Interdisciplinary Learning in Museums: When STEM Becomes STEAM

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InterActivity 2017 Association of Children’s Museums
“Learning is more than the acquisition of the ability to think; it is the acquisition of many specialized abilities for thinking about a variety of things”.

_Lev Vygotsky_
How does the Children’s Museum of Pittsburgh work with artists to turn STEM into STEAM?
1 - *Tough Art* seeks to address the needs of the artist, the museum and the audience by collaborating with artists to develop original interactive museum experiences in one of the toughest venues: a children’s museum.

2 - CMP *MAKESHOP®* is a place where physical materials and digital media resources intersect; where visitors are encouraged to be curious, creative, experimental and innovative. This is a place where hands-on activities can connect STEM to *Tough Art.*
TOUGH ART 2013
Reach by Scott Garner

Touching the moon and a star completes an electrical circuit, resulting in a sound.

Each star is a different note, so the art can be played as a musical instrument too.
You can do it by yourself.....
or you can work together by holding hands.
The hands-on connection

CMP MAKESHOP©
Circuit Blocks
TOUGH ART 2014
Prism Palace by Lindsay Packer
The hands-on connection

CMP MAKESHOP®
Light Peg Building and
Prism Photography
TOUGH ART 2011
Giant Kaleidoscope
by Christina Zaris
The hands-on connection

CMP MAKESHOP© kaleidoscopes
TOUGH ART 2010

The Beast

by Nova Jiang

https://vimeo.com/15577865
The hands-on connection

CMP MAKESHOP©

Arduinos, gears and chain reactions
The Challenge

- Engage visitors in the excitement and reward of STEAM discovery.
- Exploit the power of self-guided, informal learning across multiple disciplines to ignite the imagination and creativity of young minds.
STEAM Discovery Continuum

- Developmental continuum that spans ages, tools, challenges and skills.
- Multi-sensory environment where child leads, but has support from staff and adult caregivers.
Early childhood explorations engage all the senses and stimulate cognitive development.

Involved adults build confident children willing to take on challenges.

Real tools in kids’ hands kick-start problem-solving skills.

Access to new technologies helps kids stay apace with their peers.

Making introduces new tools and uses all the senses for problem solving.

Multi-disciplinary opportunities foster creative expression and new perspectives.

Novel experiences inspire longer term interest in the sciences.

Rich interactions with mentors cultivates communication and collaboration.

Sharing results and ideas start a new cycle of ideation and invention.

Inspired kids become STEAM problem solvers, and pursue STEAM education and careers.
Delivering STEAM Experiences

- Helping children form habits of mind associated with critical thinking, problem solving, designing and making across platforms.
Museum exhibits introduce children to STEAM concepts such as gravity, motion, and math from the earliest ages in hands-on fun ways.

Staff-led programs cover a broad range of science topics on a daily basis, engaging young people in the wonders of science.

Special events bring together young learners around STEAM programs including Google Geek Street and Boston Mini Maker Faire.

The Museum disseminates STEAM learning materials to schools, libraries, and museums through programs such as Race To The Top.

The Museum extends the reach of its content through websites including Beyond the Chalkboard, My Sky, and School Readiness.

Investigate, Bubbles, PlaySpace, Construction Zone, Johnny’s Workbench, Raceways, My Sky, and Countdown to Kindergarten
Boston Mini Maker Faire, Google Geek Street, Engineering Week, Macrophotography Workshop, and National Grid Tinker Tent
Race To The Top and National Grid STEM Guide and Kit
MySkyExhibit.org, BeyondtheChalkboard.org, and School Readiness
The Gallery
• Collaborating with local artists
• STEAM across programs, exhibits, & special events

Hideout, Amy Archambault 2017
A Map Home
Eve Ewing, 2015/2016
Not Planes, Not Trains, Just Cranes
Andrew Neumann, 2016
Small Worlds
Tim Porter, 2016
How does the Children’s Museum of Pittsburgh work with artists to turn STEM into STEAM?

1 - **PROTOTYPING IS KEY TO SUCCESS.**
   Prototyping is accepted practice in STEM – not so much in art.

2 - **MEASURES OF SUCCESS MAY NEED TO CHANGE.**
   Adjusting goals may be necessary to blend disciplines.

3 - **ENJOY THE PROCESS AND THE OUTCOME.**
   Collaboration can bring the best out of everyone.
TapeScape

Multidisciplinary STEAM Education Experience

and

Museum Engagement Installation Process
Multidisciplinary STEM Education Experience

Science: Physics/Chemistry/Biology

Technology: Manufacturing/Programming

Engineering: Structural engineering/Materials testing

Art: Design/Creative problem solving/Experiential

Math: Shapes/Curves/Geometry/Symmetry
Science:

Physics

Chemistry

Biology
Technology:

- Manufacturing
- Programming
- Communication
Engineering:

- Structural Engineering
- Materials Testing
Math:

Shapes/Curves

Symmetry

Geometry

Circle

Ellipse

Parabola

Hyperbola

Graphs of different functions and geometric shapes are depicted, including graphs of equations and geometric figures.
Multidisciplinary **STEAM** Education Experience

**Art:** Design/Creative problem solving/Immersive experience
Art:

- Design
- Immersive Experience
- Creative Problem Solving
TapeScape is the integration of all of these educational subjects into a community engagement, collaborative, hands-on, and playful exhibit!
Museum Engagement Installation Process

**Primary:** Young makers participate to create something real

**Secondary:** High school classes or youth leadership programs

**Higher Ed:** College and university class participation, from engineering and construction to arts and humanities

**Community:** Volunteer or service organizations, professional associations, member families, or general call for volunteers
Getting more people involved

Summer Student Volunteers at Liberty Science Center

5th Grade class from SEA School of Engineering and Arts- Golden Valley, MN

Tauton High School art students- Pittsburgh
Getting more people involved

Corporate groups – 3M Engineers for the adhesive and tape division

Students from many departments – Minnesota State University Construction Management and Engineering Students
Getting more people involved

Museum staff, volunteers and corporate groups working together in Winnipeg
Collaboration and multimedia communication

Collaborate with museums: Integration of mission and goals of exhibits through collaborative design process

Collaborate with other artists: New design solutions to be discovered when combining design ideas and expertise

Cobranding: Artists working with museums

Social media integration: Combine social media efforts for more mutual and viral exposure
Artist collaboration with a museum
Exposure: Collaborate with other designers
Exposure: Arts festivals and photo opportunities at the museum
Branding the museum
Using **social media**

- **encourage photos and posting** - guide the hashtags and location
- **bring in special guests or watch/monitor** to see who is visiting
- **be ready to post, repost, share and tag**
TapeScape’s background

Children’s Museum of Southern Minnesota: Local need for family activates and expanded early childhood education

Travel: Connecting with other Children’s Museums
What else is out there:
Gather more information and ideas

Over HALF the country was covered for our museum research to build a world class museum and exhibits for our community in Southern Minnesota.
What else is out there:
Gather more information and ideas
A new donated space:  
Children’s Museum of Southern Minnesota

**Donated temporary space:** lots of space, but no iconic/central exhibit  
**Change of focus:** initial focus on facilities  
**PlayLab:** a place to experiment and prototype, try new things
Inspiration from other artists and museums

Installations by Numen For Use- Europe, Australia and Japan

City Museum in St. Louis, MO; Madison and Phoenix Children’s Museums
Design and Building Process

**Design**: Ideas, themes, space available, scale

**Building**: Metal frame, sketching forms with a grid of wrap, filling in with tape, strengthening and quality control, testing and refinement, play
Design process: **Design ideas/Creative collaboration**

The tunnel form is more like a black hole or space vortex. LED Lighting taped on the forms could be used as a chasing pattern through the tape tunnels. (Lines like above image)
Building process: **Fit the space/Adaptation**

- **Play big! TapeScape**: Main multi-level climber with slide
  - High window and exit tunnel (total tunnel width 2.4 m, universally accessible)
  - Push up through tunnel to upper level
  - Movable walls pushed together and partially darken the tunnel
  - Overall area: 320 m² (reflects tape)
  - Main entry with space for floor pad, shop access, and tape below entry lane only on open floor space for universal accessibility

- **Play small: TotScape**: Smaller scale tunnel for slower play and crawling
  - Entry cut from same side of wall

- **LED light tunnel**: LED lighting on circular tunnel
  - Tunnels for TotScape could be made from fabric fencing in wall to help keep 1 meter standard away from gateway tunnel entry like TapeScape

- **Darkening the room will make the LED lighting on tunnels more dynamic**

- **Smaller scale tunnel for slower play and crawling**

- **Views into TapeScape mid and upper tunnels and climber**: Mid and upper tunnels blocked off and will need ventilation (note any/vent in plan)

- **Main views into TapeScape tunnel and climber**: Upper tunnels closed off and will need ventilation (note any/vent in plan)
Building process: **Framing/Structure**
Building process: Taping/Collaboration
Building process: Quality control/Safety
Building process: Outreach/Publicity
Final product: Have fun and play
TapeScape

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