Scaling Up In Communities Through Informal Science Education Networks & Ecosystems

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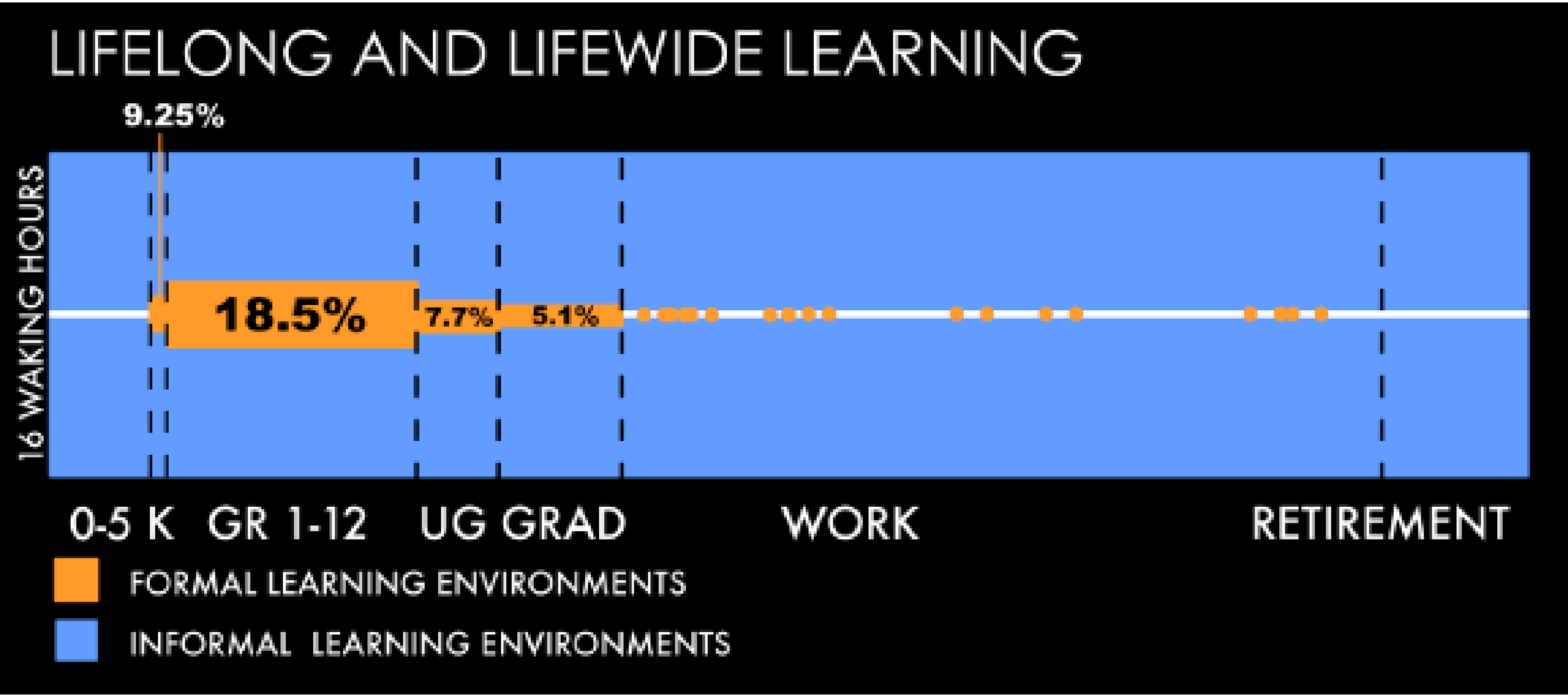
- Why informal science education environments?

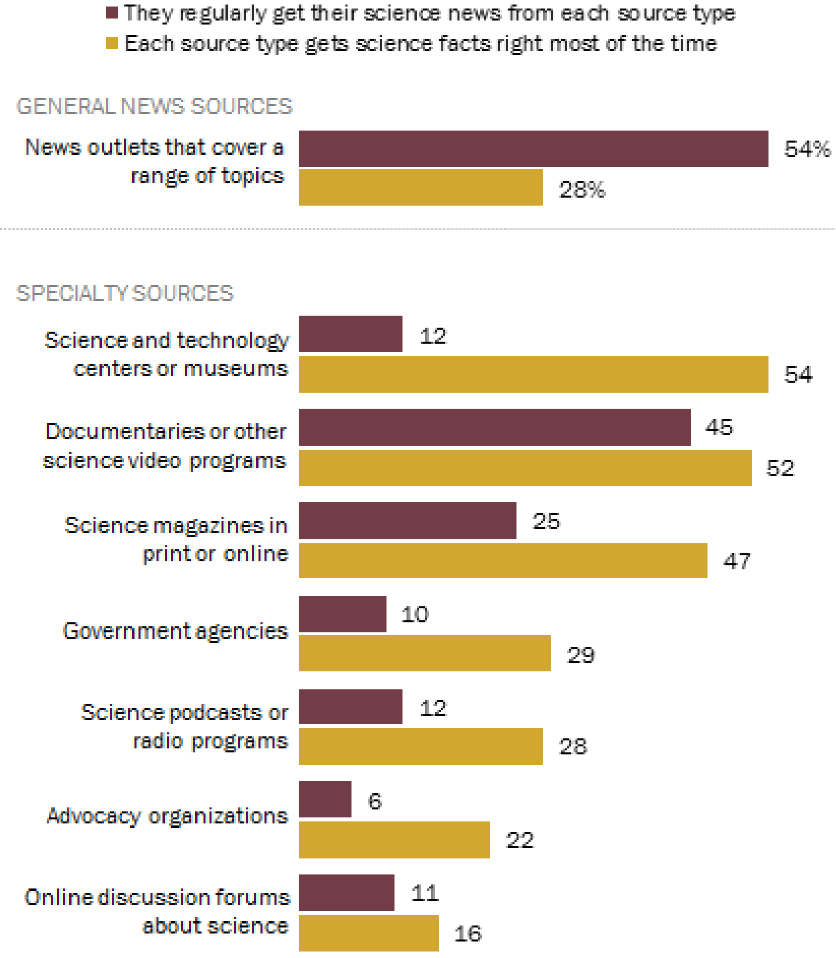
- Networks – when to partner and best use case

- Education Ecosystems – when to partner and best use case


LIFELONG AND LIFEWIDE LEARNING
9.25%
16 WAKING HOURS
18.5%
7.7%
5.1%
0-5 K
GR 1-12
UG GRAD
WORK
RETIREMENT
FORMAL LEARNING ENVIRONMENTS
INFORMAL LEARNING ENVIRONMENTS

Most Americans rely on general news outlets for science news, but only a minority says these outlets get facts right

% of U.S. adults who say ...



Note: "Most of the time" combines those who said "almost all" or "more than half" of the time. Respondents who gave other responses on each question or who did not give an answer are not shown. Other source types rated are not shown.
Source: Survey conducted May 30-June 12, 2017.
"Science News and Information Today"

PEW RESEARCH CENTER


SONY

Planning Early for Careers in Science

Robert H. Tai,* Christine Qi Liu, Adam V. Maltese, Xitao Fan

Young adolescents who expected to have a career in science were more likely to graduate from college with a science degree, emphasizing the importance of early encouragement.

Concern about U.S. leadership in science has captured the national spotlight once again (*1*). The physical sciences and engineering are at particular risk, with declines in the number of earned doctorates in these fields among U.S. citizens and permanent residents in the past decade (*2*) (figs. S1 to S3). Recommendations for improvement focus on education, particularly in improving the number of teachers and the quality of teacher training for primary and secondary schools (*1*). This is an attractive but expensive approach.

Enhanced online at www.sciencemag.org/cgi/content/full/312/5777/1143

How important is it to encourage interest in science early in children's lives? How early in their lives do students decide to pursue a science-related career? We used nationally representative longitudinal data to investigate whether science-related career expectations of early adolescent students predicted the concentrations of their baccalaureate degrees earned years later. Specifically, we asked whether eighth-grade students (approximately age 13) who reported that they expected to enter a science-related career by age 30 obtained baccalaureate degrees in science-related fields at higher rates than students who did not have this expectation. We analyzed students in the United States for years 1988 through 2000 and controlled for differences in academic achievement, academic characteristics, and students' and parents' demographics.

Survey and Analysis

We used the *National Education Longitudinal Study of 1988* (*NELS:88*) for this study. Designed and conducted by the National Center for Educational Statistics (NCES), *NELS:88* began in 1988 with a survey of 24,599 eighth graders. Researchers conducted additional surveys in 1990, 1992, 1994, and 2000. The overall sample

MULTINOMIAL LOGISTIC REGRESSION ANALYSIS

Independent variable		Coefficients of nested models: Baseline	2	3	4	Final
Career expectation	Life sci.	0.6 (0.2)	0.7 (0.2)	0.7 (0.2)	0.6 (0.2)	0.7 (0.2)
	Phy. sci. /engr.	1.7 (0.2)	1.4 (0.2)	1.2 (0.2)	1.2 (0.2)	1.2 (0.2)
Covariate groups						
Student demographics			+	+	+	+
Achievement scores				+	+	+
Academic characteristics					+	+
Parent background						+

Regression analysis results. $P < 0.001$ for all data shown; + indicates inclusion of covariates in the model; standard errors are shown in parentheses; $n = 3359$. Dependent variables: nonscience = 0, life science = 1, and physical science/engineering = 2. See supporting online material for more details.

also obtained baccalaureate degrees from 4-year colleges or universities by 2000. This reduced the sample to 3,743 participants. The sample was further reduced to a final size of 3,359 participants, because 384 participants were missing data in one or more of the variables used in the analysis.

These variables included scores from mathematics and science achievement tests (designed by the Educational Testing Service) that were administered in the first three surveys of data collection, when students were mostly enrolled in the 8th, 10th, and 12th grades (*3*, *4*).

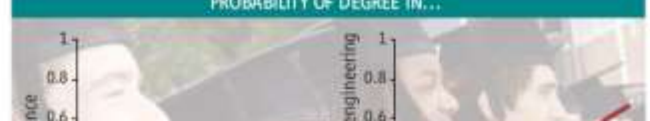
The baccalaureate degree concentrations—which were coded into three broad categories of physical science/engineering, life science, and nonscience—resulted in a categorical depend-

took into account students' backgrounds and natural propensities. For example, students with stronger performance in science and mathematics may be more likely to major in the sciences. We therefore included four covariate groups to account for (i) academic backgrounds (science and mathematics achievement scores); (ii) students' demographics (gender and ethnicity); (iii) students' academic characteristics (enrollment in advanced versus regular mathematics and science classes, attendance in these classes, and student-reported attitudes toward mathematics and science); and (iv) parents' background (highest educational level and professional versus nonprofessional employment) (*6*).

Our analysis focuses on the independent variable derived from the *NELS:88* survey question: "What kind of work do you expect to be doing when you are 30 years old?" Students were then given a list of employment options and required to select only one. We categorized the responses into two groups: science-related and nonscience career expectations, creating the Career Expectation independent variable (*4*).

We applied multinomial logistic regression, which handles categorical dependent variables with more than two outcomes. Our analysis included two outcome comparisons in earned baccalaureate degrees: (i) earning degrees in life sciences versus nonscience areas and (ii) earning degrees in physical sciences/engineering versus nonscience areas. We assessed the degree to which the independent variables could predict these two comparisons. In the *NELS:88* sampling design, two analytical issues require special attention: (i) the effect of purposeful

PROBABILITY OF DEGREE IN...




convection

✓Time

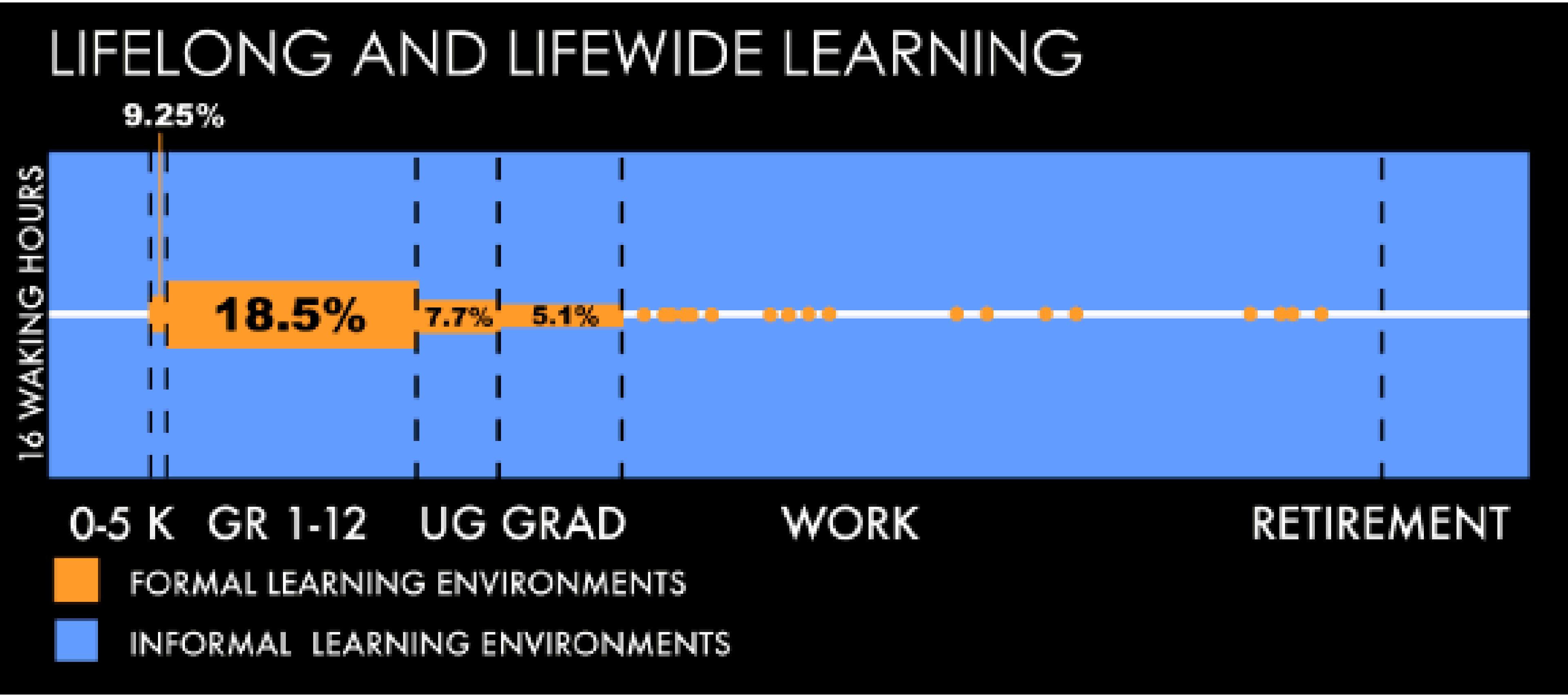
✓Trust

✓Impact

(Caveat)

Networks – scale wide

Ecosystems – scale deep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Networks

- National or international
- Values, Content, Audience, Urgency
- Boundary organizations
- Maximize (and measure) impact
- Hungry (but busy)

NISE Net

Science Festival Alliance

Citizen Science Association

Living Lab

Every Hour Counts

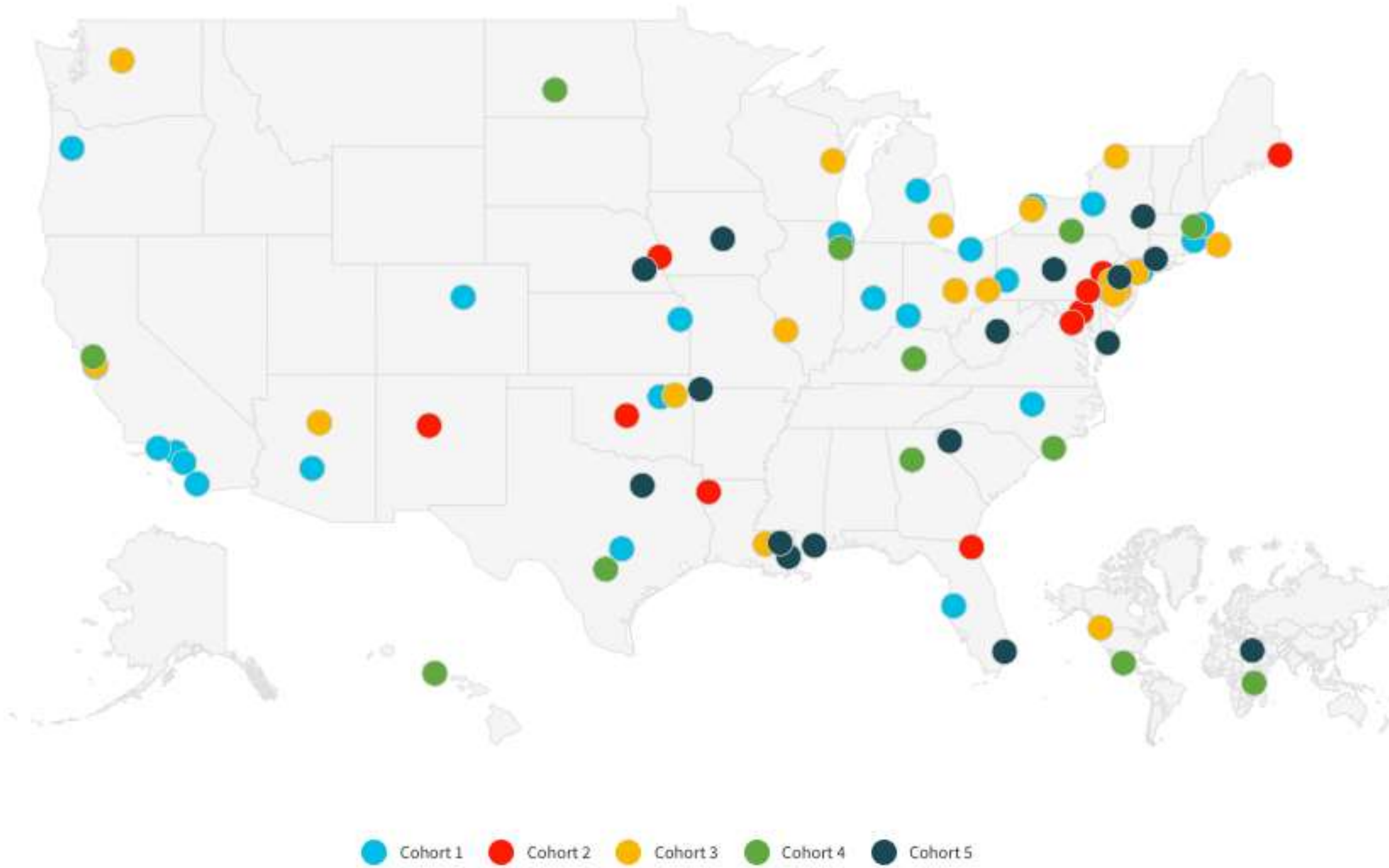
Healthy Network Test

1. Shared vision
2. Productive
3. Internal coherence
4. Two way mechanisms
5. Multiple ways to participate
6. Validity in the field
7. Codified governance

Source: Inverness Research, Characteristics of a Healthy Network

STEM ecosystems

Participating STEM Learning Ecosystems



Making in NEO
Adult Education and Certificate Programs
Museums
Libraries
Fairs and Festivals
Career and Technology Centers
Teacher/Educator Professional Development
Community Colleges
Open Maker Spaces/Fab Lab
Colleges and Universities
Hobby/Clubs/Workshops
Recreation/Community Centers
Private/Public Partnership Coalitions
Incubators
Virtual Learning
2-year program / 4-year programs
Post-college programs
Additive Manufacturing Degrees
Academic Maker Spaces
Crafting
2-year degree Programs
4-year degree Programs
Economic Development Programs
Research
Student-based Research Networks
Workforce Development
Community-based programs for children and adults
Meet-ups/Networking Events
Outreach
Clubs
Continuing Education
Professional Development
Competitions
Community Informal STEM Learning Environments
After-school Programs
STEM Schools
Workshops
Events/Festivals
Camps
Internships/Volunteers
Private Maker Spaces
Public Maker Spaces
Birth to Pre-K / Grades K-3
Summer Camps
After-school Activities
Music and Arts
Tours/Field Trips
Government Initiatives
Legos
Social Media
Community based clubs
Libraries
Schools
Museums
Grades 4-8
Community Engagement: Clubs, etc.
After School / Vacation
Competitions
Informal Education
Formal Education
Grades 9-12
Schools
Public Spaces
Summer Camps
Festivals and Fairs
After-school Programs
Competitions
Clubs
Internships and Volunteer Experiences

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