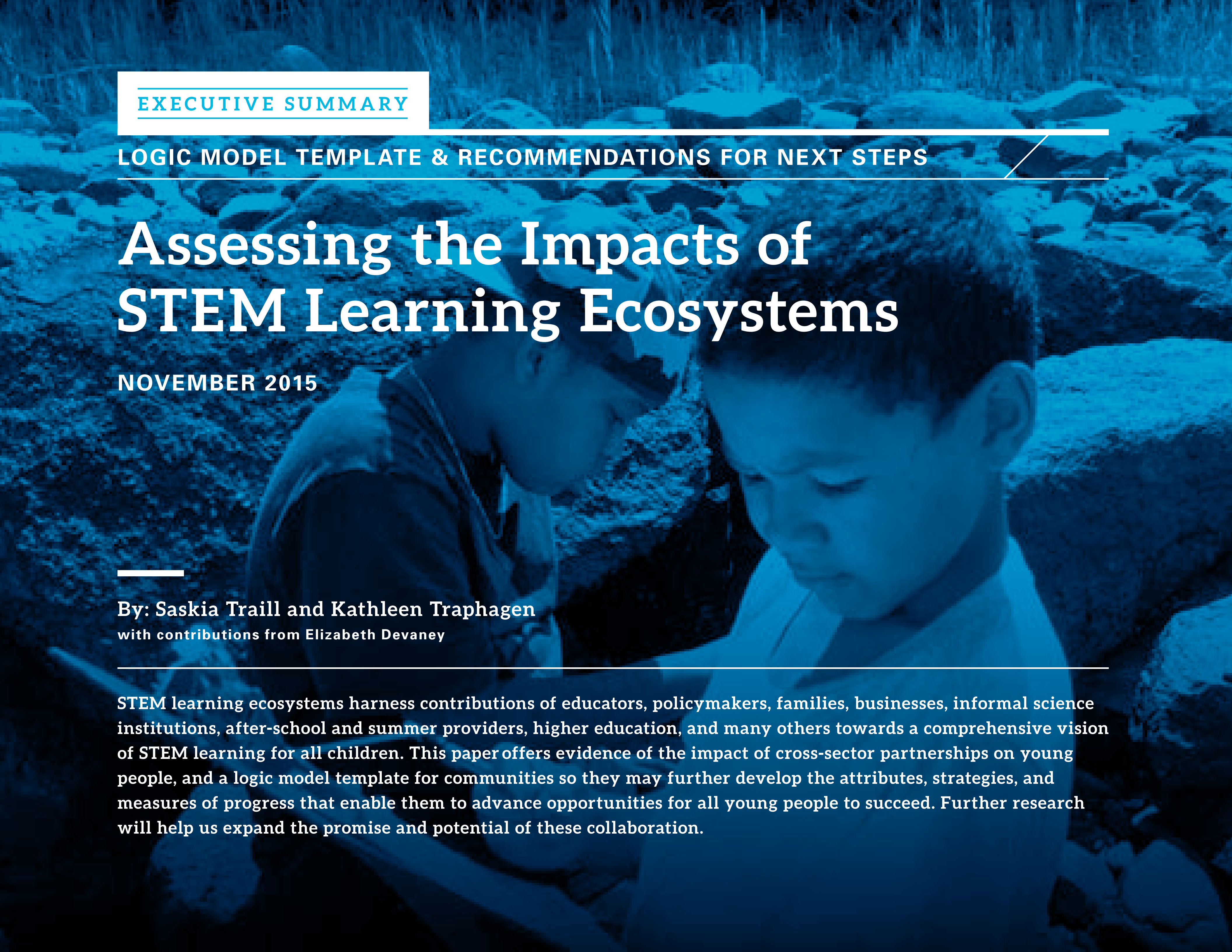

EXECUTIVE SUMMARY

LOGIC MODEL TEMPLATE & RECOMMENDATIONS FOR NEXT STEPS

Assessing the Impacts of STEM Learning Ecosystems

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STEM learning ecosystems harness contributions of educators, policymakers, families, businesses, informal science institutions, after-school and summer providers, higher education, and many others towards a comprehensive vision of STEM learning for all children. This paper offers evidence of the impact of cross-sector partnerships on young people, and a logic model template for communities so they may further develop the attributes, strategies, and measures of progress that enable them to advance opportunities for all young people to succeed. Further research will help us expand the promise and potential of these collaboration.

Executive Summary

STEM learning ecosystems harness the contributions of educators, policymakers, families, businesses, informal science institutions, afterschool and summer providers, higher education, and many others towards a comprehensive vision of science, technology, engineering, and math (STEM) learning for all children.

This paper offers emerging evidence of the impact of cross-sector partnerships on young people, and a logic model template for communities so they may further develop the attributes, strategies, and measures of progress that enable them to advance opportunities for all young people to succeed.

Further research grounded in these collaborative plans and using multiple methodologies will help us expand the promise and potential of STEM learning ecosystems.

INTRODUCTION

In February 2014, the Noyce Foundation published the working paper *How Cross-Sector Collaborations are Advancing STEM Learning*. The paper used the metaphor of ecosystems to describe how communities are attempting to create, enrich and connect varied learning opportunities to improve young people's knowledge and engagement in STEM (science, technology, engineering and mathematics) and better prepare them to be STEM-literate members of our civic communities.

As the 2014 working paper explained, *"A STEM learning ecosystem encompasses schools, community settings such as after-school and summer programs, science centers and museums, and informal experiences at home and in a variety of environments that together constitute a rich array of learning opportunities for young people. A learning ecosystem harnesses the unique contributions of all these different settings in symbiosis to deliver STEM learning for all children. Designed pathways enable young people to become engaged, knowledgeable and skilled in the STEM disciplines as they progress through childhood into adolescence and early adulthood."*

The idea of cultivating community- or regional-level STEM learning ecosystems involves blurring the traditional boundaries separating formal and informal learning to create dynamic collaborations that increase equity and discover new synergies to better prepare all young people to succeed.

The cross-sector partners profiled in the 2014 working paper join many other practitioners across the country using the ecosystems approach to increase access to STEM learning opportunities, equip educators, build interest-driven STEM pathways, deepen family engagement, and more.

As interest in ecosystems grows, so does the need to understand how to measure the impact of ecosystem cultivation. This paper, which was commissioned by the Noyce Foundation as a follow-up to the 2014 cross-sector paper, has three main aims:

1. to share evidence of the impact of cross-sector partnerships;
2. to offer a logic model template for adaptation by ecosystem cultivators;
3. and to draw on research and lessons from multiple fields to provide recommendations to practitioners, researchers, funders, and policymakers about how STEM ecosystems can manage the complexities of measuring the impact of multi-level interventions in dynamic systems over time.

Examples from identified communities showcase emergent local, regional and statewide impacts of cultivating STEM learning ecosystems. Research is still needed, however, to fully understand how community, regional, or statewide ecosystem cultivation catalyzes improved and more equitable STEM learning and engagement outcomes over the long term. We offer initial recommendations for future action by the research community, funders, practitioners, and others, and reflect on some areas for further discussion.

To download a version of this logic model designed for adaptation, click here.

// RECOMMENDATIONS:

1. Shared vision, priority outcomes, common language and agreed-upon measurements are needed for ecosystem cultivation. Ecosystem cultivators can adapt this paper's logic model template to develop their own local model.
2. Research at multiple levels using a range of methodologies is needed to better understand the optimal conditions and effective practices that undergird robust ecosystems.
3. New ways to track key indicators over time and across settings are needed to fully assess the impacts of robust STEM learning ecosystems on youth.

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Shared vision, priority outcomes, common language and agreed-upon measurements are needed for ecosystem cultivation. Local, regional and state-level ecosystem cultivators can adapt this paper's logic model template to develop their own local model.

We do not intend this template to be prescriptive nor to oversimplify the complex and dynamic set of STEM learning opportunities in an ecosystem. Rather, this template may serve as an important tool to help catalyze ongoing dialogue and relationship-building toward common vision, goals, language, outcomes and measurements among ecosystem stakeholders.

The logic model is based on a four-strategy framework for cultivating ecosystems and developing cross-sector partnerships that transform STEM education for young people.

STRATEGY 1. // ESTABLISH AND SUSTAIN CROSS-SECTOR PARTNERSHIPS TO CULTIVATE ECOSYSTEMS

Cross-sector collaborations designed to realize a collective vision of STEM success for young people are key to cultivating a rich STEM learning ecosystem. These collaborations are anchored by strong leaders and characterized by collaborative vision and practice. Ecosystem cultivators assess gaps and shift resources to ensure that young people who have been historically under-represented in STEM -- including girls, economically disadvantaged young people, linguistic minorities, young people of color, and those with disabilities -- access high-quality, diverse and inter-connected STEM learning experiences. The collaborators determine collective goals based on the community's needs, assets and interests and these goals drive decisions about how to engage in creative approaches to the remaining three strategies – creating/connecting STEM-rich learning environments; equipping educators, and building youth pathways to further learning, engagement, development and careers.

STRATEGY 2. // CREATE AND CONNECT STEM-RICH LEARNING ENVIRONMENTS IN DIVERSE SETTINGS

In a robust ecosystem, learning opportunities are high-quality, universally accessible, youth-centered, and connected so learners can deepen their skills and interests, and tackle increasingly complex challenges over time. Curricula and pedagogical approaches are grounded in seminal reports on STEM education by the National Research Council.
As young people engage in STEM learning in and out of school, they experience the joy of learning and the rewards of persistence through unhurried opportunities to tinker, experiment, and explore subject matter that is relevant to them. They are actively engaged in science, engineering and mathematical practices. Young people's development of a "STEM identity" and increase of their self-perception of confidence in STEM is spurred on by engaging in challenging, relevant problem-solving on issues they care about; being publicly recognized for their efforts in and out of school; and gaining support from their parents and guardians for their pursuit of and interest in STEM. Development of a strong STEM identity leads to long-term success and engagement.

STRATEGY 3. // EQUIP EDUCATORS TO LEAD ACTIVE LEARNING IN DIVERSE SETTINGS

To lead active learning across settings that young people encounter throughout the day, educators--whether K-12 teachers, pre-service teacher candidates, after-school or summer program staff, experts in informal STEM institutions, or STEM professionals acting as mentors--need professional development and appropriate materials and curricula. Educators across sectors need competencies and tools to be able to work together to increase their efficacy, for example fostering young peoples' deep understanding of cross-cutting concepts and core ideas through multiple learning experiences throughout the day. Educators need opportunities to share effective practices, build common understanding, and gain respect for each other's roles. Finally, they must be equipped to support young people's ability to navigate and connect learning opportunities across settings.

STRATEGY 4. // SUPPORT YOUTH TO ACCESS PATHWAYS AND EXPLORATION TO FURTHER LEARNING AND CAREERS

Pathways and opportunities for exploration enable young people to become engaged, knowledgeable and skilled in the STEM disciplines as they progress through childhood into adolescence and early adulthood. Young people's interest in STEM learning is sparked in diverse environments, and then deepened by their cross-sector pursuit of more knowledge. Young people are aided by adults who are skilled at empowering them to navigate boundaries and access resources. Young people have opportunities to meet and build mentoring relationships with STEM professionals from similar backgrounds who serve as role models in their school and out-of-school experiences. In and out of school, young people learn from an early age about a range of STEM career possibilities. PreK-12 STEM learning is connected to post-secondary and STEM career opportunities to ensure that STEM learning pathways evolve to meet the changing needs of STEM employers. Parents and guardians receive consistent messaging, guidance and resources from multiple sources about how to support their children's long-term STEM success.

Assessing gaps, identifying partners, developing a collective vision and committing to shared outcomes creates a strong base to develop creative approaches to implementing strategies, based on each community's needs, assets, and interests. We hope use of this logic model or a similar tool to define the parameters of collaboration will help local ecosystem cultivators tackle several important and complex tasks: deepening relationships, defining common language and shared outcomes, and importantly, moving toward adopting common assessments. Shared logic will create a strong footing for approaching increasingly complex evaluation questions. For example, a community might first agree on its shared logic model, focus evaluation on process and implementation, then on effective practice related to set of strategies, and finally on impact on young people when sufficient time has passed for effects to surface.

Youth participating in Boston After School & Beyond's Summer Learning Project observe pond life at the Hale Reservation in Westwood, MA. Photo

// Photo Credit: Tiffany Knight

2 Research at multiple levels using a range of methodologies is needed to better understand the optimal conditions and effective practices that undergird robust ecosystems.

Youth in the California Academy of Sciences Science Action Club record citizen science observations to verify accuracy of NASA satellite images. // Photo Courtesy of California Academy of Sciences

Nearly everyone interviewed for this paper agreed on the need for more robust research about the value and impact of strategies to cultivate STEM learning ecosystems. Multiple methodologies should be employed to help us understand the full impacts of connecting STEM opportunities for young people and of building youth pathways that are designed to maintain interest and build STEM competencies. We need to understand the effects of cross-sector professional development and effective family involvement, among other strategies. Research is also needed to shed light on which ecosystem cultivation strategies lead to increased equity in opportunity and success for young people historically under-represented in STEM majors and careers.

We recommend that ecosystem leaders, researchers and funders work jointly to launch comparative studies looking at efforts in multiple communities, as well as in-depth community-level studies. In both cases, it will be important to disseminate findings broadly among ecosystem proponents. Using multiple methodologies -- such as ethnographic approaches, in-depth qualitative case studies, and individual learning narratives -- can help illustrate how the evolving dynamics and relationships that comprise a healthy ecosystem impact the quality, availability, and coordination of STEM learning opportunities.

Ecosystem researchers will need to have a flexible approach, comfort with the messiness and complexity that characterize ecosystems, interest in multi-disciplinary work, and a willingness to work with practitioners playing a central role in helping to design and implement research.

Involving researchers as partners in nurturing and developing strong ecosystems with common goals and visions will encourage even more responsive research methods and findings. Researchers may need support to be effective communicators of their plans and their findings to multiple types of audiences, using new and diverse mechanisms to disseminate findings. We also must understand and address the concerns of the practitioners we want to engage in this research. Many practitioners described a desire to build their personal and organizational relationships before engaging in research, despite interest in deepening understanding about cross-sector collaboration. The STEM Funder Network ecosystems initiative, with its focus on building a community of practice among cities, regions and states, will provide an initial stage for a multi-city study and a forum for practitioners and researchers to consider other specific research initiatives.

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New ways to track key indicators over time and across settings are needed to fully assess the impacts of robust STEM learning ecosystems on youth.

Ecosystems need ways to assess a broader of set of STEM outcomes for all youth within their boundary area. Such outcomes could include evidence of active participation in STEM learning opportunities, self-perceptions of STEM identity, success in academic STEM courses, pursuit of higher education and STEM majors, and eventual employment in jobs that require STEM skills. Widespread adoption and administration of common measures would prove useful in building large data sets of affect and interest, though data-sharing capabilities would need to be in place so information could be interpreted by cross-sector practitioner teams for continuous improvement.

Photo Credit: Tiffany Knight

CONCLUSION

Ecosystem cultivators will need to find new ways to tackle complex questions about how we, as a society, can support long-term development of children and adults. Dealing with these challenges will require funders to provide flexible resources to the many innovative practitioners and researchers working in this space. Researchers and practitioners will need to work together within and across disciplines to expand the questions they seek to answer and the ways they work together to improve practice and ultimately the impact, sustainability, and reach of STEM education efforts. Those innovators need supporters, partners, cheerleaders, colleagues, networkers and storytellers. It is in that spirit we offer this paper.

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

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

- Engage in activities from Strategies 2-4 that best meet priority goals
- Sponsor cross-setting site visits, job shadows, literature reviews, retreats, etc., for all partners
- Expand and/or reallocate financial and human capital resources to support cross-sector initiatives
- Adjust policies and practices to support cross-sector initiatives
- Engage in outreach and communication to key stakeholders and broader community
- Implement evaluation that provides useful and timely data, encourages reflective practice, and enables continuous improvement
- Build capacity of partners to engage in evaluation process

Outputs

- Partners participating in cross-sector learning
- Newly expanded/connected STEM learning opportunities for young people and educators
- New pathways youth can navigate toward STEM success
- Committed, long-term funding
- Policy and practice changes to support cross-sector STEM are embedded in partners' strategic planning documents, defining and requiring cross-sector learning
- New or reallocated resources to support cross-sector work, (e.g. a school district appointing a STEM partnerships director)
- Number/reach of communications
- Partners are developing capacity to reflect on their actions and decisions, use data to inform course adjustments

Outcomes

- Cross-sector partnerships expand/connect youth and educators to STEM learning across settings
- Partners are well versed in and committed to cross-sector approaches
- Articulated pathways guide youth from K-12 to higher education to STEM careers
- Resources and policies supporting cross-sector work are institutionalized
- Partnership has secured stable financial/human capital support for infrastructure and evaluation
- Increased understanding among community members of importance of STEM learning in and out of school
- Measurable population level improvement in STEM learning and engagement outcomes for youth

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.

LOGIC MODEL // STRATEGY 2:
CREATE AND CONNECT STEM-RICH LEARNING ENVIRONMENTS IN DIVERSE SETTINGS

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 (e.g. Common Instrument) • 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)

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 PQA) • 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

- 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

Activities

- 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

Outputs

- 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

Outcomes

- 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

Measurement

- 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