CHARACTERISTICS OF SUCCESSFUL OST STEM LEARNING EFFORTS

Bronwyn Bevan
Exploratorium

June 3, 2014

PRESENTATION OVERVIEW

Assumptions

Characteristics

Equity Orientation

QUESTION

What are the characteristics of successful OST STEM learning efforts?

ASSUMPTIONS

ASSUMPTIONS ABOUT STEM OST EFFORTS

There is a thing called "STEM OST"

ASSUMPTIONS
ABOUT STEM OST EFFORTS

Afterschool +
Summer Programs

Cultural Institutions/
Community Events

Media Events
(episodes, podcasts)

Internet Resources/
Community

ASSUMPTIONS
ABOUT STEM OST EFFORTS

Afterschool +
Summer Programs

Cultural Institutions/
Community Events

Media Events
(episodes, podcasts)

Internet Resources/
Community

State/Civic

Youth
Development

Science-Specific

ASSUMPTIONS
ABOUT STEM OST EFFORTS

Afterschool + Summer Programs

Cultural Institutions/ Community Events

Media Events (episodes, podcasts)

Internet Resources/ Community

State/Civic

Youth Development

Science-Specific

Time

Staffing

Setting

Connectivity

Goals

Partnerships

ASSUMPTIONS ABOUT SUCCESS

There is agreement on
"what success looks like"
in OST settings

ASSUMPTIONS ABOUT SUCCESS

Producing Future Scientists

ASSUMPTIONS ABOUT SUCCESS

Producing Future Scientists

Producing More STEM-Engaged School Students

ASSUMPTIONS ABOUT SUCCESS

Producing Future Scientists

Producing More STEM-Engaged School Students

Producing More Lifelong STEM-Engaged Learners

Enthusiasts/Supporters?

Active Hobbyists/Citizen Scientists?

Evidence-Based Critical Thinkers?

ASSUMPTIONS ABOUT SUCCESS

Producing Future Scientists

Producing More STEM-Engaged School Students

Producing More Lifelong STEM-Engaged Learners

Enthusiasts/Supporters?

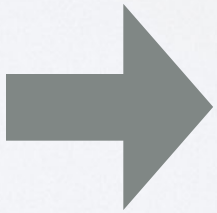
Active Hobbyists/Citizen Scientists?

Evidence-Based Critical Thinkers?

Expanding Access to Rich Learning Opportunities

ASSUMPTIONS

There is a [consistent/variable] relationship between characteristics and success

Characteristics  Success

ASSUMPTIONS ABOUT CHARACTERISTICS

$C_1+C_2+C_3$ ... = Characteristics of Success

ASSUMPTIONS ABOUT CHARACTERISTICS

$C_1 + C_2 + C_3 \ldots$ = Characteristics of Success

$C_1 \times C_2 = C_3 + C_4 + C_5$

ASSUMPTIONS ABOUT CHARACTERISTICS

$C_1 + C_2 + C_3 \ldots$ = Characteristics of Success

$$C_1 \times C_2 = C_3 + C_4 + C_5$$

$$C_1 \times C_2 > C_3 + C_4 + C_5$$

ASSUMPTIONS ABOUT CHARACTERISTICS

$C_1+C_2+C_3 \ldots$ = Characteristics of Success

$$C_1 \times C_2 = C_1+C_2+C_3$$

$$C_1 \times C_2 > C_3+C_4+C_5$$

$$(C_1 \times C_2) + (C_3+C_5)/4 \geq C_1+C_2+C_3+C_4$$

PAUSE

CHARACTERISTICS

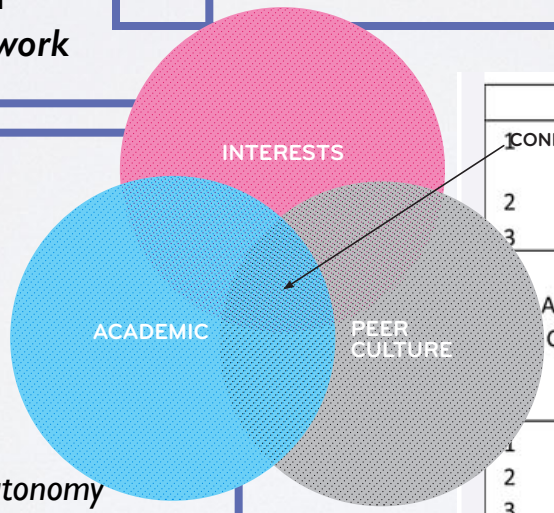
CHARACTERISTICS
LISTS, FRAMEWORKS, ETC.

Environment and climate
Administration and organization
Relationships
Staffing and professional development
Programming and activities
Linkages between school and afterschool
Youth participation and engagement; Parent, family, and community partnerships;
Program growth and sustainability
Measuring outcomes and evaluation
-NY State Quality Afterschool Framework

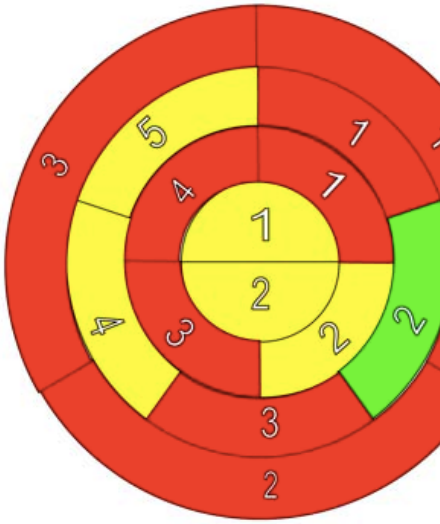
Supportive relationships with adults
Supportive relationships with peers
Engagement
Cognitive Growth and Mastery
Orientation
Structure, Control, Chaos
—Vandell et al 2006

Girls STEM Programs
Hands on
Mentoring
Internship
Career Exploration

Building on prior interests
Multiple pathways
STEM as means not ends
Inviting materials that spark engagement
Sparking interest through modeling
Asking "what-if" questions
Supporting reflection
Ideas and inspiration
Opportunities for collaboration and for autonomy
-MAPDD



	category	value
1	Classroom preparation	1
2	Teacher-organization collaboration	1
3	Connection to curriculum	1
	Clarifying the goals	1
	Addressing the environment	3
	Connection to everyday life	1
	Social interactions	2
	Guide performances	2
1	Physical activity-observer	1
2	Active learning-observer	2
3	Active learning	1
4	Physical activity	1
1	Beliefs, views & values	2
2	Knowledge & understanding	2



NRC RESEARCH SYNTHESIS RE STRONG YD AND STRONG STEM

Physical Well-Being	Interest
Intellectual Development	Concepts
Psychological + Emotional Development	Inquiry
Social Development	Epistemologies
	STEM Practices
	Identity

STRONG YOUTH DEVELOPMENT
NRC, 2002

Physical Well-Being

Intellectual Development

Psychological + Emotional Development

Social Development

critical thinking
school success
life and vocational skills

confidence/self-efficacy
autonomy
mastery orientation

STRONG YOUTH DEVELOPMENT
NRC, 2002

Physical Well-Being

Intellectual Development

Psychological + Emotional Development

Social Development

connectedness
civic engagement
relationships

STRONG SCIENCE
NRC, 2012, 2009 AND 2006

participate
intellectually, socially, physically, emotionally
in scientific and learning practices with others, using scientific language and tools

Concepts

Cross-Cutting Themes

Science & Eng Practices

Interest

Concepts

Inquiry

Epistemologies

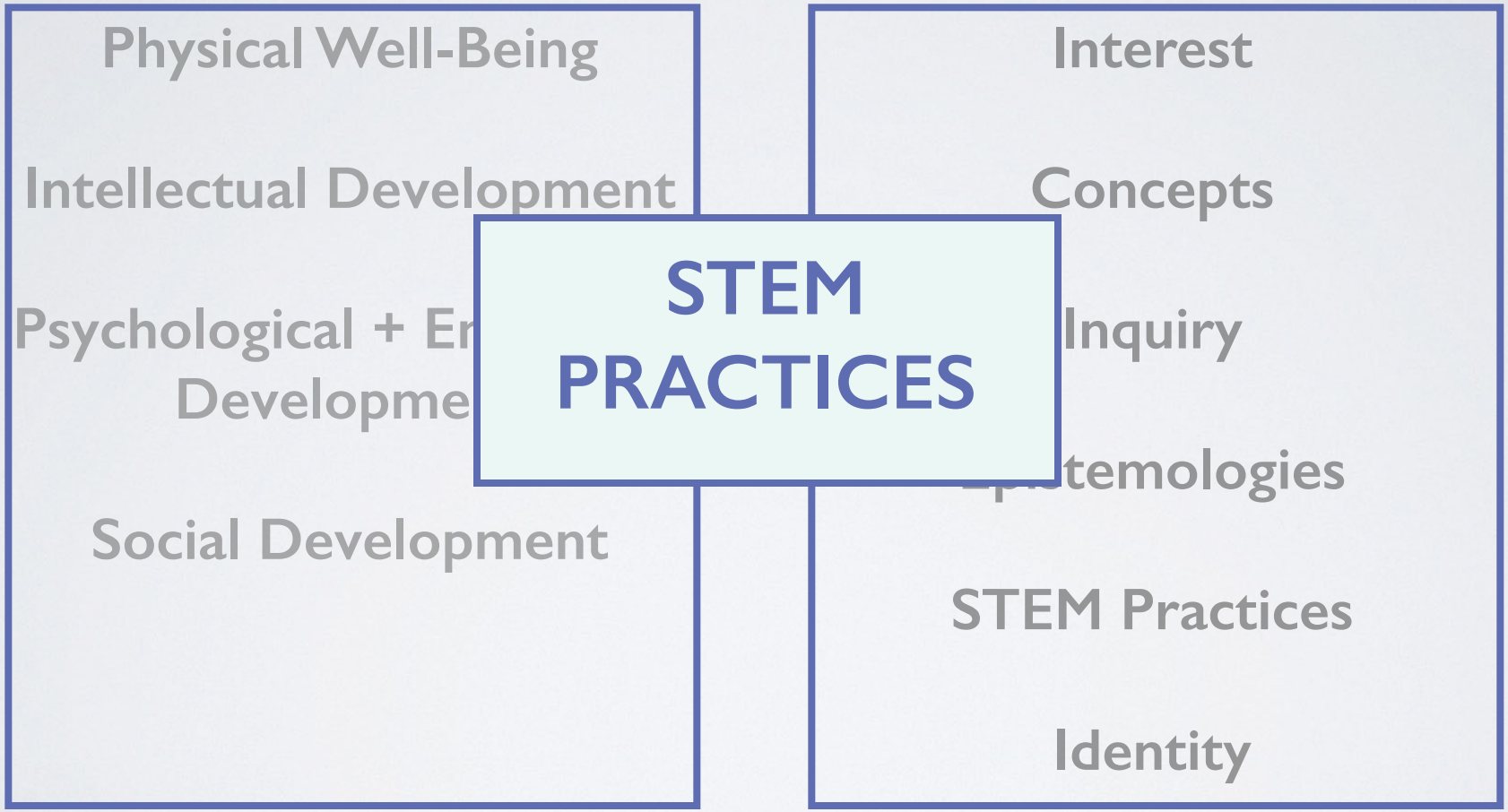
STEM Practices

Identity

STEM PRACTICES (NRC, 2012)

1. Asking questions (science) and defining problems (engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (science) and designing solutions (engineering)
7. Engaging in arguments from evidence
8. Obtaining, evaluating, and communicating information

STEM PRACTICES
AT THE INTERSECTION



WHAT DOES IT LOOK LIKE?

STEM PRACTICES

Smoothie day with a bike!

Today was awesome for the get city experts. We made a smoothie maker using a **blender with a bike as a power source**. We used a bike because we are looking at ways to get off the power grid, and survive without using electricity. We used fruit, maple syrup, and milk as ingredients in the smoothies. It was so sweet.
More»

June 19th, 2012 | chontalice | Leave a comment

WHAT DOES IT LOOK LIKE?
DOING, PERSISTING, CARING

ECOLOGICAL PERSPECTIVES

BROADENING PARTICIPATION IN STEM:

CHARACTERISTICS FOR ACCESS AND EQUITY

EQUITY IN STEM EDUCATION

- Access to ongoing, multiple opportunities to do and learn STEM.
- STEM introduced as the best means towards achieving goals that are meaningful to the learner.
- Learning activities leverage young people's familiar personal, family, and cultural resources and routines.

EQUITY ORIENTED OST STEM
EXPLO/SF B&G CLUBS

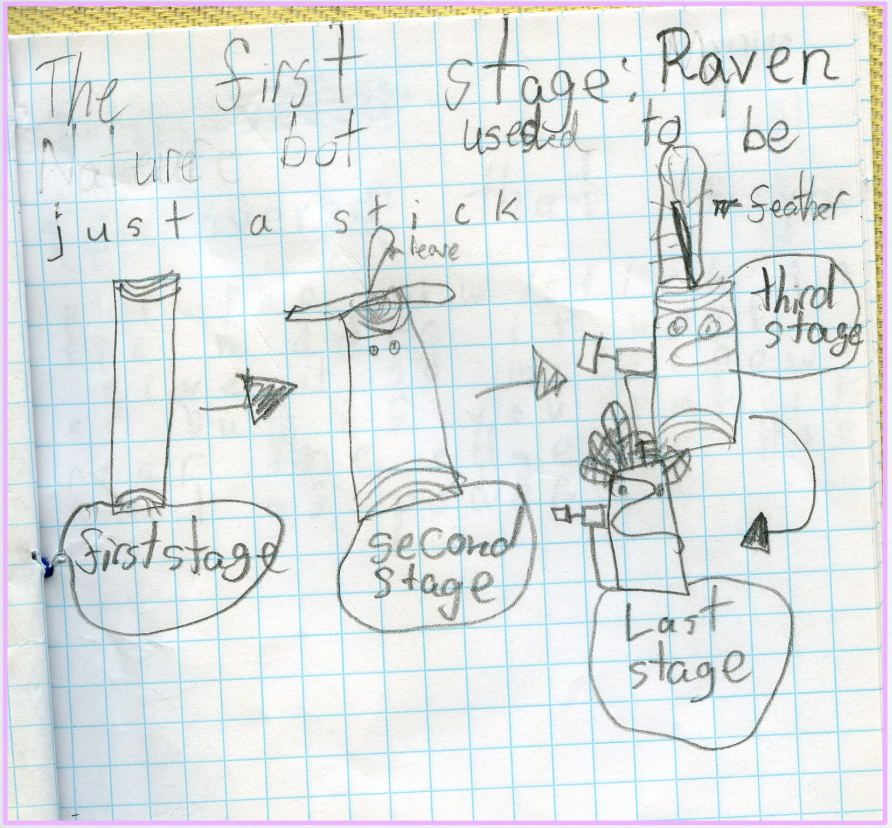
Weekly Tinkering Program offered by Exploratorium and SF Boys & Girls Clubs

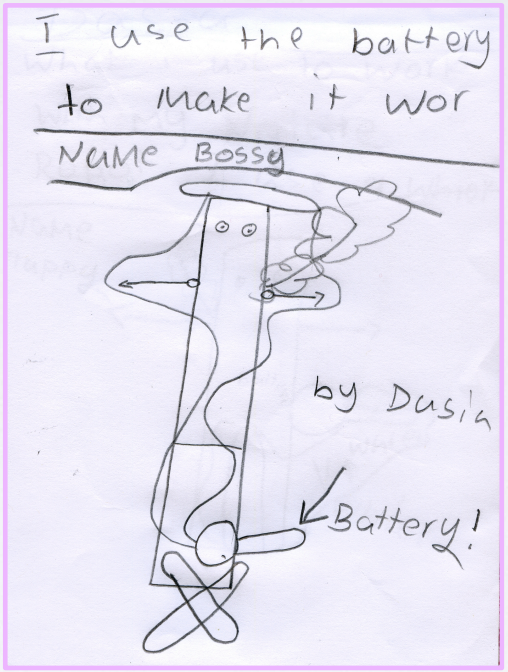
Each semester organized around 2-3 key phenomena

EQUITY ORIENTED OST STEM
EXPLO/SF B&G CLUBS

Each idea, tool, or process introduced in context of familiar family or youth practices

EQUITY ORIENTED OST STEM
EXPLO/SF B&G CLUBS





Intentional connections and language associated with STEM practices and with school practices

EXPLO/SF B&G CLUBS STRUCTURES

Time	Weekly
Staffing	Science Educators + Youth Developers
Setting	Community Clubhouse
Connections	Language and Practices
Goals	Rich Learning Opportunities
Partnership	Science Museum and Y.D.

CHARACTERISTICS OF EQUITABLE OST STEM

Intellectually Engaging and Challenging

Relevant

Contextualized in Matters of Young People's Interests
Mixed Age Groups/Peer-Mentoring

Expanding Horizons

Opportunities for Research
Opportunities to meet and know STEM professionals

Intentional Connections Across Settings and Time

Leveraging Familiar Routines, Tools, and Experiences
Making Connections Between Home, School, OST, Future

QUESTIONS FOR POLICY AND PROGRAM LEADERS

1. **What other learning opportunities and activities are available to the young person?**

2. **How do programs make intentional connections among learning opportunities? (*but critical to open up rather than narrow down*)**

3. **Can we replace "align to" with "relate to"?**

4. **How do we expand access/scale opportunities without losing local meaning and variation?**

CROSS SETTING INFRASTRUCTURE TO EXPAND ACCESS AND EQUITY

1. Use of social media to allow youth to expand and explore interests — open up possibilities.

2. Networks that broker relationships and opportunities and connect youth with adults in shared areas of STEM practice/interest.

3. Systems for recognizing learning across settings (badging is one alternative, intentional coordination and talking across levels/systems is another).

-Penuel, Lee, & Bevan (2014)