

I Own My STEM Journey: Young Black Women Authoring 3D Re-Presentations of their STEM Pathways



Day Greenberg¹, Angela Calabrese Barton¹, Christina Restrepo Nazar¹, Myunghwan Shin¹, Chandler Turner², Camryn Turner³

¹Michigan State University

²the University of Notre Dame

³the Boys and Girls Club of Lansing

Overview & Objectives

In this project, a group of young, African American, female science enthusiasts and learners mapped their journeys (including ecological contexts like people, places, and events) as they worked to author unique and powerful science pathways. The purpose of this work is to illuminate often-invisible perspectives and challenges of youth who seek out and explore science learning opportunities over time and across life spaces. We discuss affordances of youth participatory methodologies, for recognizing, analyzing, and supporting youth voice, agency, development and learning pathways.

We acknowledge the complex and overlapping roles we embody as collaborators, mentors, teachers, network gatekeepers, and participant-observers. We problematize traditional power structures that mediate youth movement and development in the contexts we study. Participants include 5 women (ages 12-19) who identify as black, female, low-SES, and interested in future STEM learning and work; we have had STEM-related relationships with each for at least 3 years. Participants created innovative, three-dimensional visualizations of experiences they argue were important in shaping their STEM journeys. They 3D-modeled which events were important and why, with a coding framework they developed. They indicated which connections were stronger/weaker, where they felt more/less empowered, where they did/didn't have helpful relationships, etc.

Conceptual Framework

Mobilities of Learning (Calabrese Barton, Tan, & Greenberg, 2016)

- Learning involves **vertical** and **horizontal** movement (Engeström & Sannino, 2010)
- Ideas, practices and tools are re-purposed and re-mixed towards new meanings and new possibilities for becoming (Gutiérrez, 2012)
- Learning always takes place somewhere, both in "relation to history (time) and context (place/space) (Bright et al., 2013)
- It challenges normative views of what it means to participate in practice within community by making visible the boundaries of formal/informal, novice/expert, and past/present/future, and how these boundaries change over time and across space (Rahm, 2014)
- Learning is situated within local practice (Holland & Lave, 2009)

Youth Participatory Design (Kirshner, O'Donoghue, & McLaughlin, 2005)

- Youth participants are recognized as knowledge creators, legitimate co-researchers, and working partners
- Central to this design is power-sharing between co-researchers in a partnership of respect

Research Design

Data generation:

Data Form	Specific Data Generation Strategy
Artifact Interviews	<ul style="list-style-type: none"> • Participants shared narratives of their STEM pathways across settings and over time • Participants explained how/why their STEM pathways were constructed, what people, places, things, and events were of critical importance, and how they believed their pathways should be coded and visually represented
Artifact Creation & Think Aloud	<ul style="list-style-type: none"> • Participants constructed 3D re-presentations of their STEM pathways across settings and over time, and they talked about their STEM pathway in detail to reflect on aspects/items of importance as well as how their pathway has been constructed and connected (or not)
Artifact collection	<ul style="list-style-type: none"> • Youth's audio-recorded interviews and think alouds, 3D re-presentations, 2D preparatory sketches and notes, researcher field notes, written and coded narrative documents

Data analysis: Our conceptual framework (e.g., mobilities of learning) guides analysis

Contexts:

- Participants in Lansing, Michigan, United States
- Participants are current and former members of an afterschool integrated STEM makerspace program
- The authors have all been involved in the afterschool program for at least 3 years
- Partnership with Boys and Girls Clubs, allowing ongoing, sustainable relationships with participants over time (e.g., former program members often visit)

Findings

Implicit (versus "explicit") pathways into STEM: Youth described pathways navigated as implicit because they did not contain events typically legitimized as STEM-preparatory.

Example: As the first in her family to author a STEM pathway, Chandler described often feeling like an imposter for daring to claim that journey. She highlighted the critical junctures that illuminated resources and tools that helped her to clear safe spaces in otherwise unsafe and uncharted territory.

Pathway representations as tools of empowerment: Youth saw their maps as tools for peer empowerment, inspiration, and responsive, transformative action.

Example: One participant explained that publicly sharing her life story in such a visually impactful way, beyond text, was important "for future kids to be inspired and think, 'Oh! This chick didn't go the traditional route but she still got there and I can too.'"

3D Representations as Conceptual Tools
Constructing pathways in such a visually striking, 3D layout captures the complexities of spaces (which are often described in homogeneous and static ways), illuminating those spaces as different for each individual as well as dynamic and shifting across time.

Example: One participant stated that her playdough work helped her to see previously hidden parts of her STEM pathway.

We present youth-generated pathway representations (e.g., figures 1-4) and describe the often-invisible perspectives and challenges of the youth as they named them in their representations.

Significance

New methods for creating striking and memorable 3D visualizations of often-untold and marginalized life stories in STEM are powerful tools for pushing these stories more immediately and directly in front of the decision-makers who need to see, recognize, and acknowledge them.

This work is increasingly urgent to ensure more democratic and equitable action from the educational leaders who control the power structures that matter to youth and who design, facilitate and gate-keep educational opportunities that allow diverse youth to author the STEM journeys they desire.

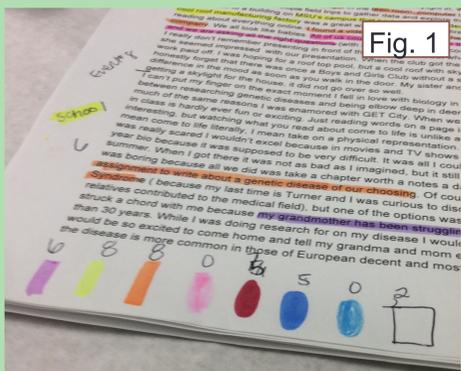


Fig. 1

Fig. 1. A participant narrated a reflection on her STEM pathway. She coded the pathway description for the most salient dimensions of her experiences (e.g., highlighting every mention of important people with purple, and ranking each mention on a 0-10 scale of importance for her STEM pathway).

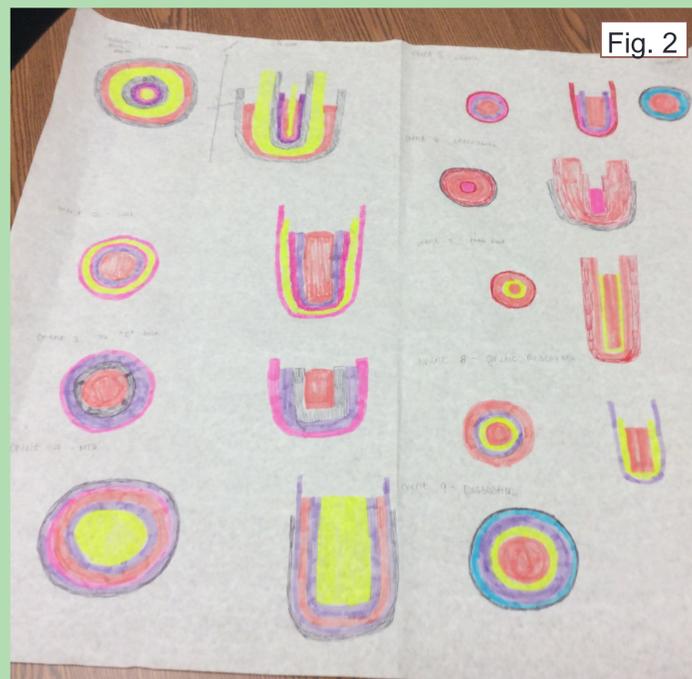


Fig. 2

Fig. 2. Next, she experimented with different ways of visually representing her codes to aid others in understanding her journey.



Fig. 3

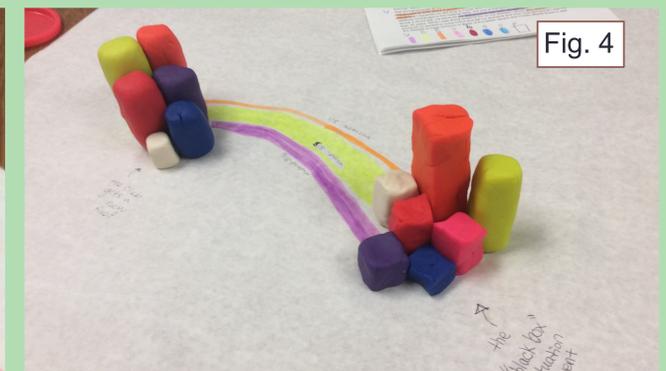


Fig. 4

Fig. 3. A participant chose to represent her STEM pathway as a 3D topographical map. Doing so in such a tactile way (e.g., manually molding playdough) caused her to reflect on how her representation told her story, and what items (e.g., connections across events) had become hidden in the data that she wished to make more explicit. This inspired her to go back and re-code her written narrative for connections between key life events.

Fig. 4. This participant envisioned key life events as block groups, with color and height representing her codes and connections between events represented as a color-coded road.