and to broaden participation in STEM.

Things to Consider

“Learning ecosystems” or “learning ecologies” are constituted by the places, ideas, institutions, and people available to support learning and engagement. The nature of a local STEM learning ecosystem directly affects the availability and quality of opportunities to learn STEM. As with natural ecosystems, learning ecosystems evolve over time; they have human and social histories. How a learning ecosystem developed—who participated, contributed, and benefited in the past—shapes how people perceive and participate in it today.

Robust STEM learning ecosystems go beyond simply making opportunities available; they take histories of inclusion and exclusion into account to ensure that opportunities are inviting, relevant, responsive, and intellectually engaging to all learners. They are intentionally designed to help learners make connections across the ecosystem—to build on what came before,

Why It Matters to You

- **Science communicators** and **STEM educators** can increase the relevance and inclusiveness of their programs by making explicit connections between the programs they offer and additional or ongoing opportunities learners can pursue in the local STEM learning ecosystem.
- **Professional development leaders** and **science communication trainers** can help their audiences position their programs to address gaps in available opportunities within an ecosystem, or conversely, reinforce strengths in the ecosystem.
- **Funders** and other stakeholders need to consider how programs are connected to one another, formally and informally, to enrich the STEM learning ecosystem.

Things to Consider (continued)

on what may be occurring simultaneously in another setting, and towards future opportunities to go deeper and broader with one's interests, skills, and understanding.

Like ecosystems in nature, robust learning ecosystems are characterized by diversity, redundancy, and local adaptation. To thrive, they need to blend multiple, differentiated, and ongoing opportunities for learners to engage and deepen their engagement with STEM. It is critical to avoid creating a monoculture, which ultimately will exclude most learners. Instead, leaders must work to create multiple access points that reflect the range of perspectives, backgrounds, and strengths of the diverse people who inhabit the learning ecosystems.

STEM learning ecosystems, like natural ecosystems, have deep histories that shape the present. In socially constructed systems, histories often relate to power and privilege. It is important to recognize how your local community may have excluded specific groups (by age, race, sex, faith, gender, or other factors) from pursuing STEM tracks in school, from participating in STEM careers, from becoming STEM mentors, or from accessing science lectures, museums, and public nature settings. Naming and confronting these histories can help STEM communicators/educators gain clarity on the need to create learning opportunities that counteract past injustices and create a more inclusive future.

Recommended Actions You Can Take

- Design your science communication and education programs in ways that explicitly build on your audiences' prior experiences.
- Provide explicit guidance to audience members about where they can go to learn or do more. Be sensitive to whether your audiences will feel welcome and included at the places you suggest, so that you provide next steps for all program participants.
- Meet with other STEM providers in your region to explore how your program may connect with, reinforce, supplement, or possibly conflict with their programs.

Reflection Questions

- + Does your program explicitly help participants identify opportunities for further engagement with the program's ideas and experiences?
- + How do your programs fit within the local STEM learning ecosystem? Who is doing similar work? How is the work different? How does it offer useful or unnecessary redundancies?
- + Are there important community organizations or actors who are not an active part of the STEM learning ecosystem? Why?
- + Do all STEM learners—across age, race, sex, and other factors—have access to STEM learning ecosystems in your community? Are there any STEM learning “deserts” in particular neighborhoods, age ranges, abilities, or other sectors?

Tools You Can Use

- More detailed descriptions of learning ecosystems can be found here: [STEM learning ecologies: Relevant, responsive, connected](#) in the *Connected Science Learning* journal and [STEM learning ecosystems: Critical approaches](#) in *Spokes* magazine.
- The Hive Research Lab's toolkit, [Brokering Youth Pathways](#), shares techniques for connecting youth to future learning opportunities and resources.
- Use this Funds of Knowledge [video and handout](#) from the National Center on Cultural and Linguistic Responsiveness to consider how to engage families within learning ecosystems by building on their cultural funds of knowledge.
- The national STEM Learning Ecosystem initiative provides [design principles, strategies, case studies, and other tools](#) from existing local STEM ecosystems across the country.

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