Making is Learning

Design

Make

Play

tinker

play

Design Lab
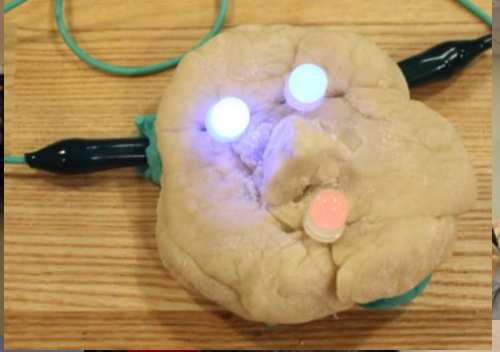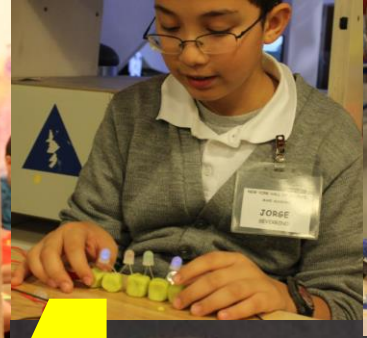
ideate

create

force

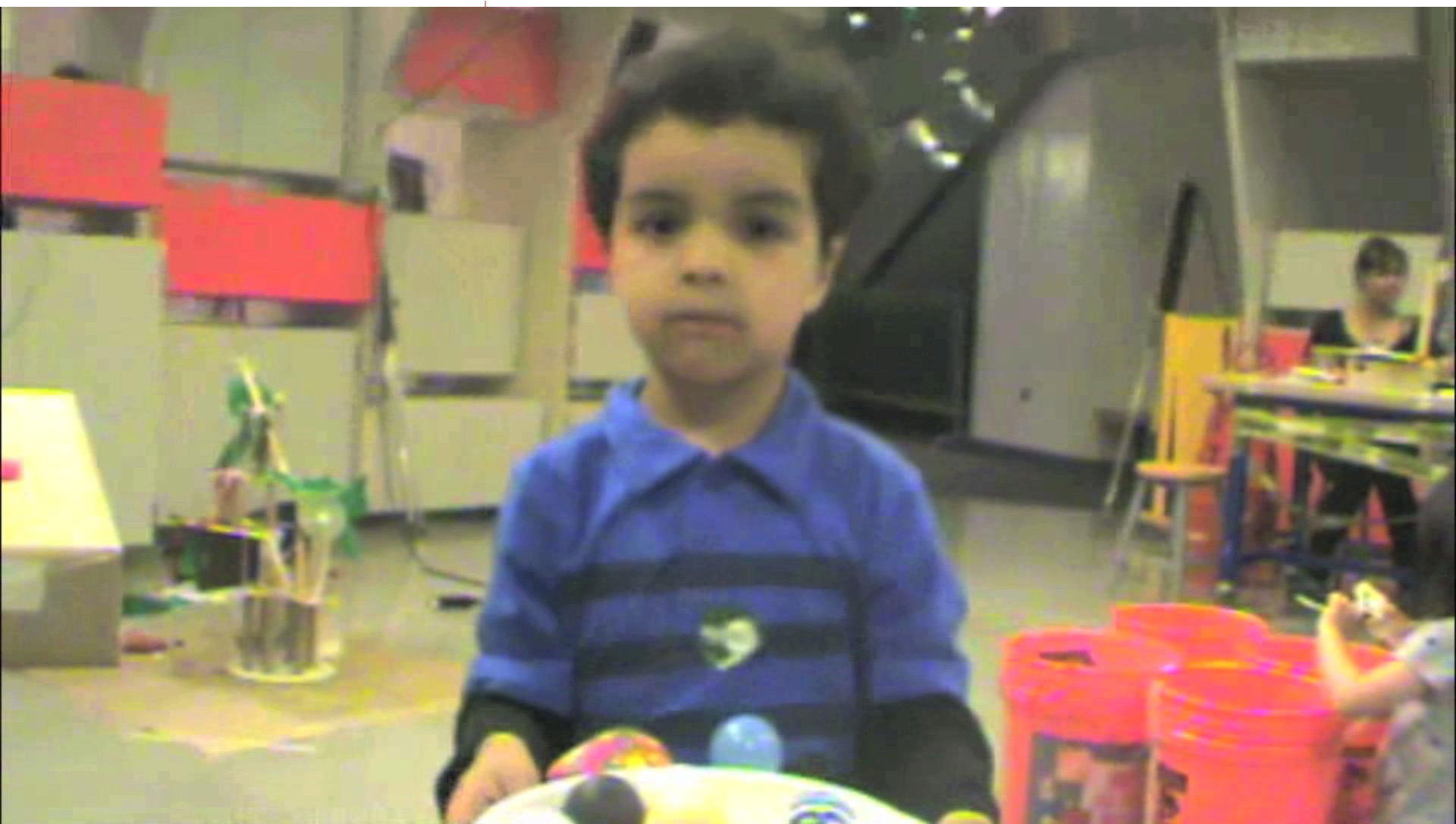motion

energy

sciplay

Maker Space

Open Ended

Minimally Scaffolded

Tools enable ideas

to coalesce

Learning through Making

What Does it Mean?

Personal Interests

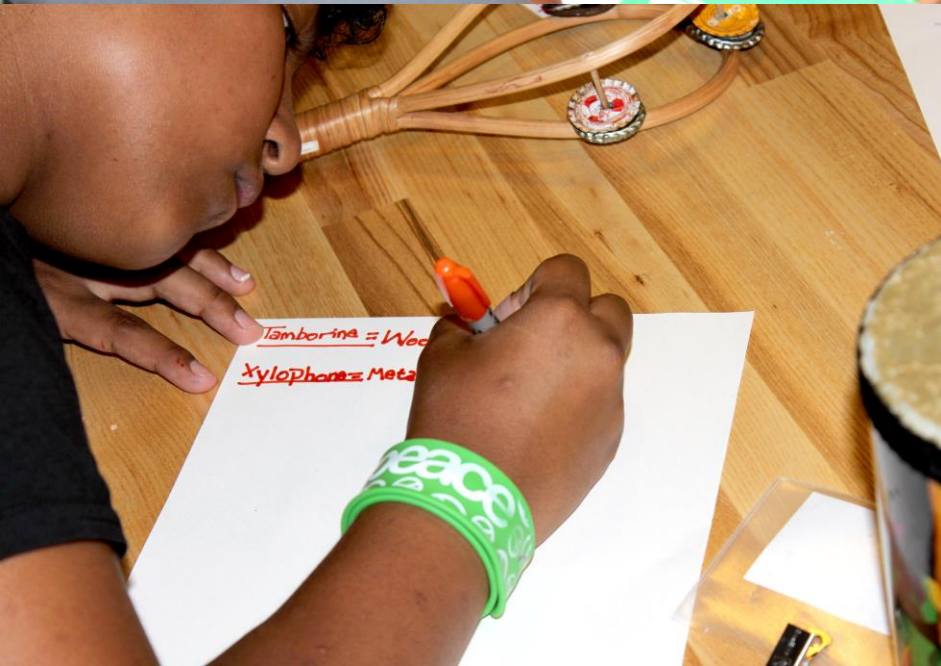Problem Solving

Materials & Tools
Literacy

Facilitation

Exploration Learning

Deconstruct

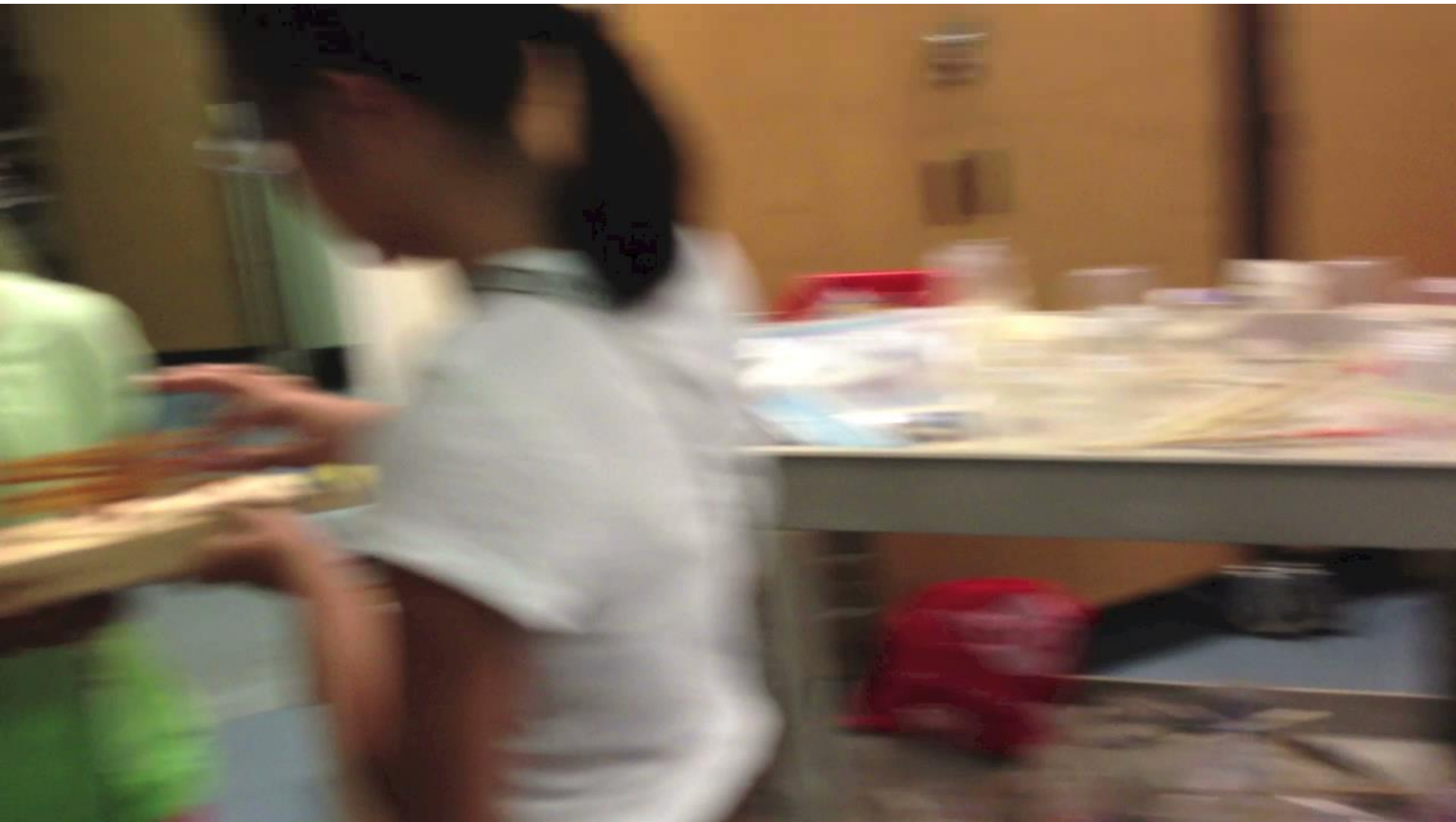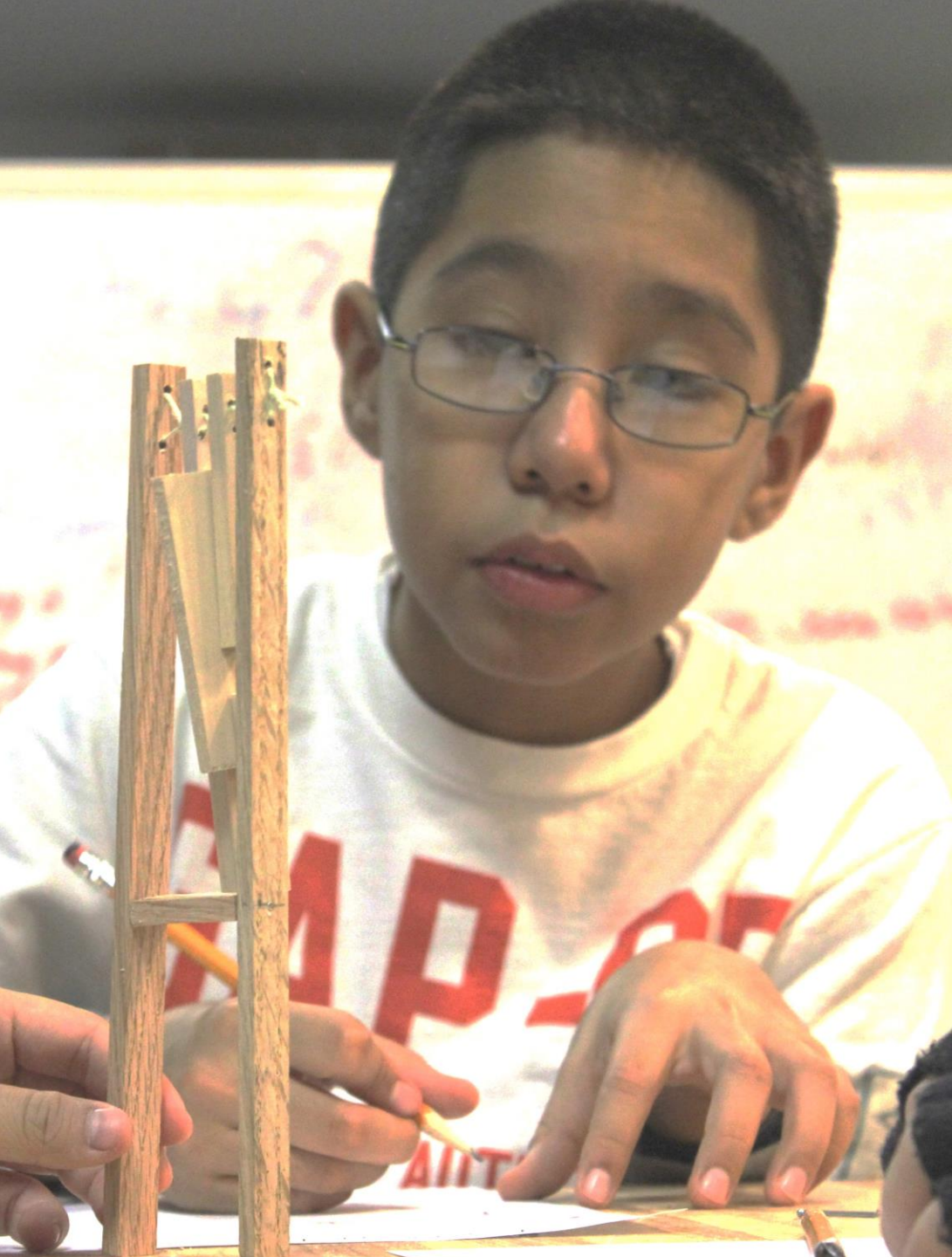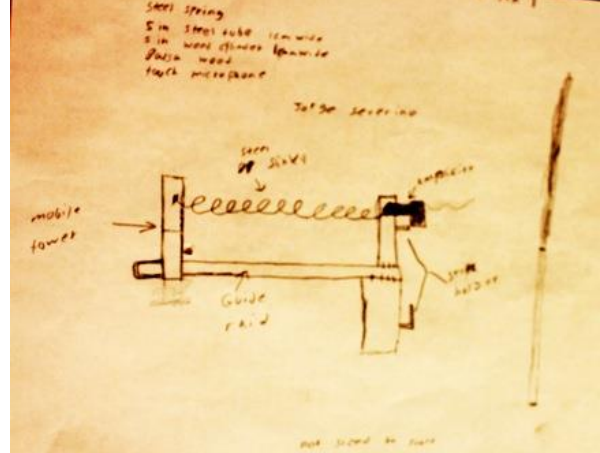Discover

Design &...

Make

Display

Developing Life

Long Learners

"The self is not something

ready-made, but something

in continuous formation

through choice of action."

- John Dewey

New York Hall of Science

makerspace.nysci.org

Design | Make | Play

Family Learning in Museum Maker Spaces

Little Makers invites young children and their families to tinker, design and make together.

Research Questions

How should we design to best support the range of family participation in museum-based makerspaces?

Sub-Questions:

- In what diverse ways do families participate in museum-based makerspaces as contexts for family learning?

  - What are the identifiable practices, resources and roles being enacted and negotiated as individuals and communities participate in making?

- What is evidence of participants' learning through making?

  - How do we know that families are engaging in productive participation patterns?
  - As families make in these interdisciplinary spaces, what do they learn about disciplinary STEAM skills and practices?
  - Are there additional or alterative learning outcomes of families' participation?
  - How to we assess this learning and its impact?

- How does the presence of family making in museums change the meaning of the family museum experience?

  - How do designers support productive family participation in making?
  - How should the various elements of the activity system be considered?

Make:

Textual reference points for making community

The **Make:** Community
Content Analysis

Unit of Analysis: Articles

Data Collection and Analysis:

- One Year of MAKE Magazine; Volumes 30-33, n=160
- Connection to disciplinary practice literature
- A priori & grounded approach
- Identification of variable patterns
- Iterative development of coding scheme and manual
- Quantitative and qualitative examples of participation

Patterns of Family Participation
Practices, Resources & Roles

Unit of Analysis: family-unit. Operationally defined as consisting of at least one child between the ages 2-12, and one adult of significant relation to the child

Observational Episode: one cycle of family's making experience in exhibit or program (e.g. tinkering with tools & process; making of product, experience of lesson plan)

Sampling Frame:

NYSCI: 10 Episodes

CMP: 10 Episodes

Balanced across target child ages: 2-12 years

Maker Practices

The authentic ways in which members of the community (making, museum, family) participate and create a shared repertoire of value and meaning; used in the development, coordination and application of skills and knowledge when "making"

Maker Practice	Definition
Explore & Question	Observe, investigate, play with and discover relationships, representations, pursue personal and collaborative inquiries, be open to change
Iterate, Test & Tinker	Explore processes; Repeatedly plan, model, construct, test and evaluate project, or aspects of a project to discover what is possible and/or to make it better
Collaborate	Seeking out and/or rely on the expertise of others; working together and communicating
Seek Out Resources	Know where and to whom to turn for guidance. Interacting flexibly with the distributed tools and materials of the community. Referencing resources/sources for extended or background knowledge.
Hack & Repurpose	Assessment, reuse, and remixing of processes and made products of the community. Finding inspiration from past processes and projects.
Share	Openly share, access, and further pursue explorations, questions, process, and products with the community through diverse platforms for presentation and reception; "open source"
Combine & Make Compatible	Use, integrate or extend existing technologies. Intentionally making products that can be used and made by others.
Customize	Personalization; making a product or process one's own, adding customized features

Maker Resources

Flexible and adaptive social, dispositional and cognitive mechanisms that underlie, support and engender the development of more sophisticated participation in the practices of the community.

Type	Resource	Definition
Dispositional	Curiosity	A desire to know more about, investigate and question one's self and/or the environment; wondering, investigation and excitement in learning more.
	Persistence	Actions taken to remain engaged when facing a difficult obstacle, or maintaining engagement in learning activity over extended periods; the pursuit of a passion, overcoming barriers, looking for problems to address.
	Motivation	The desire and choice to continue, learn more, engage further; the feelings (affective) and thoughts (cognitive) underlying behavior; the reasons one has for engaging in a particular behaviors (e.g. interest, goals, values, etc.).
	Playfulness	A mode of active engagement, one that encourages experimentation and risk taking, one that views the process of solving a problem as important as finding the answer, one that offers clearly defined goals and roles that encourage strong identifications and emotional investments; Learning to reach beyond one's capacities, to explore playfully without a preconceived plan, and to embrace the opportunity to learn from mistakes and accidents.
	Agentive/Initiative	Taking initiative, pride in or ownership of the learning process and/or product, being comfortable with being uncomfortable, having confidence in your capacity to figure things out and/or be successful accomplishing a task
	Flexibility	The capacity to expect a diversity of solutions and improvising with materials and ideas, thinking in divergent ways, going beyond the directions, acquiring a vocabulary for innovative thinking and innovative doing.
Cognitive	Skill	Demonstrable techniques, processes and procedures; the acquisition and development of skill is often focused on a particular project, interest area, or activity context.
	Knowledge	Declarative interdisciplinary, and/or context-specific understandings of phenomena, concepts, theories, history and relationships within a given project or activity context.

Learner Goals of Making
Design, Make, Play

- **New STEM Pathways:** Making can create new pathways into science, technology, engineering and math (STEM), particularly among children

- Motivation to participate in STEM: Making can fulfill a critical national need to motivate young people to engage more deeply in STEM learning; Making enables learners to recognize that their participation in STEM disciplines has personal relevance to their lives; making *intrinsically* motivates participation.

- 21st Century Learning: Making develops 21st century skills, knowledge and vocabulary: Critical thinking and problems solving, cooperation, collaboration and communication, creativity and innovation, flexibility and adaptability, initiative, self-direction and entrepreneurship, materials, technology, media and information literacy; Making prepares youth for productive participation in the 21st century workplace/workforce.

- Seeding Innovation: Making awakens curiosity, creativity, improvisation, divergent thinking, resourcefulness, expression and sharing; Making sparks new innovations and collaborations across discipline and context/setting.

Materials Literacy And Tool Skills

Scientific Inquiry Skills

Mathematical Thinking

Creative Thinking And Divergent Solutions

New York Hall of Science