LOGIC MODEL // STRATEGY 1: ESTABLISH CROSS-SECTOR PARTNERSHIPS TO CULTIVATE ECOSYSTEMS

Early Stages: Networking and Cooperation

**Inputs**
- Credible, highly engaged lead organization committed to collaborative practice
- Receptive partners:
  - Schools/school districts
  - Out-of-school time (OST) system/programs
  - STEM-expert museums, science centers
  - Institutions of higher education
  - STEM companies
  - Businesses that recognize the need for STEM competencies
  - STEM professional associations
  - Libraries
  - Community-based organizations
  - Philanthropies
  - Families and parent organizations
  - Youth organizing and advisory groups
- Financial, human capital, and other resources

**Activities**
- Create structures for networking and cooperation:
  - Assess readiness to begin ecosystem cultivation process
  - Develop a deeper understanding of ecosystem’s assets and gaps by mapping:
    1) learning opportunities for youth in and out of school
    2) existing and potential ecosystem partners
    3) existing cross-sector initiatives
  - Define shared vision, design principles, priority goals and desired outcomes
  - Define enlightened self-interest and role(s) for each stakeholder
- Identify and engage additional partners
- Build partners’ familiarity with system evaluation strategies

**Outputs**
- Self-assessment for readiness
- Ecosystem maps
- Gap analysis
- Shared vision, priority goals and desired outcomes
- Design principles
- Evidence that partners understand their own and other’s enlightened self-interest and their role(s) in emerging ecosystem
- Evidence of partners’ familiarity with different approaches to system evaluation

**Outcomes**
- Collaboration agreement(s)
- Evidence of initial financial and human capital support
- Evidence that stakeholders have increased interest in and knowledge of STEM learning in settings that are not their own and what connections exist among settings
- Stakeholders are beginning to use common language to describe STEM learning in different settings

**Measurement**
- Documents showing in-kind and financial support • Readiness self-assessments • Ecosystem map • Gap analysis • Goal and outcome statements • Evaluation alternatives
- Interviews/surveys with stakeholders across sectors
- Analysis of partnership to determine level of diversity and representation of all sectors
**Logic Model // Strategy 1: Establish Cross-Sector Partnerships to Cultivate Ecosystems**

Later Stages: Collaboration and Synergy

<table>
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<th>Inputs</th>
<th>Activities</th>
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<tr>
<td>• Credible, highly engaged lead organization committed to collaborative practice</td>
<td>• Engage in activities from Strategies 2-4 that best meet priority goals</td>
<td>• Partners participating in cross-sector learning</td>
<td>• Cross-sector partnerships expand/connect youth and educators to STEM learning across settings</td>
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<tr>
<td>• Receptive partners: – Schools/school districts – Out-of-school time (OST) system/programs – STEM-expert museums, science centers – Institutions of higher education – STEM companies – Businesses that recognize the need for STEM competencies – STEM professional associations – Libraries – Community-based organizations – Philanthropies – Families and parent organizations – Youth organizing and advisory groups</td>
<td>• Sponsor cross-setting site visits, job shadows, literature reviews, retreats, etc., for all partners</td>
<td>• Newly expanded/connected STEM learning opportunities for young people and educators</td>
<td>• Partners are well versed in and committed to cross-sector approaches</td>
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<td>• Financial, human capital, and other resources</td>
<td>• Expand and/or reallocate financial and human capital resources to support cross-sector initiatives</td>
<td>• New pathways youth can navigate toward STEM success</td>
<td>• Articulated pathways guide youth from K-12 to higher education to STEM careers</td>
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<td>• Adjust policies and practices to support cross-sector initiatives</td>
<td>• Committed, long-term funding</td>
<td>• Resources and policies supporting cross-sector work are institutionalized</td>
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<td>• Engage in outreach and communication to key stakeholders and broader community</td>
<td>• Policy and practice changes to support cross-sector STEM are embedded in partners’ strategic planning documents, defining and requiring cross-sector learning</td>
<td>• Partnership has secured stable financial/human capital support for infrastructure and evaluation</td>
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<td>• Implement evaluation that provides useful and timely data, encourages reflective practice, and enables continuous improvement</td>
<td>• New or reallocated resources to support cross-sector work, (e.g. a school district appointing a STEM partnerships director)</td>
<td>• Increased understanding among community members of importance of STEM learning in and out of school</td>
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<td>• Build capacity of partners to engage in evaluation process</td>
<td>• Number/reach of communications</td>
<td>• Measurable population level improvement in STEM learning and engagement outcomes for youth</td>
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**Measurement**

- Map of additional STEM learning opportunities, showing cross-sector connections
- Map of new articulated pathways and evidence that youth are accessing
- Examples of grant awards
- Evidence of partners institutionalizing resource and policy support for ecosystem approaches
- Open rates/re-posting rates for digital resources show engagement/impact of communications

**Note:** Better measures of population level improvement in STEM learning and engagement for youth are needed. Current measurements include K12 grades, standardized test scores, graduation rates and rate of entrance into post-secondary STEM majors or technical education, rates of employment in STEM fields or in jobs requiring STEM skills.
Inputs

- STEM partners named in Strategy 1
- Leaders and practitioners from STEM learning environments in multiple settings: K12 classrooms, OST, science centers, libraries, homes, etc.
- Research-aligned STEM curricula with adequate materials
- Access to digital media
- Educators from different settings equipped with knowledge and skill to lead learning
- Financial, human capital and other supports to expand, connect and improve quality of STEM learning environments

Activities

- Provide subsidies, transportation and family outreach to increase access of underserved youth to multiple STEM learning opportunities
- Expand access to STEM-rich learning for youth through field trips, mobile science labs, visiting STEM professionals
- Link STEM learning in and out of school through intentional use of common language and matching curricula scope/sequence
- Use OST programs and other out-of-school settings to more deeply explore cross-cutting STEM concepts with emphasis on scientific inquiry, engineering design, collaboration, and problem-solving
- Link programs and other learning opportunities to enable youth to progress from one to the next by age, interest and/or skill
- Build career exploration and internship opportunities with explicit classroom preparation components
- Show parents/guardians how to support youth to learn across STEM settings

Outputs

- Increased recruitment of underserved youth to access multiple STEM learning opportunities
- Increased horizontal and vertical points of connection between and among schools and informal STEM learning organizations
- More partnerships between schools and youth programs with time for joint planning and delivery of STEM-rich learning experiences
- Curricula that encourage cross-sector learning opportunities, including interdisciplinary project-based learning and school/afterschool aligned curricula
- Resources for parent and guardians to support youth STEM pursuits delivered by educators in various learning settings
- STEM learning institutes enroll educators across settings

Outcomes

- Increased participation of underserved youth in multiple and connected STEM learning opportunities
- Increased quality of STEM learning opportunities through use of STEM-rich environments in and out of school
- Better resources and spaces to facilitate scientific inquiry, engineering design, collaboration, and problem-solving
- Increased parent/guardian involvement and support of their child(ren)'s pursuit of STEM learning
- Increased youth capacity to apply STEM skills and knowledge to novel and applied problems
- Increased youth understanding of math concepts, cross-cutting concepts in science and core ideas of science
- Greater self-perceptions of youth engagement and interest in STEM
- Increased understanding by youth and parents/guardians of the requirements and pathways to pursue STEM careers

Measurement

- Participation tracking using a comprehensive data system (e.g. school attendance system, YouthServices.net, KidTrax, ETO)
- Observation using a research-validated quality assessment tool (e.g. DoS, STEM PQA)
- Localized measure of the efficacy of STEM teaching and learning K12
- Self-report youth surveys that measure engagement, motivation and interest in STEM
- Badges and portfolio assessments of student competencies
- Localized measures of STEM knowledge/competency and persistence
- Parent/guardian surveys that measure perceptions of their role in supporting their child(ren)
LOGIC MODEL // STRATEGY 3: EQUIP EDUCATORS TO LEAD ACTIVE LEARNING IN DIVERSE SETTINGS

**Inputs**
- Financial/in-kind support for professional development (PD), pre- and in-service teacher education, and co-teaching across sectors
- PD leaders with flexibility and capacity to train educators across sectors and with deep knowledge of STEM learning informed by the NRC’s Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas (2012); Surrounded by Science: Learning Science in Informal Environments (2010); and Community Programs to Promote Youth Development (2002)
- Adequate materials and resources for educators
- Co-planning by partners
- Business and higher education STEM professionals to mentor and sponsor educator externships

**Activities**
- Design/implement relevant, high-quality joint PD and co-teaching for educators across settings
- Offer educators across settings externships with STEM professionals
- Implement cross-sector placements, e.g.: K-12 teachers and district STEM specialists in OST programs • Educators from STEM-expert institutions in K-12 and OST programs • OST educators and STEM-expert institutions in the school day
- Tap school STEM specialists and science center staff to advise on OST STEM
- Within STEM expert institutions, connect K-12 and OST PD programs
- Use OST, science centers, informal learning spaces as pre-service practical sites
- Use technologies for learning, e.g. videoing, peer-to-peer review, and social media
- Develop Lead STEM Practitioners to provide PD and consultation across settings

**Outputs**
- Increased high quality PD and coaching support that is accessible to educators from all sectors
- Increased hours teachers and educators from diverse settings are engaged in joint PD, coaching and/or co-teaching
- Increase in number of Lead STEM Practitioners working across sectors
- STEM learning institutes enroll educators across settings
- Evidence of cross-sector connections among district STEM specialists, teachers, educators from STEM-expert institutions, and OST site directors and educators
- Evidence of educators across settings participating in externships w/STEM professionals
- Evidence of pre-service STEM educators completing practica in diverse settings
- STEM educator certification/badges

**Outcomes**
- Teachers and educators in a variety of settings who can design and facilitate STEM learning opportunities grounded in scientific inquiry and practice and engineering design
- New skills, outlook, knowledge and change in practice that educators can apply in multiple settings
- Educator and administrator attitudes across sectors support an integrated approach to STEM teaching and learning
- Engaged students with ability to think critically, collaborate on projects, and analyze information

**Measurement**
- Documentation of PD participation • Educator surveys on use and impact of PD in their own practice and respect for other educators’ roles • Program/classroom observations using school district observation protocol like Classroom Assessment Scoring System or a valid quality assessment tool designed for OST (e.g. DoS, STEM POA) • Localized measure of the efficacy of STEM teaching and learning K12 • Localized measures of STEM knowledge/competency and persistence • Student engagement and interest surveys, e.g. the Common Instrument • Number of educator certifications/badges
LOGIC MODEL // STRATEGY 4:
SUPPORT YOUTH TO ACCESS PATHWAYS AND EXPLORATION TO FURTHER LEARNING AND CAREERS

Inputs → Activities → Outputs → Outcomes

- Scan of existing partnerships that connect young people to learning experiences over time
- Searchable databases – such as the Connectory – used to catalogue and identify STEM opportunities
- Mechanisms for collaboration across K-12 and higher education
- STEM mentors from business, higher education, and STEM professional associations
- Resources for trainings and convenings for educators, families and youth

- Identify gaps in access and barriers to scale
- Promote use of searchable database of STEM opportunities
- Ensure that STEM learning opportunities across sectors include timely information about career opportunities and requirements
- Increase opportunities for youth to take and pass Advanced Placement (AP) courses and exams as pathway to STEM majors
- Increase opportunities for youth to experience STEM careers through internships, jobs and shadow days
- Increase number/quality of mentorship experiences for youth
- Increase youth access to STEM professionals with career knowledge
- Institute badges/portfolios so youth can demonstrate competency/knowledge across settings
- Assess and align curriculum and competency expectations in K-12 and higher education and create articulated pathways from education to business and industry
- Teach STEM educators, parents/guardians, and advisors to provide support to youth in navigating pathways

- Increase in use of searchable database of STEM opportunities
- Increased confidence of parents/guardians and educators in providing guidance to youth on pursuing STEM interests and preparing for STEM career/education
- Increased STEM career awareness among youth, educators and parent/guardians
- Increased number of STEM professionals mentoring youth on interest, career and education pathways
- Increased opportunities for young people to experience STEM careers through internships, jobs and shadow days
- Articulated pathways from K-12 to higher education or other post-secondary learning to jobs in business and industry
- Evidence of new credentialing opportunities such as digital badges and opportunities for students to earn academic credit for STEM internships, and acceptance of the credentials in multiple settings

- Case studies and learning narratives of youth pursuing STEM interests
- Evidence of digital badges/portfolios earned and accepted across settings
- AP course enrollment, scores and passage rates
- Number of students taking and completing college-accredited high school courses (e.g. CA’s A-G classes)
- Number of students enrolled and progressing in articulated pathways
- Student portfolios demonstrating growth of STEM competencies over time
- Surveys of youth interest in STEM, measured over time
- Educator, STEM professional, and parent/guardian surveys on their knowledge of STEM pathways and confidence in capacity to mentor youth toward goals
- Youth surveys on their knowledge of STEM pathways and requirements for career and post-secondary entrance

Measurement

- Increased number of youth pursuing STEM interests across settings and over time
- Increased number of Advanced Placement courses in STEM subjects taken and exams passed
- Increased understanding by youth and parents/guardians of the requirements and pathways to pursue STEM careers
- Increased self-identification of youth as scientists
- Increased parent/guardian and educator support for youth in pursuing STEM interests in different settings
- Increased number of students persisting along articulated pathways and succeeding in postsecondary education and careers
- Increased understanding among youth and families of the importance of STEM skills and literacy even for those not choosing a STEM career