Hybrid Spaces & Third Places

For Scientizing with Mobile, Wearabile, & Community Technologies

Tamara L. Clegg • University of Maryland • tclegg@umd.edu

① Intro & Goals


BodyVis


NatureNet


Science Everywhere

② Hybrid Spaces

③ Third Places

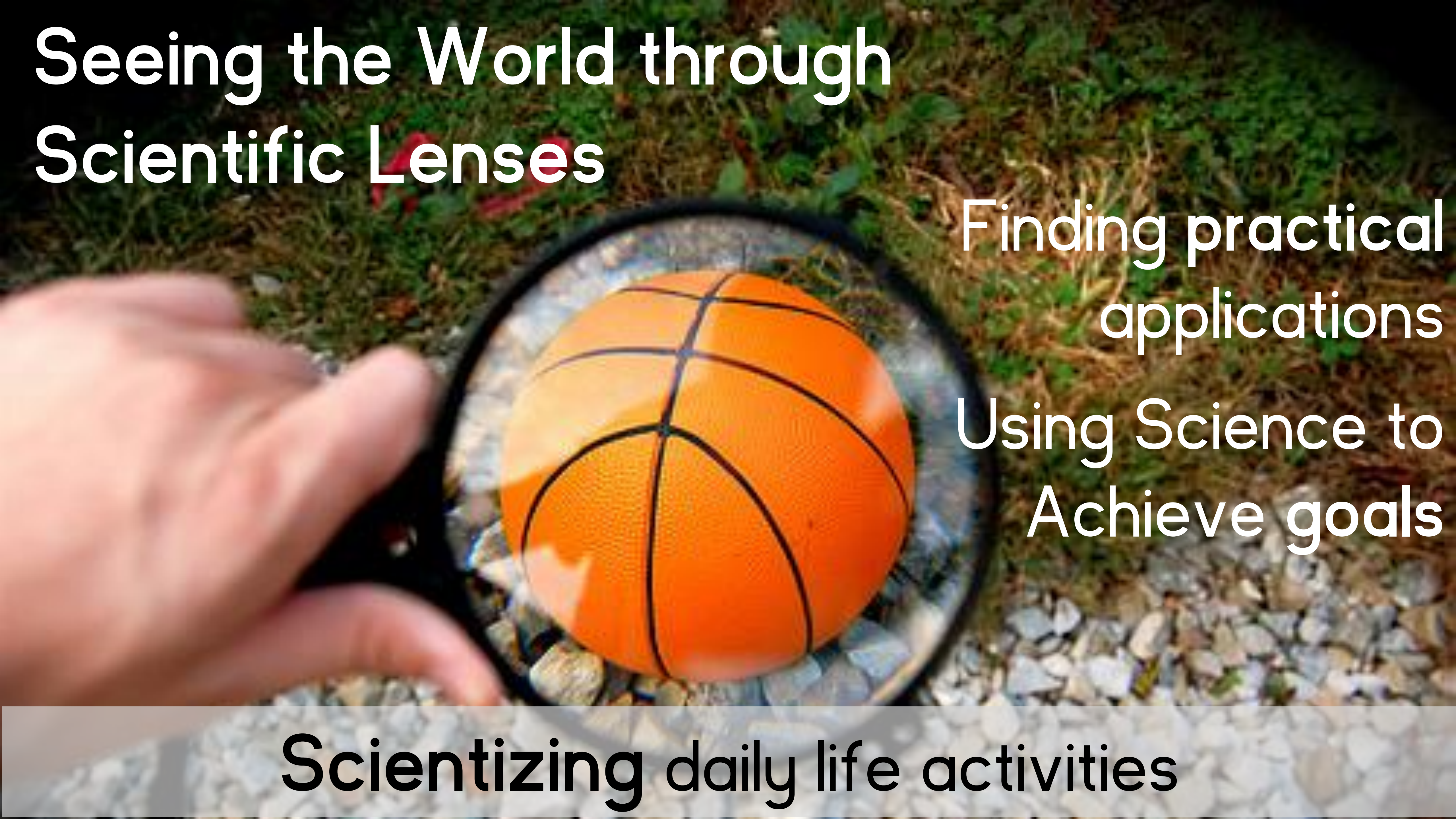
④ Future Work

Learning Sciences &
HCI Researcher

① Intro & Goals

Participatory Design with Children

Druin, 2002


Seeing the World through
Scientific Lenses
Finding practical
applications
Using Science to
Achieve goals
Scientizing daily life activities

Procedural & Conceptual Understanding

Interest

Social Interactions

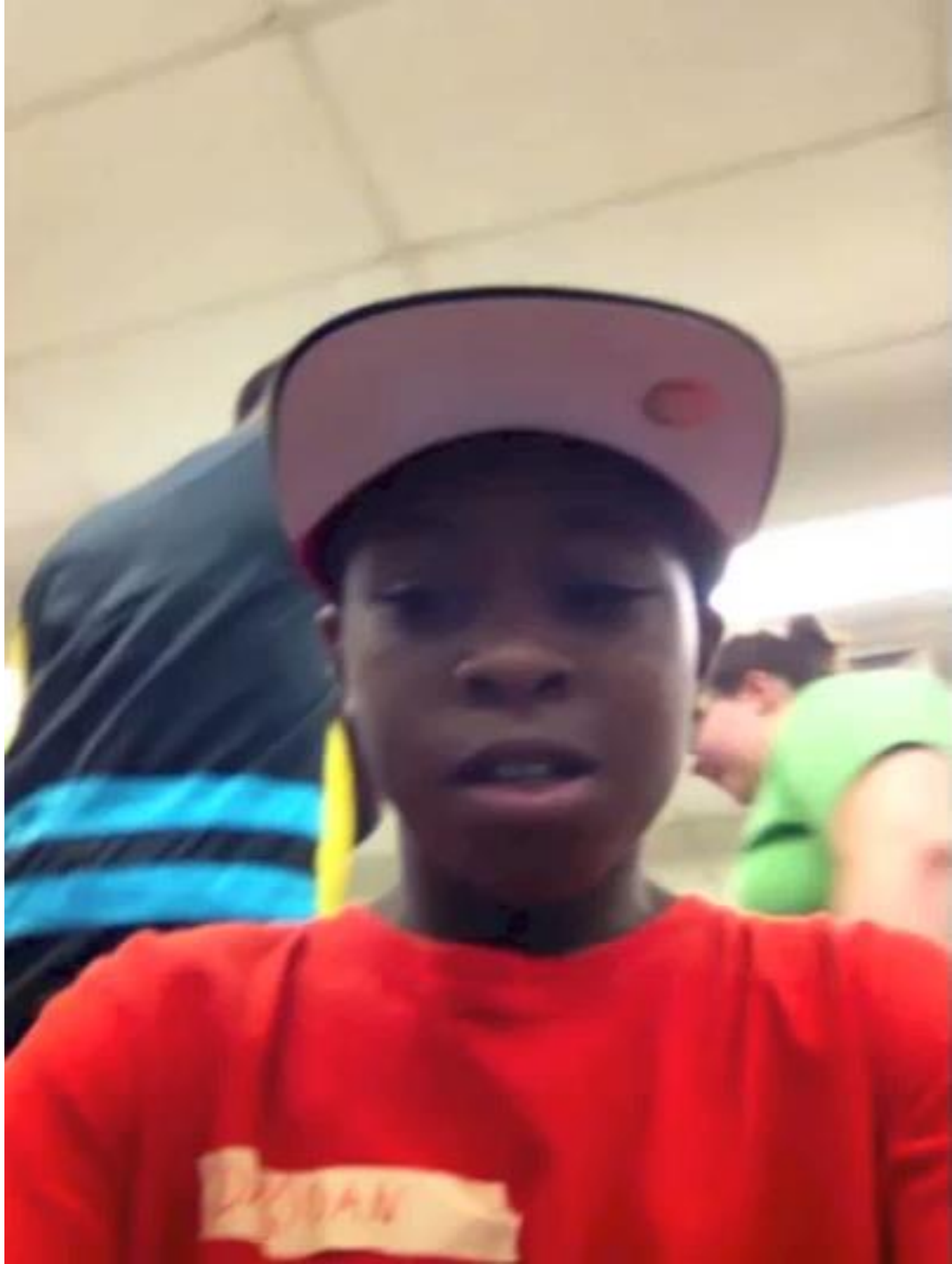
Personal Connections

Building Blocks

to disposition development

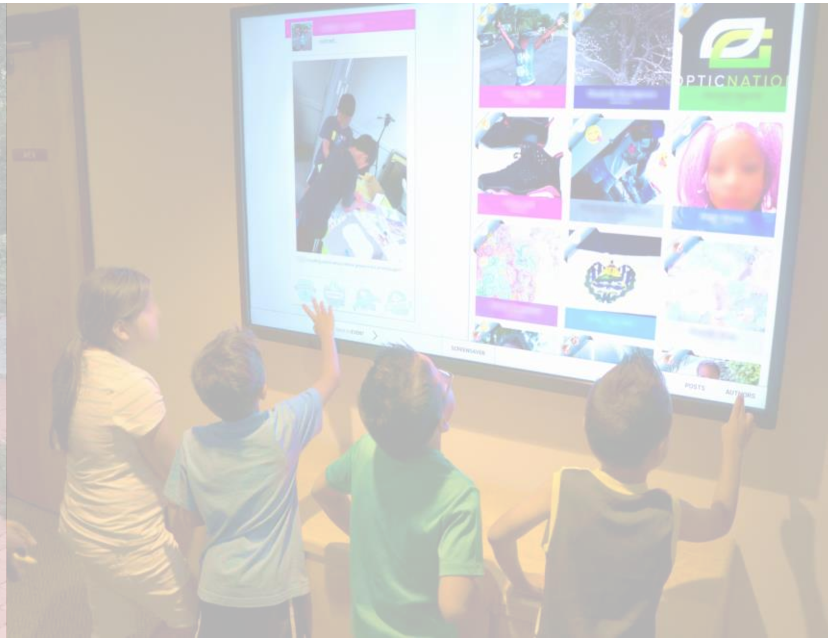
Clegg & Kolodner, 2014

Potential of New Media for Scientizing



How can mobile, wearable, and community technologies support scientizing in everyday life?

1 Intro & Goals




2 **Hybrid Spaces**

Ways hybrid spaces for wearable-based inquiry can be designed to support scientizing

ADVANCING SCIENCE LEARNING & INQUIRY EXPERIENCES THROUGH WEARABLES

BODYVIS & SHAREDPHYS TEAM

PROFESSORS

Jon Froehlich

Tamara Clegg

GRAD STUDENTS

Leyla Norooz

Seokbin Kang

Virginia Byrne

Rafael Velez

Amy Green

UNDERGRADUATE STUDENTS

Monica Katzen

Angelisa Plane

Vanessa Oguamanam

Thomas Outing

Anita Jorgensen

HIGH SCHOOL STUDENT

Sage Chen

Hybrid Spaces

Learning environments that integrate aspects of learners'

Home cultures

Individual interests

Scientific practices

Barton, Tan, & Rivet, 2008; Gutierrez et al., 1999; Kamberelis & Wehunt, 2012

What if our clothes revealed how our body's functioned?

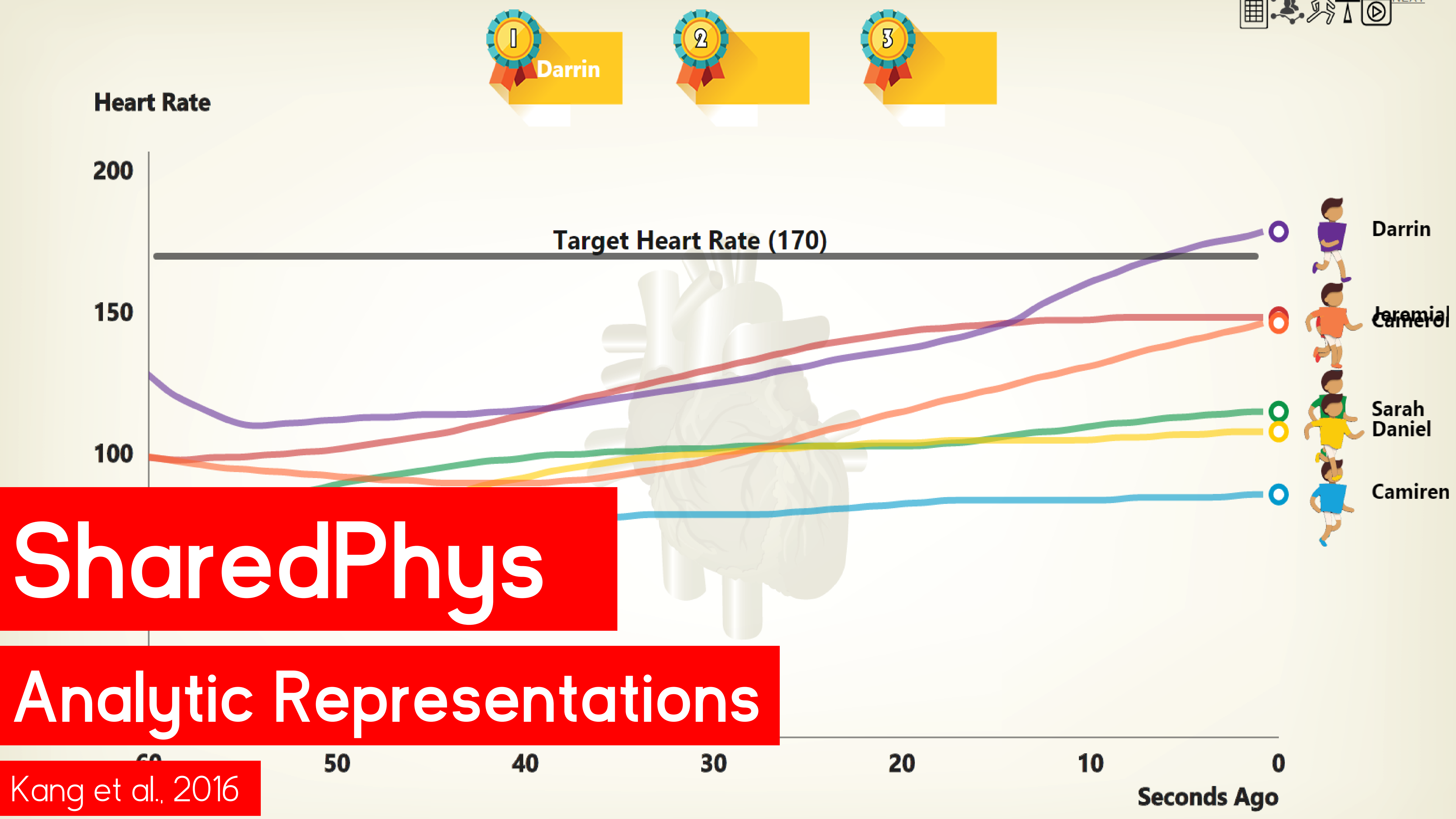
How could this change the way children learn about and understand their bodies?

Could a t-shirt be a platform for experimentation and inquiry?

BodyVis

Live Physiological Sensing and Visualization Tools

Two LPSV Tools

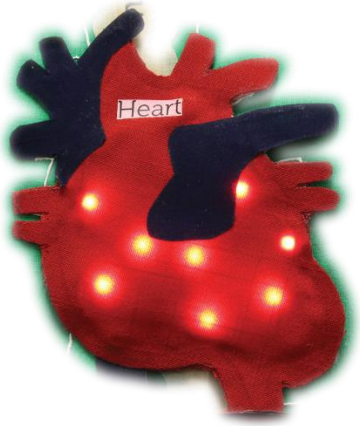


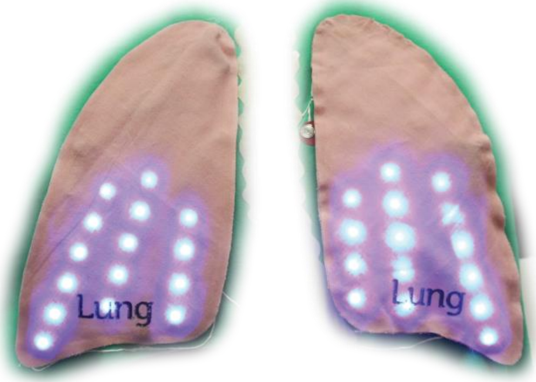
SharedPhys

Analytic Representations

Kang et al., 2016

Moving Graphs





BodyVis

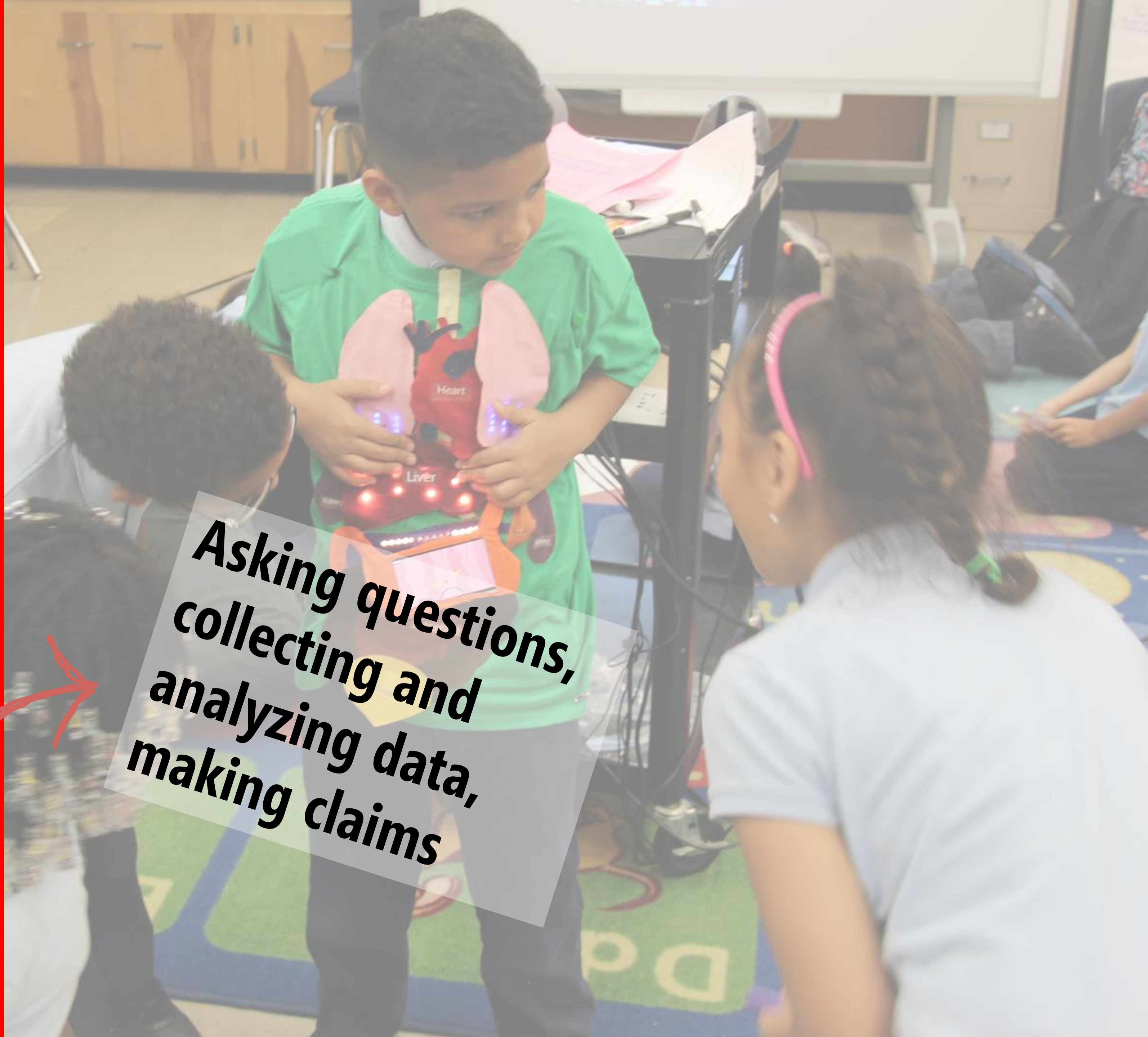
Model-based Representations

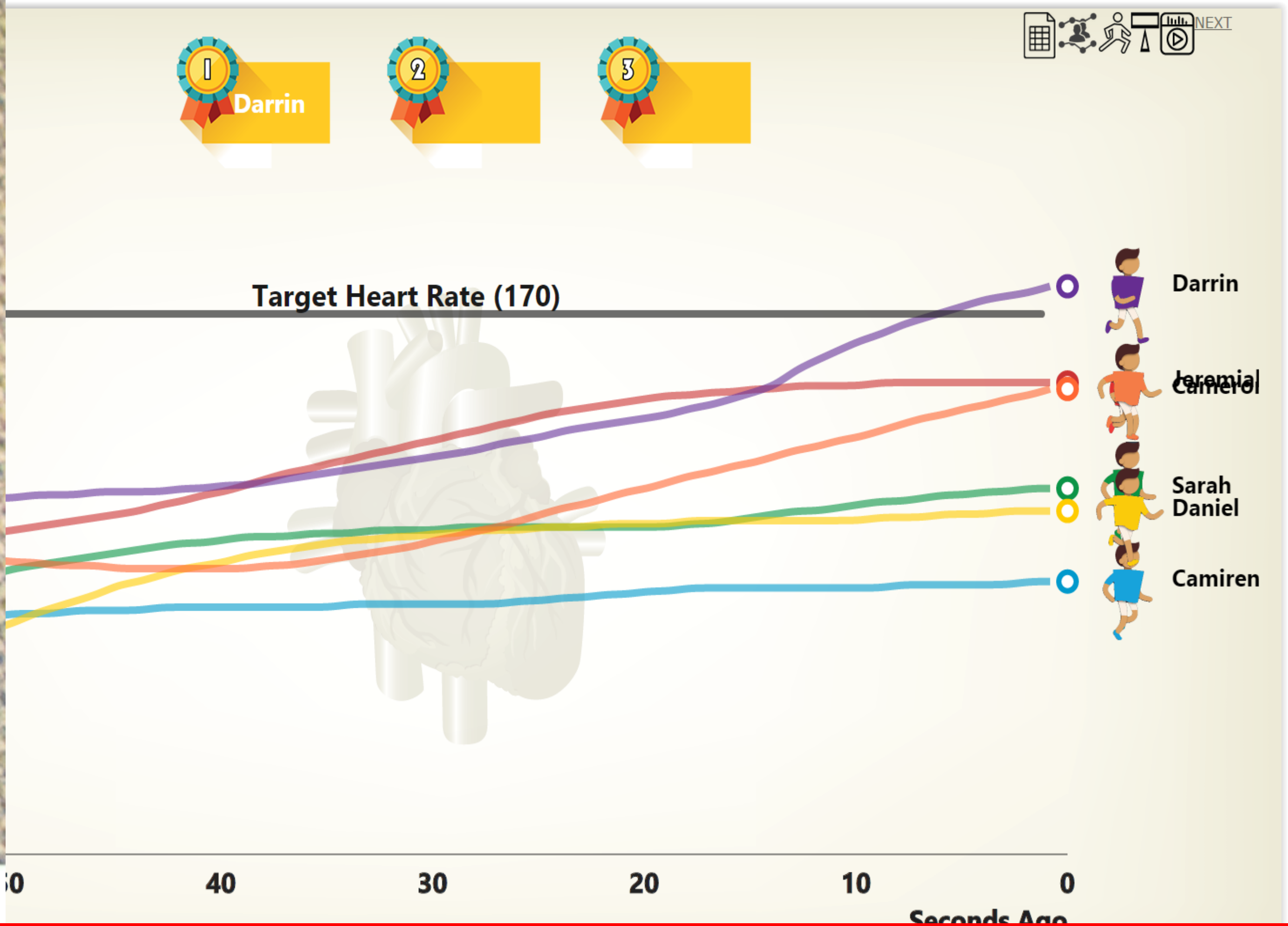
Norooz et al., 2015; Norooz et al., 2016

Snack time!
Esophagus
Heart
Lung
Lung
Liver
Large Intestine
Small Intestine

Leveraging the Body as a Platform for Inquiry

Leveraging the Body as a Platform for Inquiry





Home cultures & Individual Interests

Scientific practices

Hybrid Spaces

Norooz et al., 2016

Sensor Based Learning Potential

Inquiry and Conceptual Learning

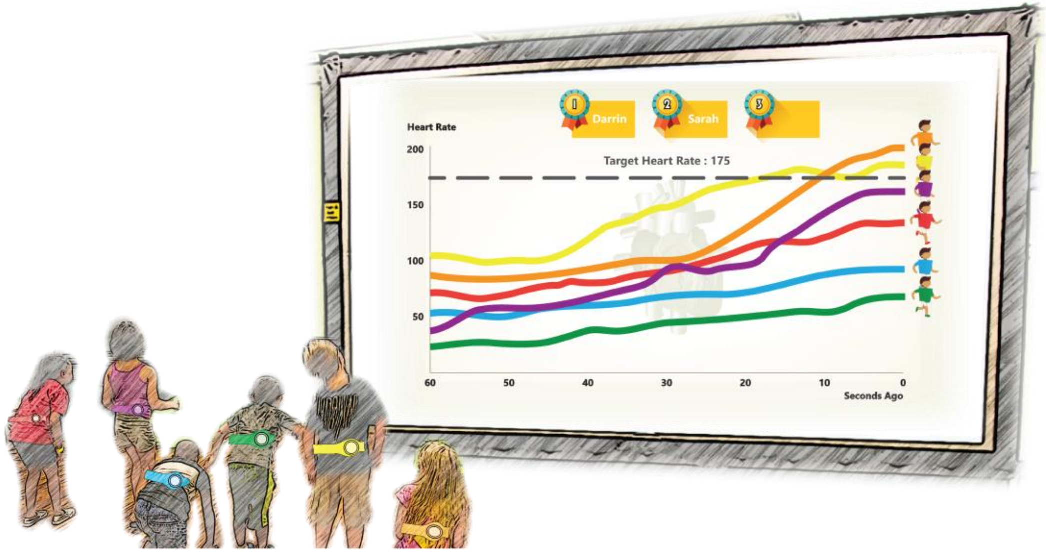
Interests, Goals, Dispositions Towards Science

E.g., Gallagher & Lindgren, 2015; Nemirovsky, Tierney, & Wright, 1998; Tinker, 1996

Lab Based

Pre & Post Test Analysis

Shorter-term Assessments



Four Day Evaluation

1st Grade

2nd Grade

4th Grade

Learning Activities for LPSV Tools

Participatory Design


Children


Teachers

LPSV

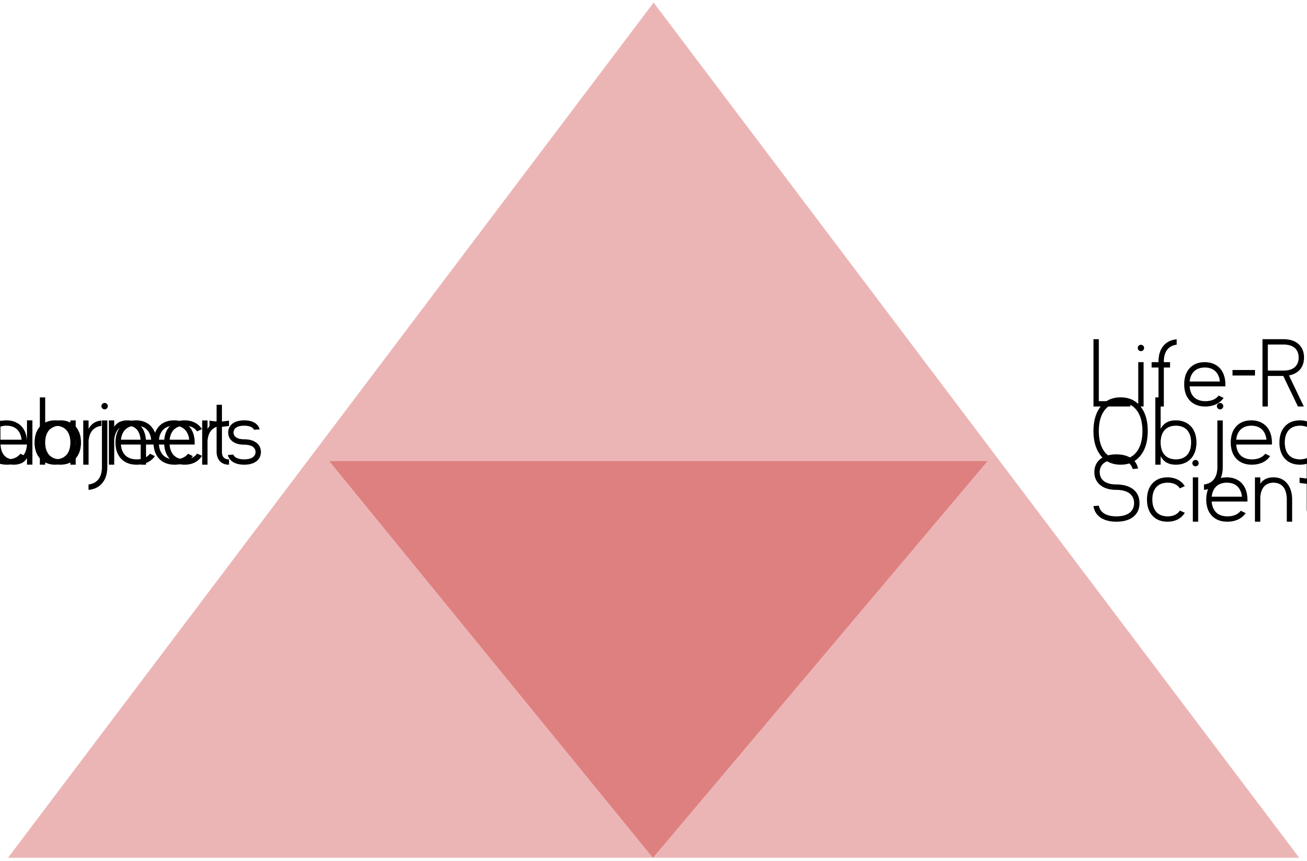
Ecosystems

Support for Scientific Inquiry

Within and Across Grade Levels

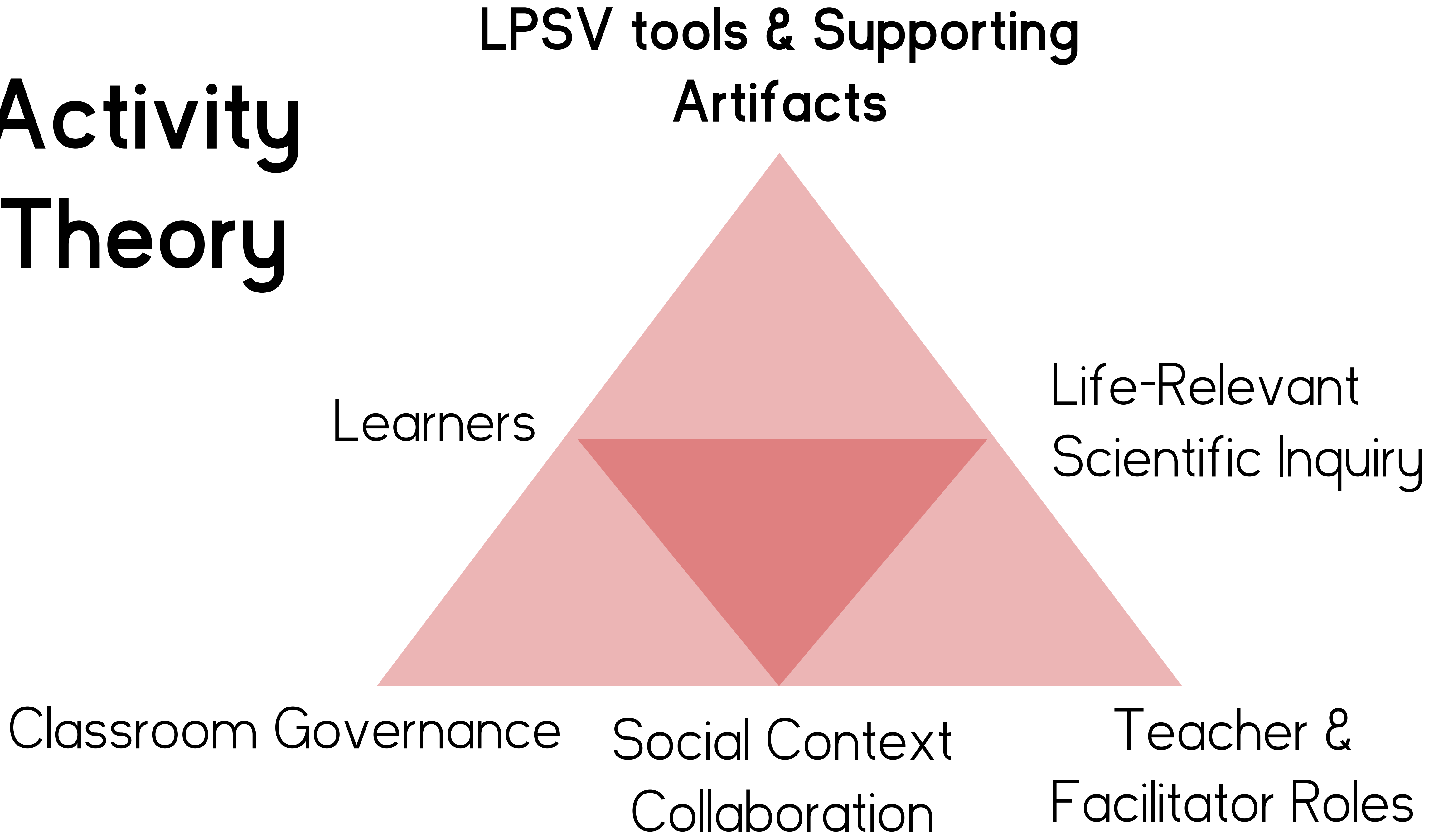
Classroom Context

Activity Theory

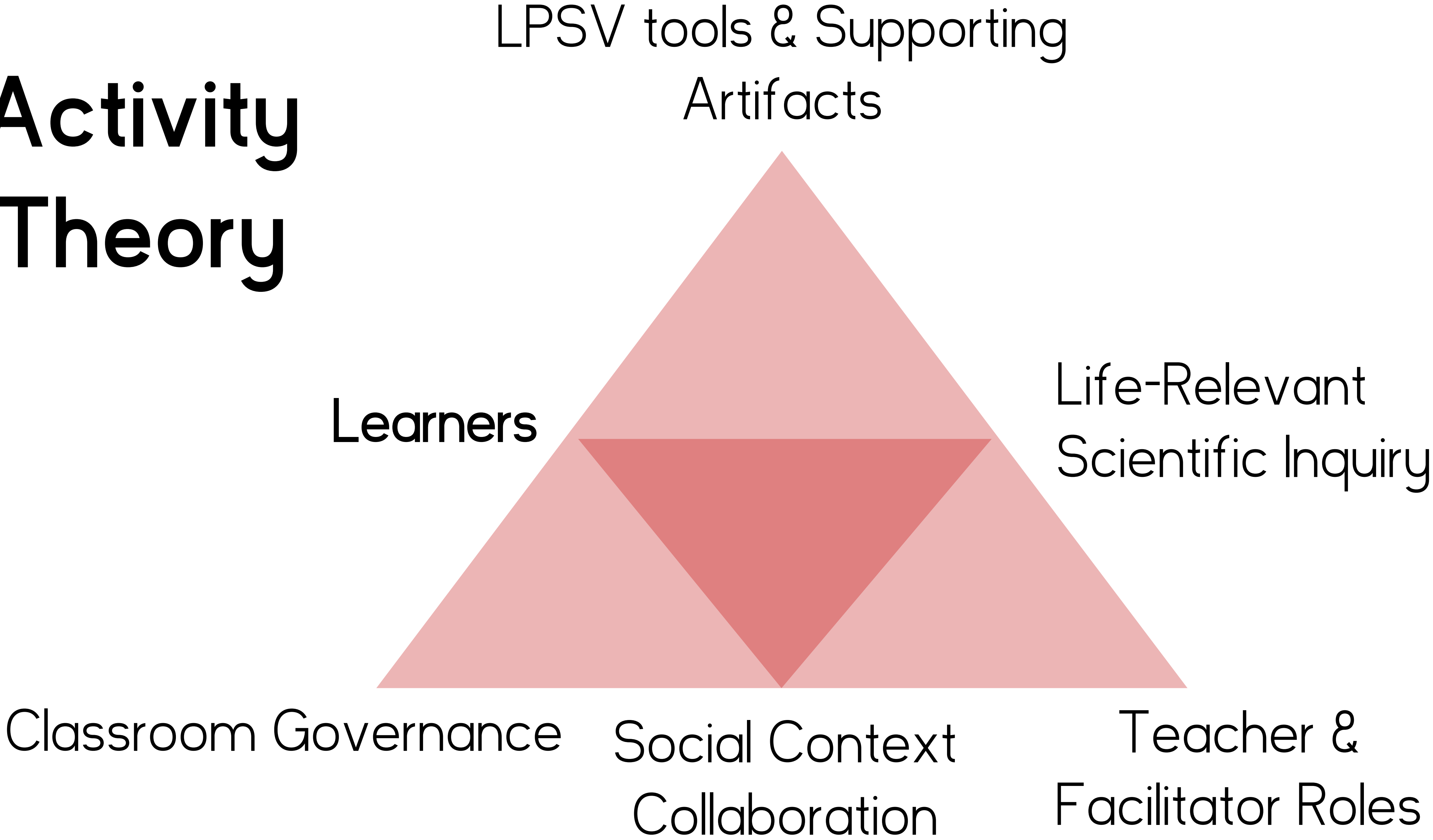


E.g., Engeström, Miettinen, & Punamäki, 1999; Nardi, 1996

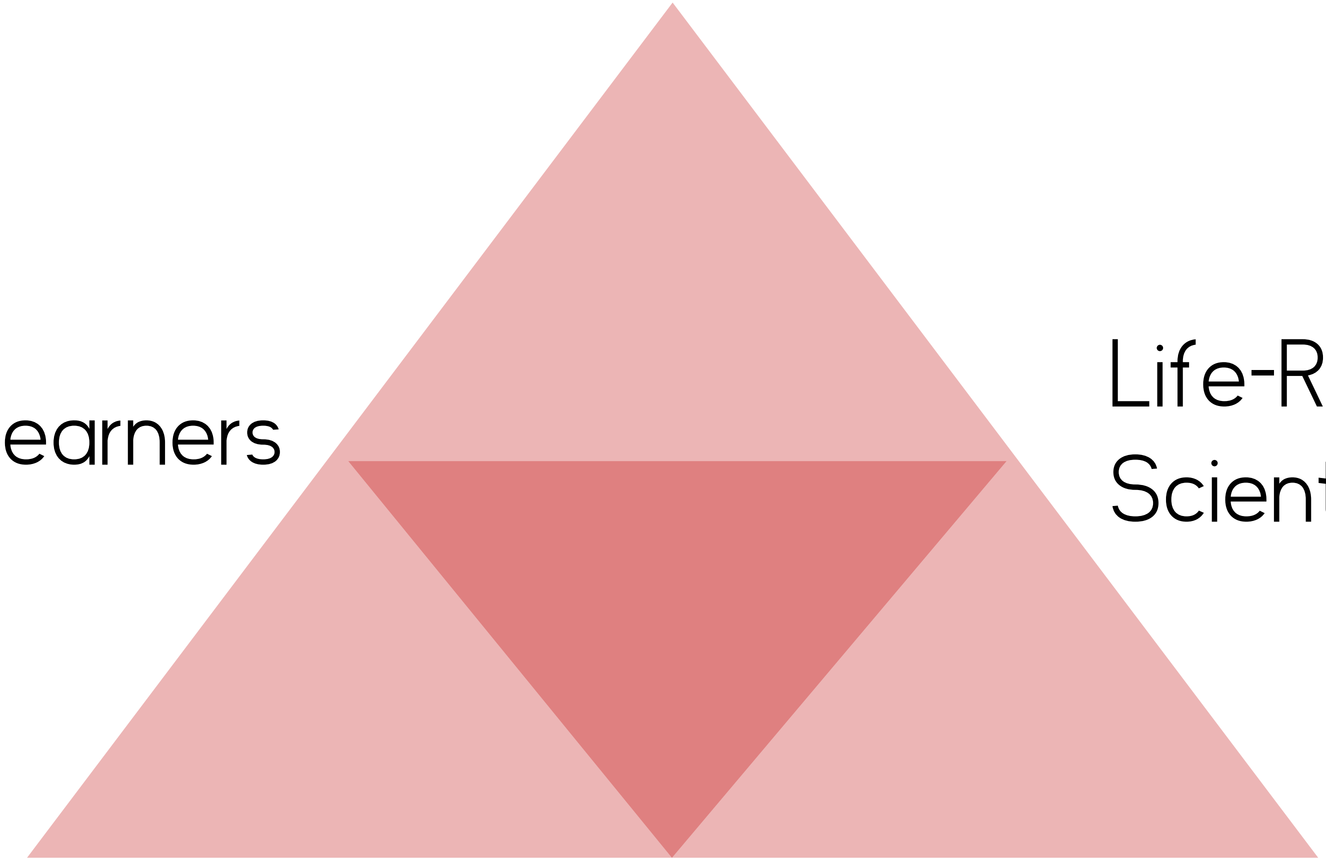
Activity Theory



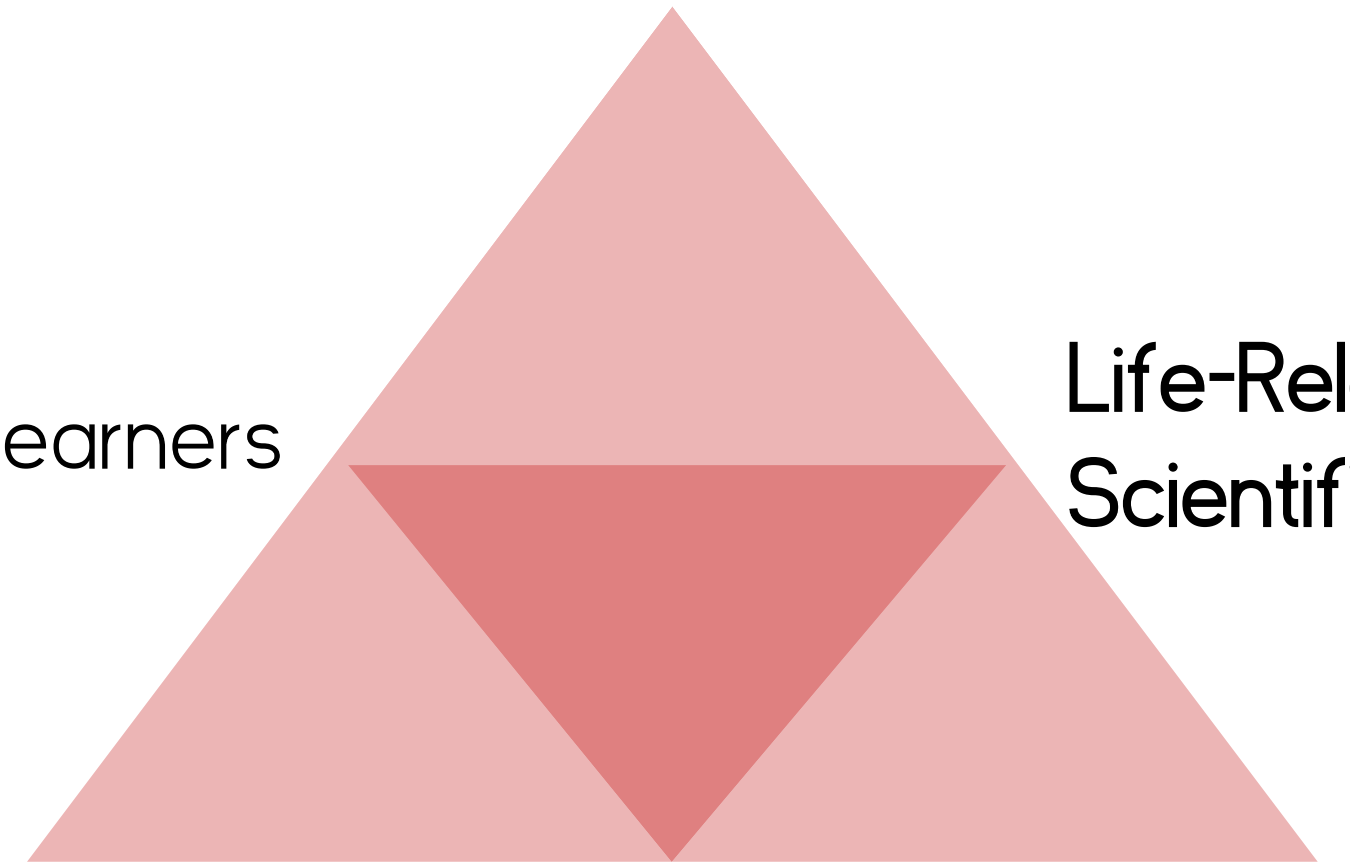
Activity Theory



Activity Theory



Activity Theory

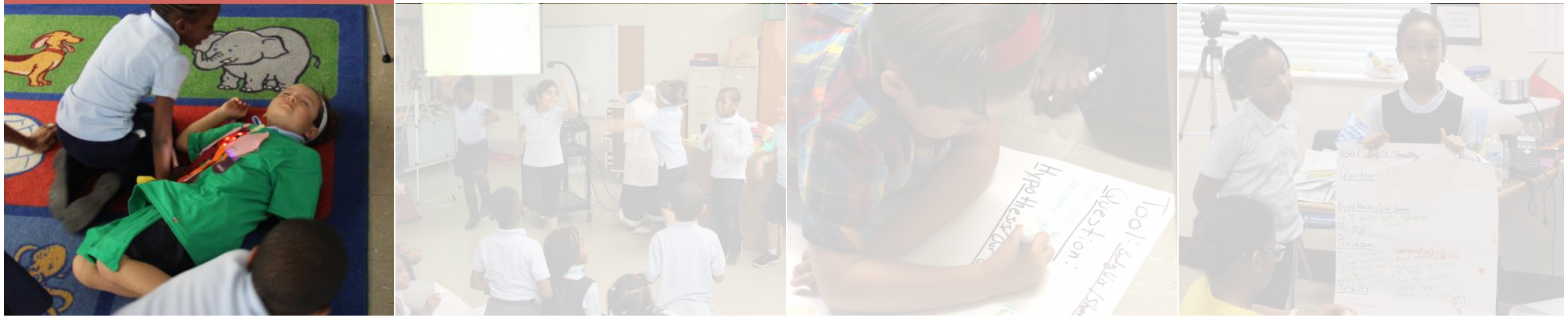


How the Components of the Ecosystem Come Together

Day 1: Play and Discovery

Children **discussed questions** and engaged in **free-form exploration** with the tools in a scavenger hunt.

1. PLAY



Day 2: Exploring Physical Activities

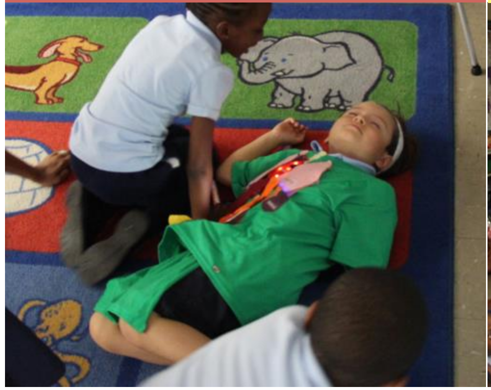
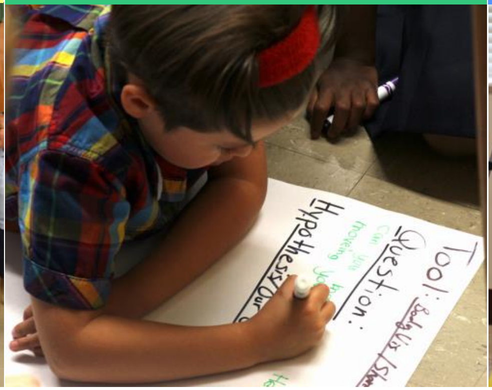
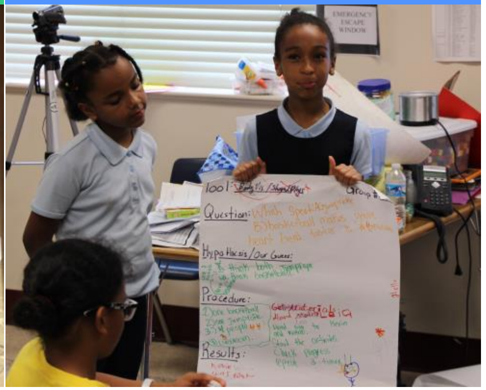
Children **brainstormed physical activities** with BodyVis. They then **tested their hypotheses** with SharedPhys.

Day 3: Science Experiments

Children **planned scientific investigations** of their choosing with **BodyVis or SharedPhys**.

Day 4: Presentations

Children **presented** their choice-based investigations.

1. PLAY	2. EXPLORE	3. EXPERIMENT	4. PRESENT
			

4-Day Workshops

1st Grade

2nd Grade

4th Grade

1. PLAY	2. EXPLORE	3. EXPERIMENT	4. PRESENT

Participants

Urban public elementary school

68% African-American

23% Latino/Hispanic

3% Asian

2% Caucasian

3.5% Mixed Race

65.6% Free & Reduced Lunch

Participants (Total)

62
Participants

27 Female

24 Male

Undisclosed 11

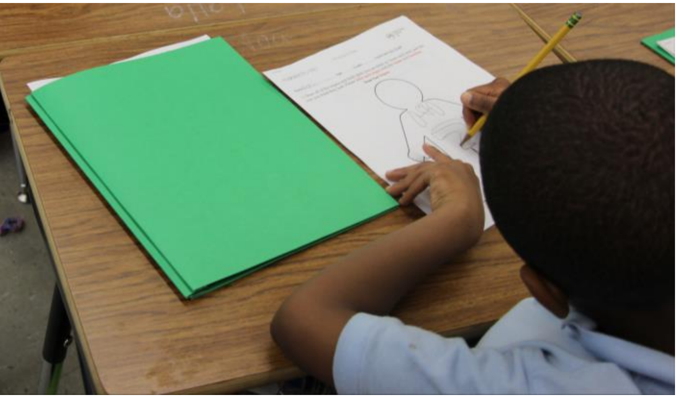
24 1st Graders

17 2nd Graders

21 4th Graders

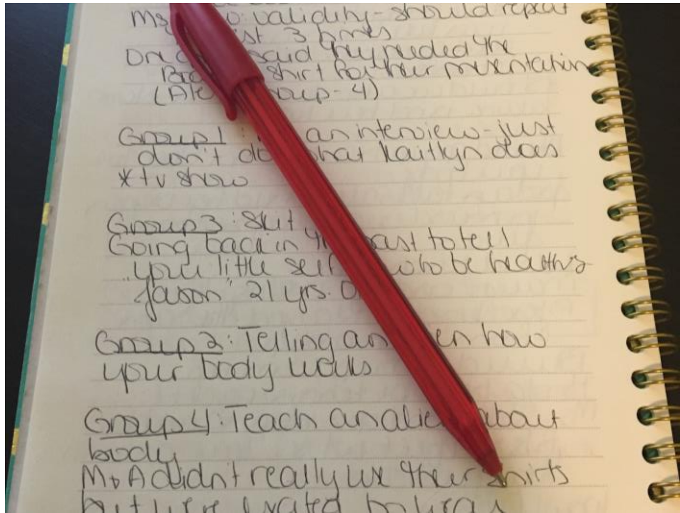
Teacher Interviews

Video Data



Supporting Artifacts

Pre & Post Assessments



Facilitator Post Observation Field Notes

Child Focus Groups

Saldaña, 2015

Video Data

Types of Interactions with Artifacts & Motivations,

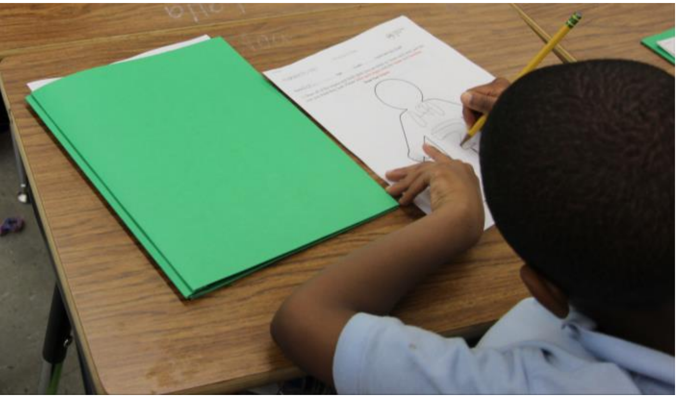
Life-relevant Experiences

Scientific Inquiry Experiences

Saldaña, 2015

Teacher Interviews

Video Data

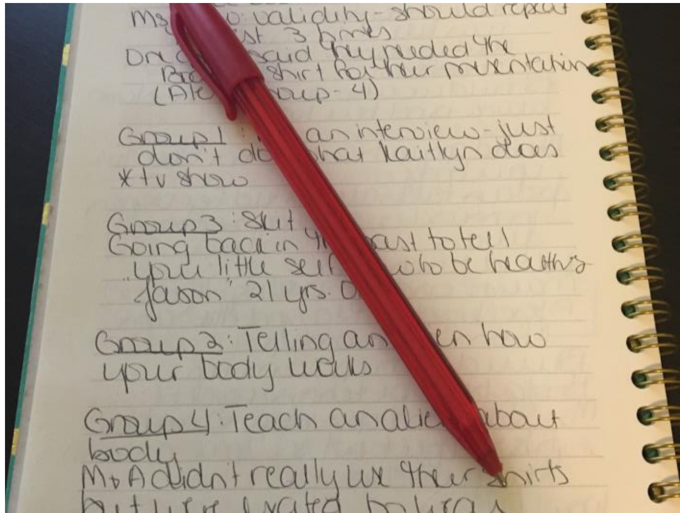


Supporting Artifacts

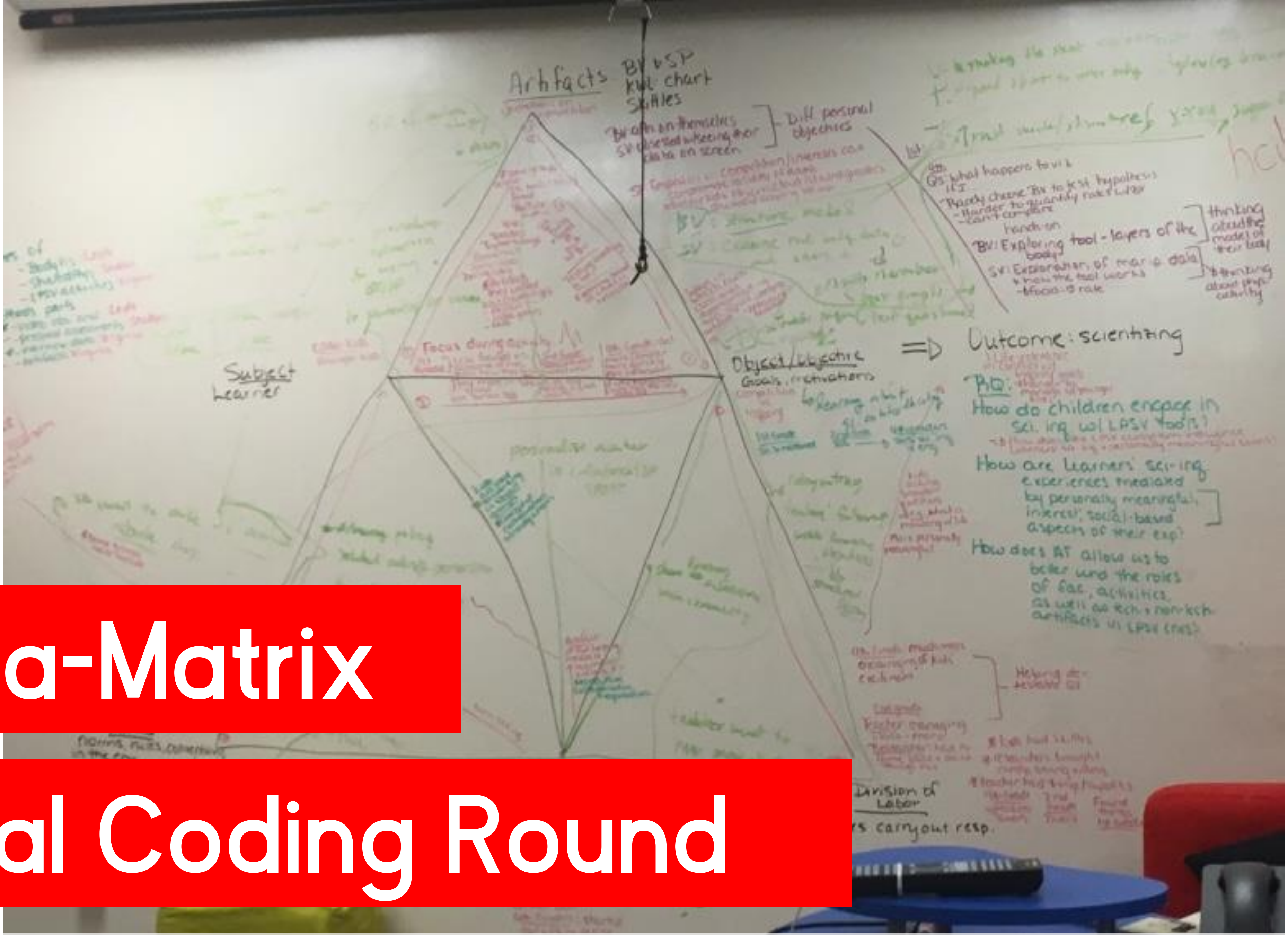
Pre & Post Assessments

Child Focus Groups

Facilitator Post Observation Field Notes



Saldaña, 2015



Meta-Matrix

Axial Coding Round

Miles & Huberman, 1994

Findings

Scientific Inquiry

Life-relevant Connections

Findings

Scientific Inquiry

Differences Between Grade Levels

Role of Facilitators and Teachers

Importance of Space

Life-relevant Connections

Personal and Social Connections

Leveraging the Environment

Touching and Sensitive Topics

Findings

Scientific Inquiry

Differences Between Grade Levels

Role of Facilitators and Teachers

Importance of Space

Life-relevant Connections

Personal and Social Connections

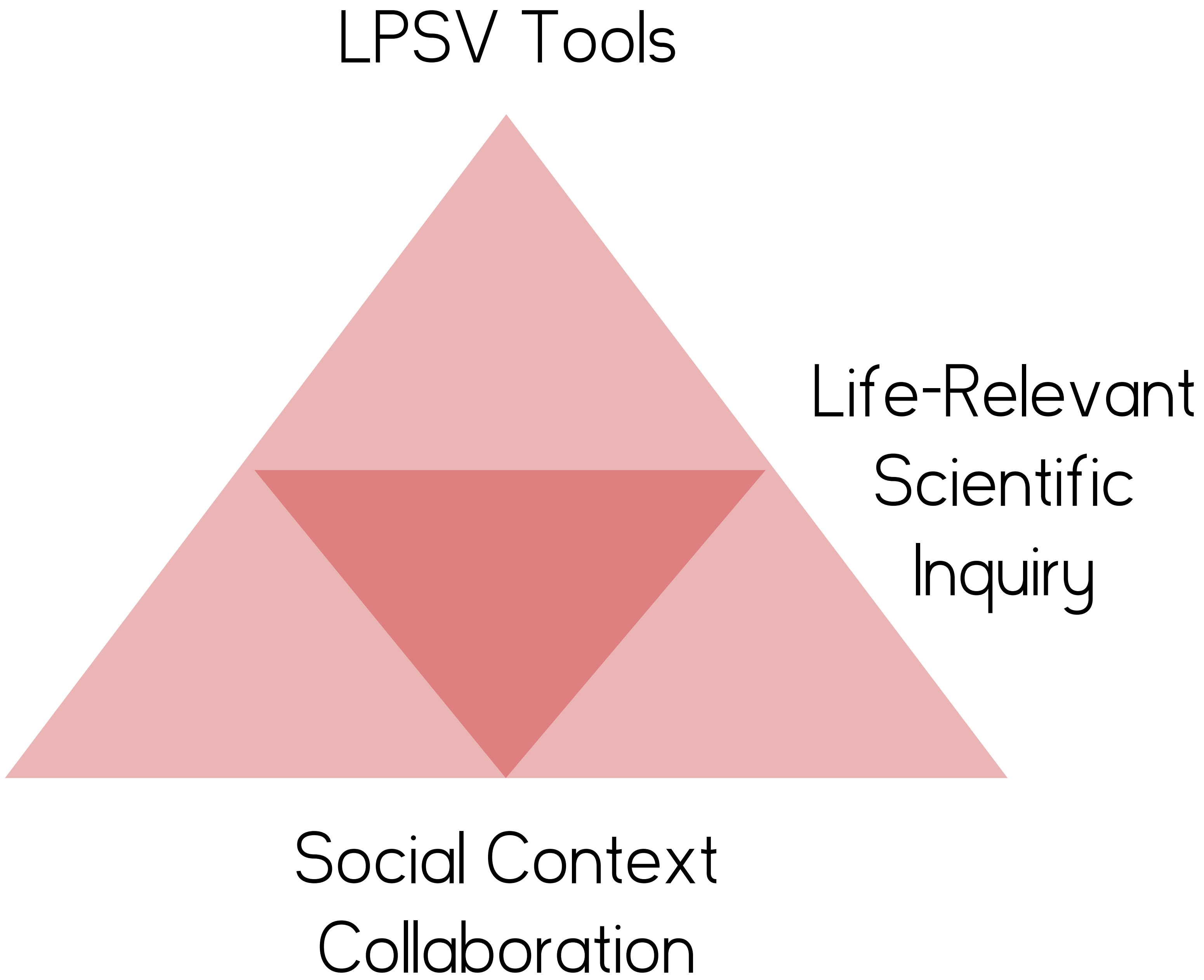
Leveraging the Environment

Touching and Sensitive Topics

Findings

Scientific Inquiry

Difference Between Grades



1st and 2nd Graders

Focused on the **Model-based Representations**

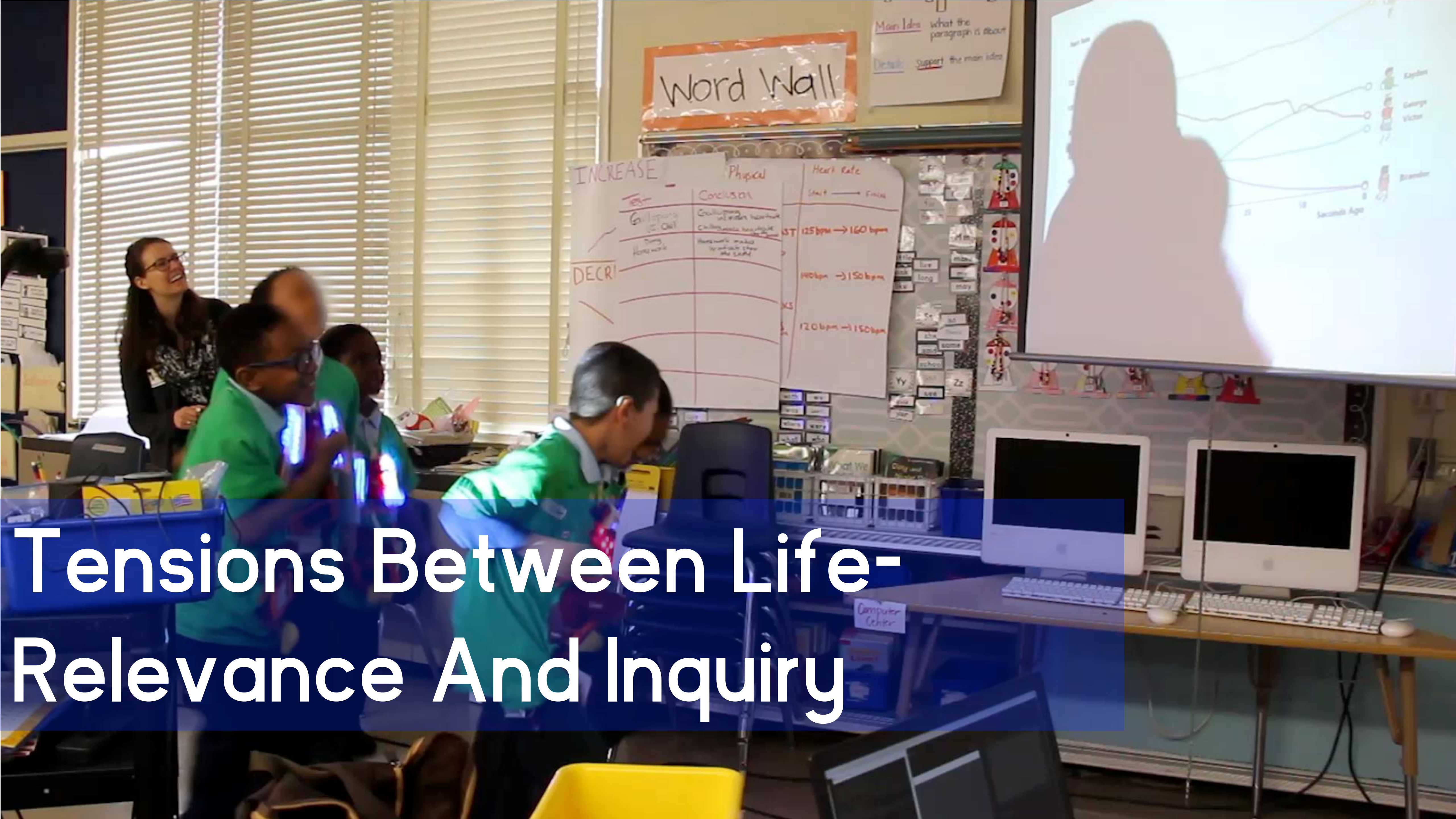
62% 4th Graders

25% 1st Graders

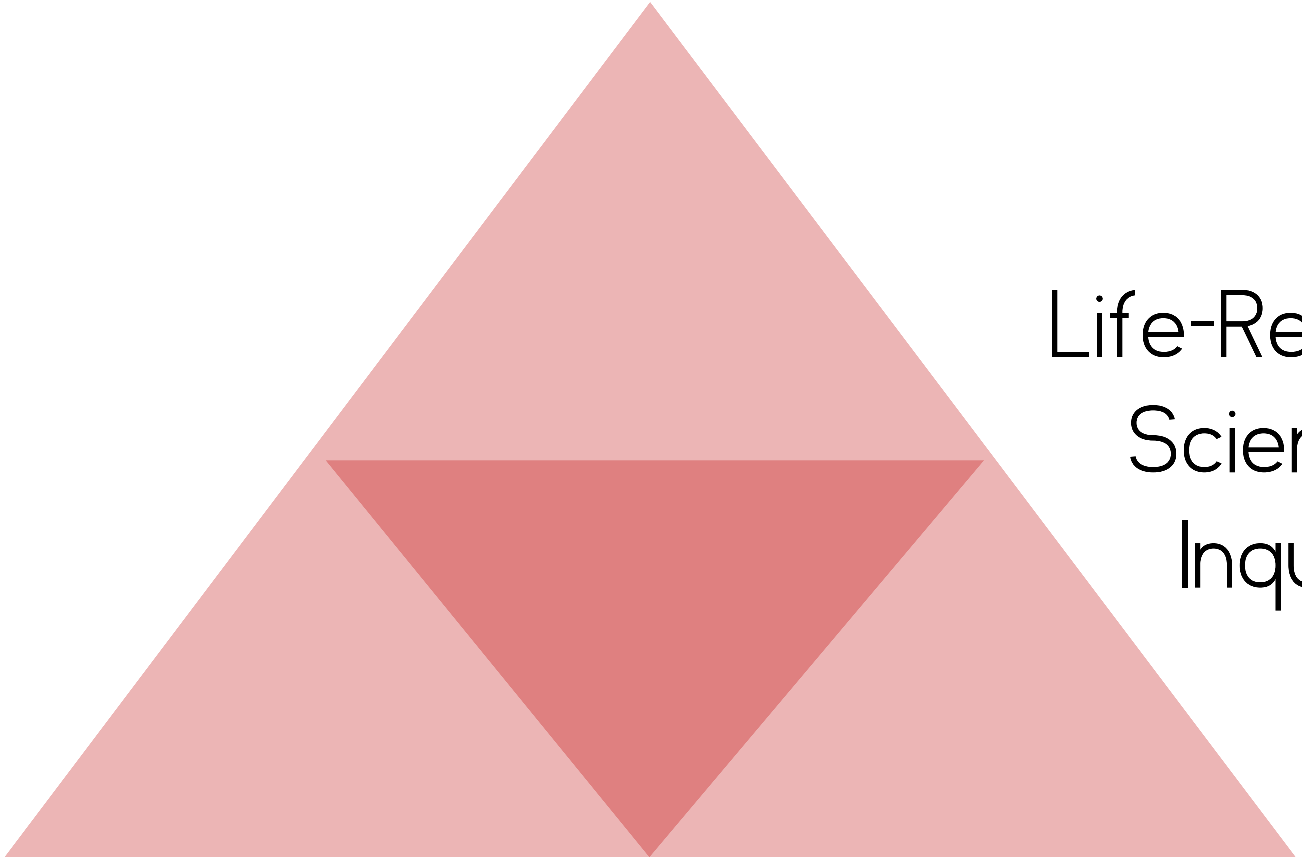
24% 2nd Graders

4th Graders
Especially Attuned to
Scientific Inquiry

Tensions Between Life-Relevance And Inquiry



Importance of Space



4th Grade: Limited Space

1st & 2nd Grade: Free Space

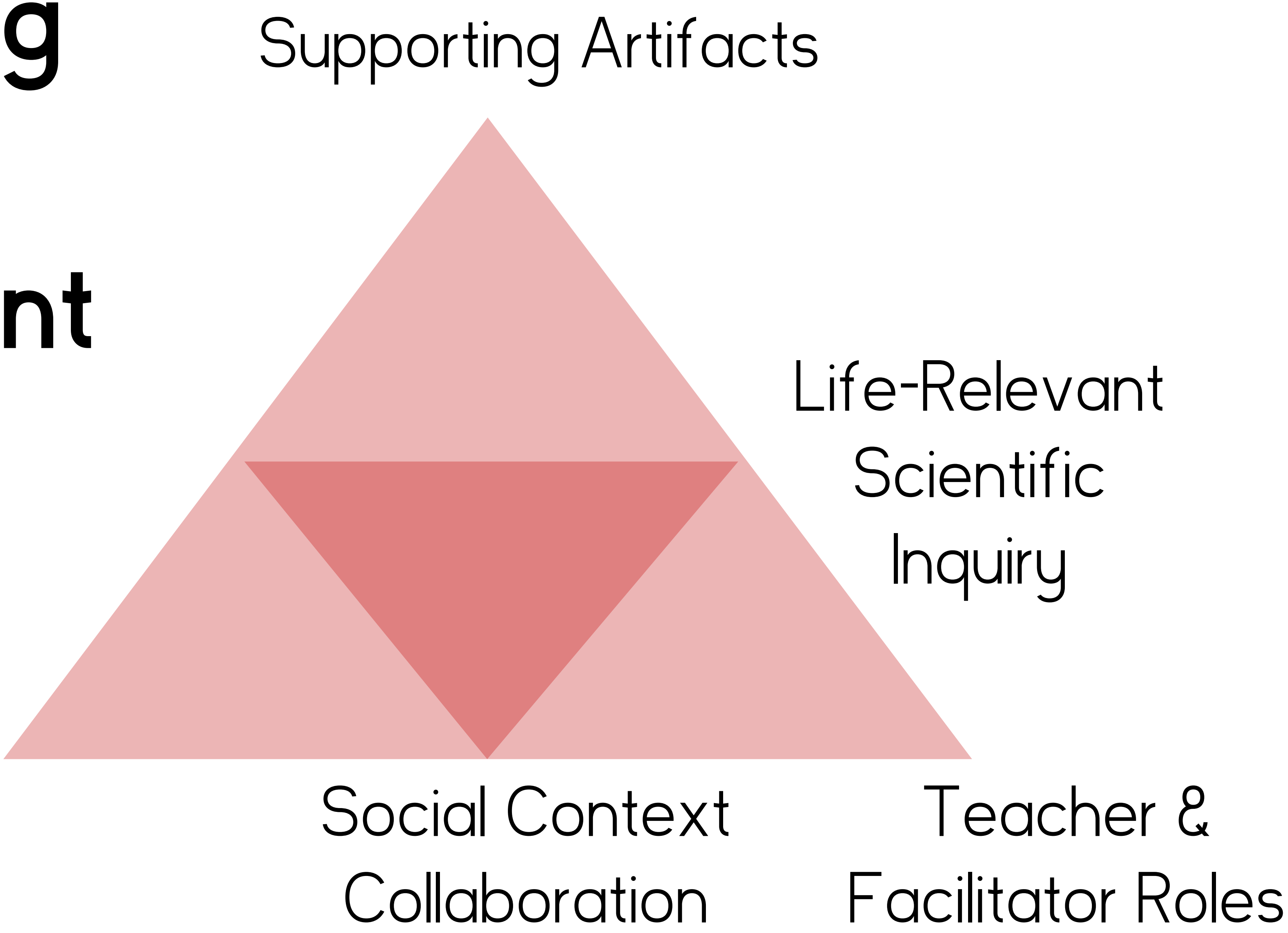
“... rather than everyone standing in the back watching, specific seats. You're going to sit in your normal seat unless you're wearing a [bioharness].”

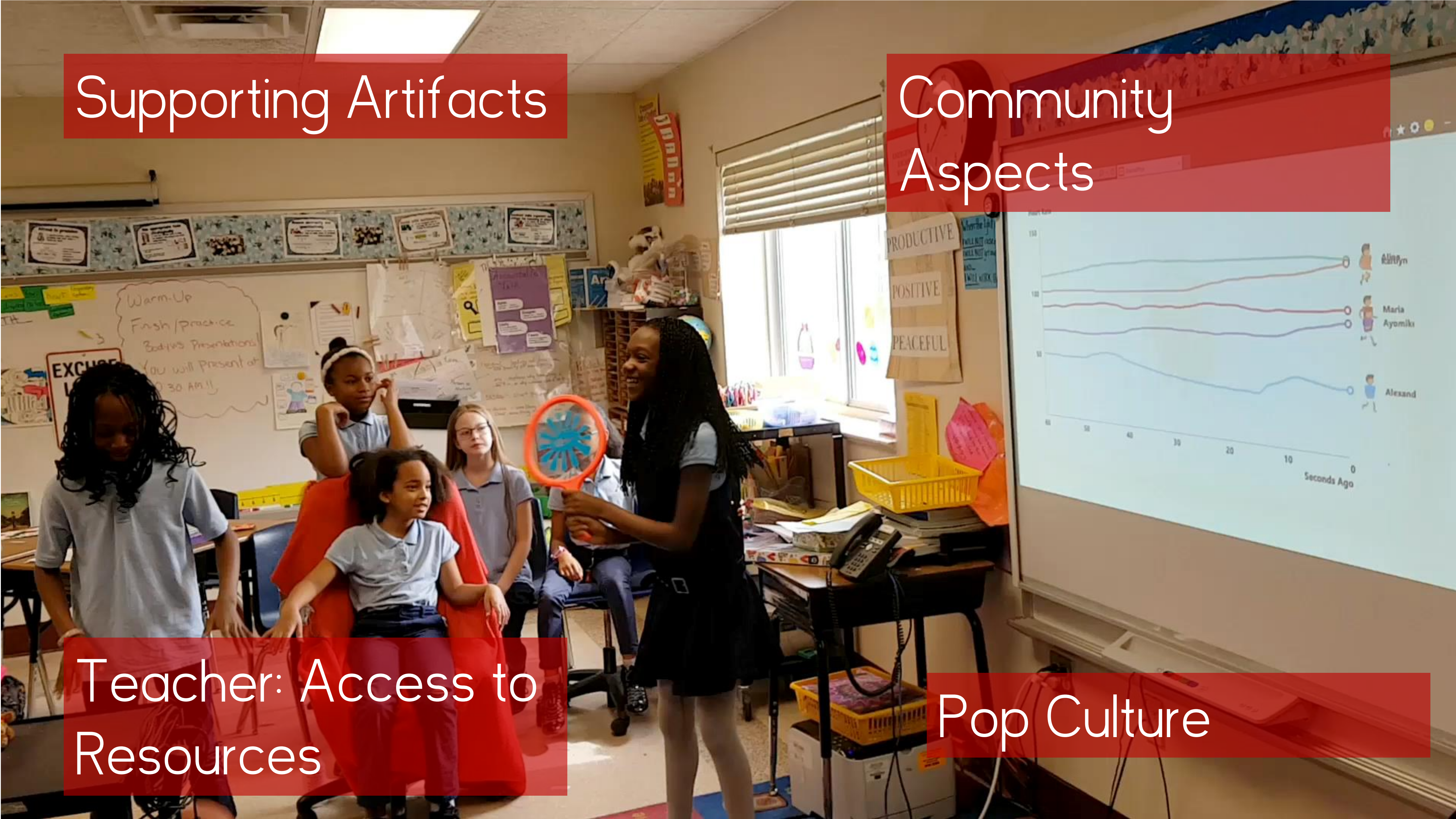
2nd Grade Teacher

Findings

Life-relevant Connections to Inquiry

Leveraging the Environment




Supporting Artifacts
Community Aspects
Teacher: Access to Resources
Pop Culture
PRODUCTIVE
POSITIVE
PEACEFUL
Warm-Up
Seconds Ago

Scientific & Life-relevant Inquiry

Implications

Integrating SBL Tools in the Classroom

Implications

Designing Artifacts to Support Life-Relevant Inquiry

Link model-based and **analytic representations** to help children make connections

Leverage **non-technical artifacts** to promote inquiry investigations and life-relevant connections

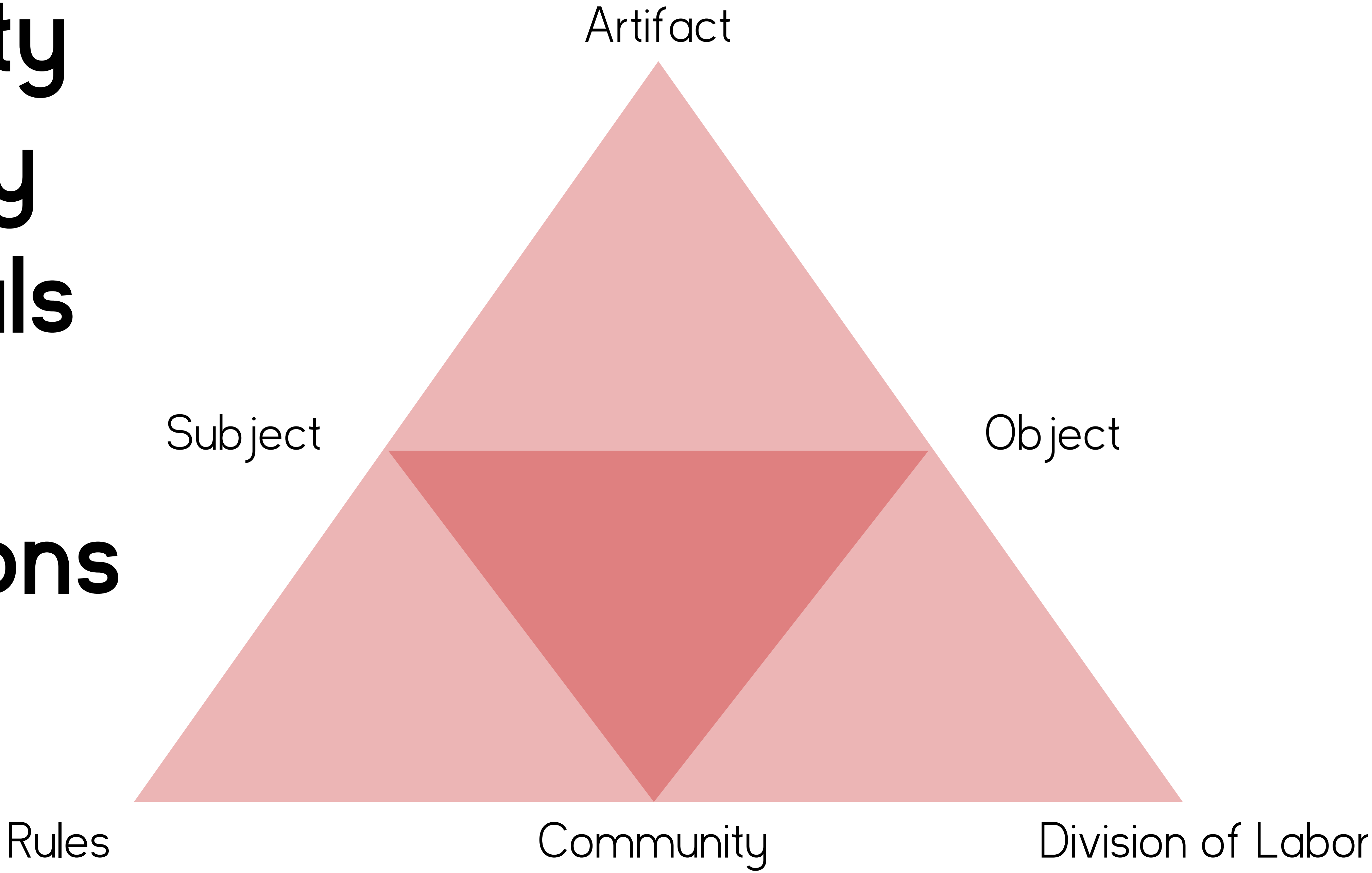
Implications

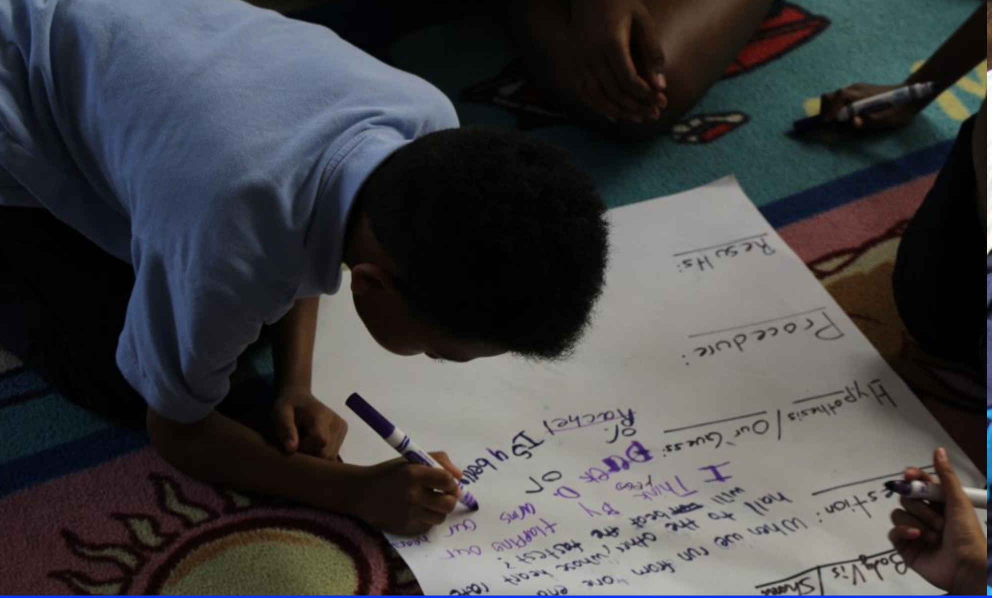
Integrating LPSV Tools into the Classroom Environment

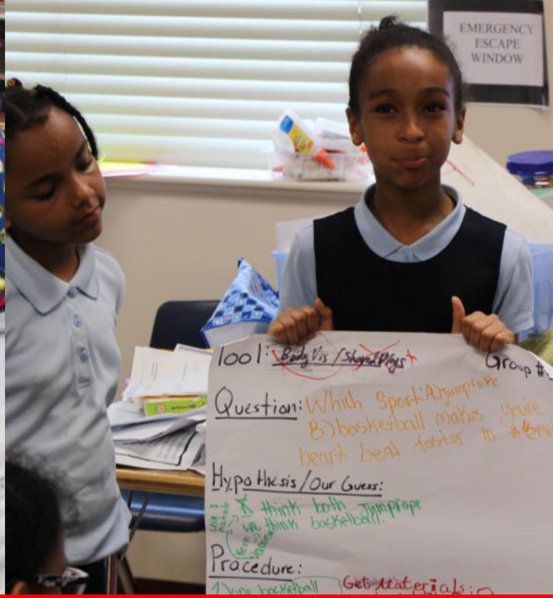
Allow for **incremental integration** of new variables into inquiry experiences for younger learners

Consider the **Social & Physical** constraints and opportunities for use of **space**

Activity Theory Reveals Key Tensions







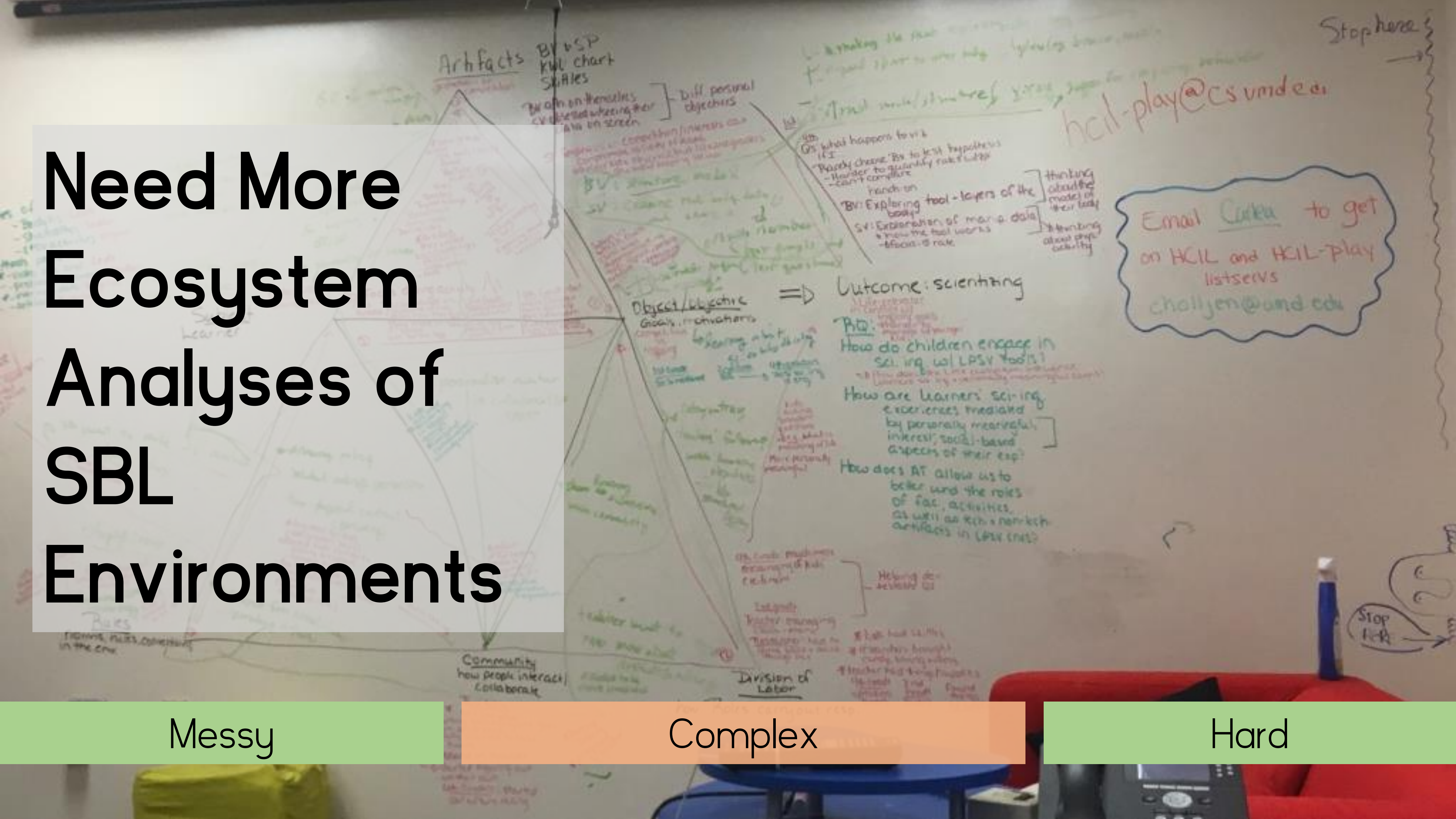
How Teachers Perceive LPSV Tools

How Kids Perceive LPSV Tools

Space
&
Layout

Supporting
Artifacts

Need More Ecosystem Analyses of SBL Environments



Messy | Complex | Hard

3 Third Places

Informal Learning

My own experiences engaging in STEM

Being Smart

Being Cool

Tensions

Establish community with shared goals & values

Find balance between work & fun

Community-based Programs

E.g., MSEN Pre-College Program

Importance of Community Settings

E.g., Bang et al., 2013; Bouillion & Gomez, 2001; Polman, 2010

Gathering places where informal public life develops dynamically

Third Place

Oldenburg, 1989

Third Places

Cooperative Inquiry

Druin, 2002

Third Places

Oldenburg, 1989

Situating cooperative inquiry in the learning contexts

Involving children with experience in the relevant context

Engaging multiple community stakeholders

Third Place Design

Third Places

Oldenburg, 1989

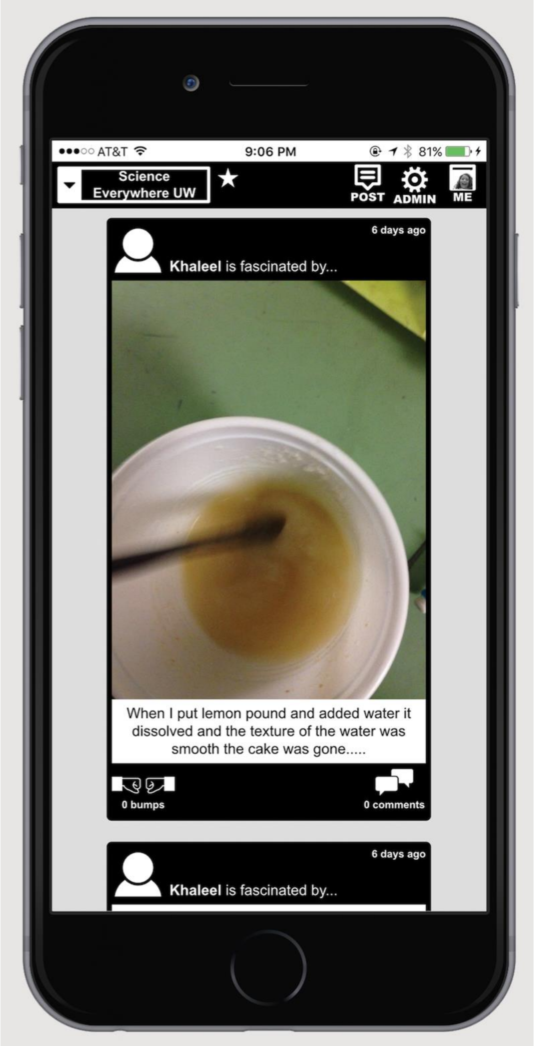
Third Place Projects

Leveraging social media & ubiquitous technologies to support scientizing

Science Everywhere

Home * School * After-school

Tangible, community displays



Mobile social media

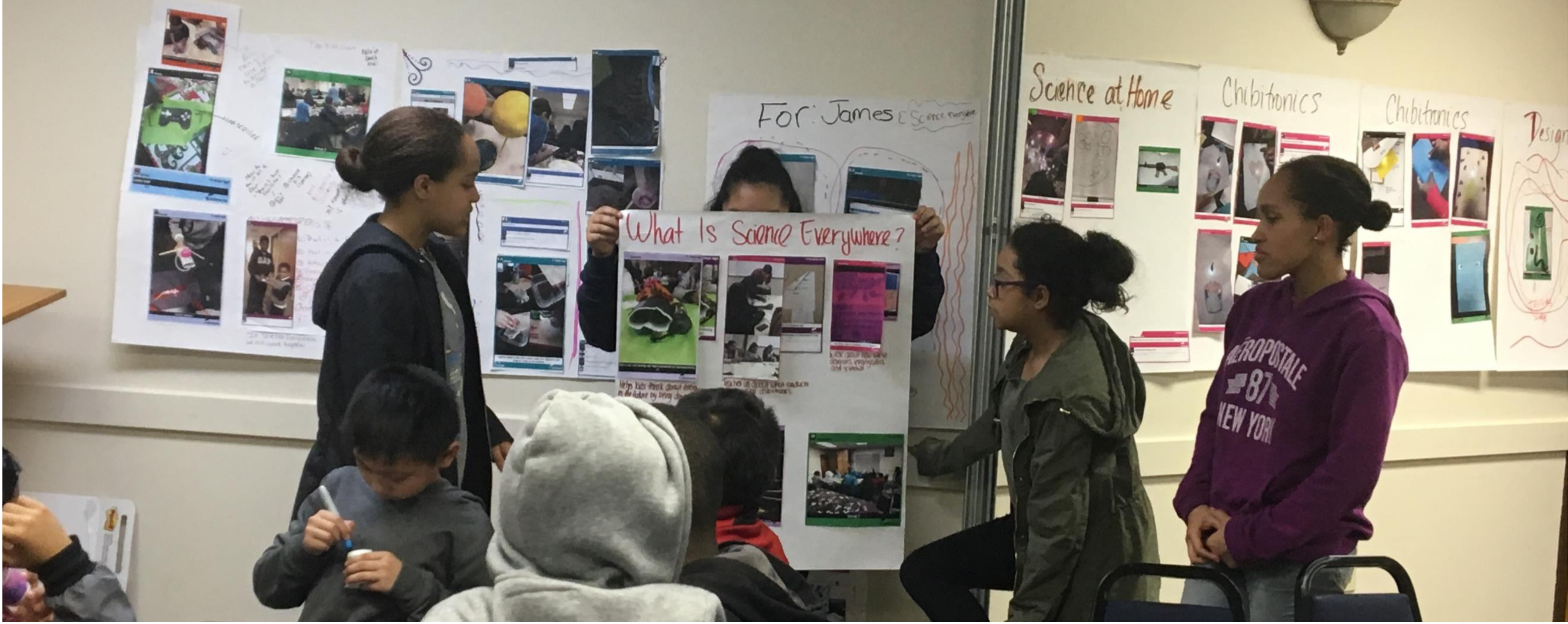

Science Everywhere Pacific Northwest
Science Everywhere Mid Atlantic

Home

School

Community

Integrated Neighborhoods



Youth

Designing with the Community

Parents

Designing with the Community

Teachers

Designing with the Community

Community Volunteers

Designing with the Community

Yip, Clegg, Ahn, Uchidiuno, & Bonsignore et al, CHI 2016

The Evolution of Engagements and Social Bonds During Child-Parent Co-design

Jason C. Yip[1], Tamara Clegg[2], June Ahn[2], Judith Odili Uchidiuno[3], Elizabeth Bonsignore[2], Austin Beck[2], Daniel Pauw[2], & Kelly Mills[2]

[1]University of Washington
Seattle, USA
jcyip@uw.edu

[2]University of Maryland
College Park, USA
{tclegg, juneahn, ebonsign, austinbb dpauw, kmills1}@umd.edu

[3]Carnegie Mellon University
Pittsburgh, USA
jio@andrew.cmu.edu

ABSTRACT

Partnering with parents and children in the design process can be important for producing technologies that take into consideration the rich context of family life. However, to date, few studies have examined the actual process of designing with families and their children. Without understanding the process, we risk making poor design choices in user-interactive experiences that take into account important family dynamics. The purpose of this investigation is to understand how parent-child relationships in families shape co-design processes and how they are reshaped through co-design. We document the evolutionary process and outcomes that exist in co-design partnerships between researchers and families. We found that parents' engagement patterns shifted more slowly than that of children's from observing and facilitating to design partnering practices. Our analysis suggests the importance of establishing and nurturing social bonds among parents, children, and researchers in the co-design process.

Author Keywords

Participatory design; families; children; parents; co-design; methods and techniques

ACM Classification Keywords

D.2.10. Design: Methodologies

INTRODUCTION

Interviewer: *What do you think about designing with the adults, like with your parents?*

Amy: *I think that sometimes we don't agree on things. But I think it's kind of fun because you get to bond with your parents and we get to see like what ideas are cool and like, I can design things with my family.*

Interviewer: *Okay. So what's an example of something you don't agree on or that you didn't agree on?*

Amy: *Well, like how it should look like, size, what it should have and stuff like that.*

This is how one of our youth participants (Amy, age 12, pseudonym) reflected on a 10-month process of designing new learning technologies together with her father, siblings, other families, and design researchers. Her words highlight how the co-design experience involved moments of tension, but also deeper social bonding, with her father, and underscores the importance of spending time designing with her parents. Amy's reflection illuminates a ripe opportunity to more deeply understand the co-design processes of families and design researchers. HCI researchers are increasingly utilizing participatory design (PD) methodologies to develop new technologies for and with families [19,28,29,33,57,63,64]. While existing research has focused on the products that arise out of family co-design [30,42,57] and the co-design methods used [33,40,63], a key question that HCI researchers have not fully explored is, ***"How do the design processes between children, parents/guardians, and researchers evolve over time, and how might we best support them?"***

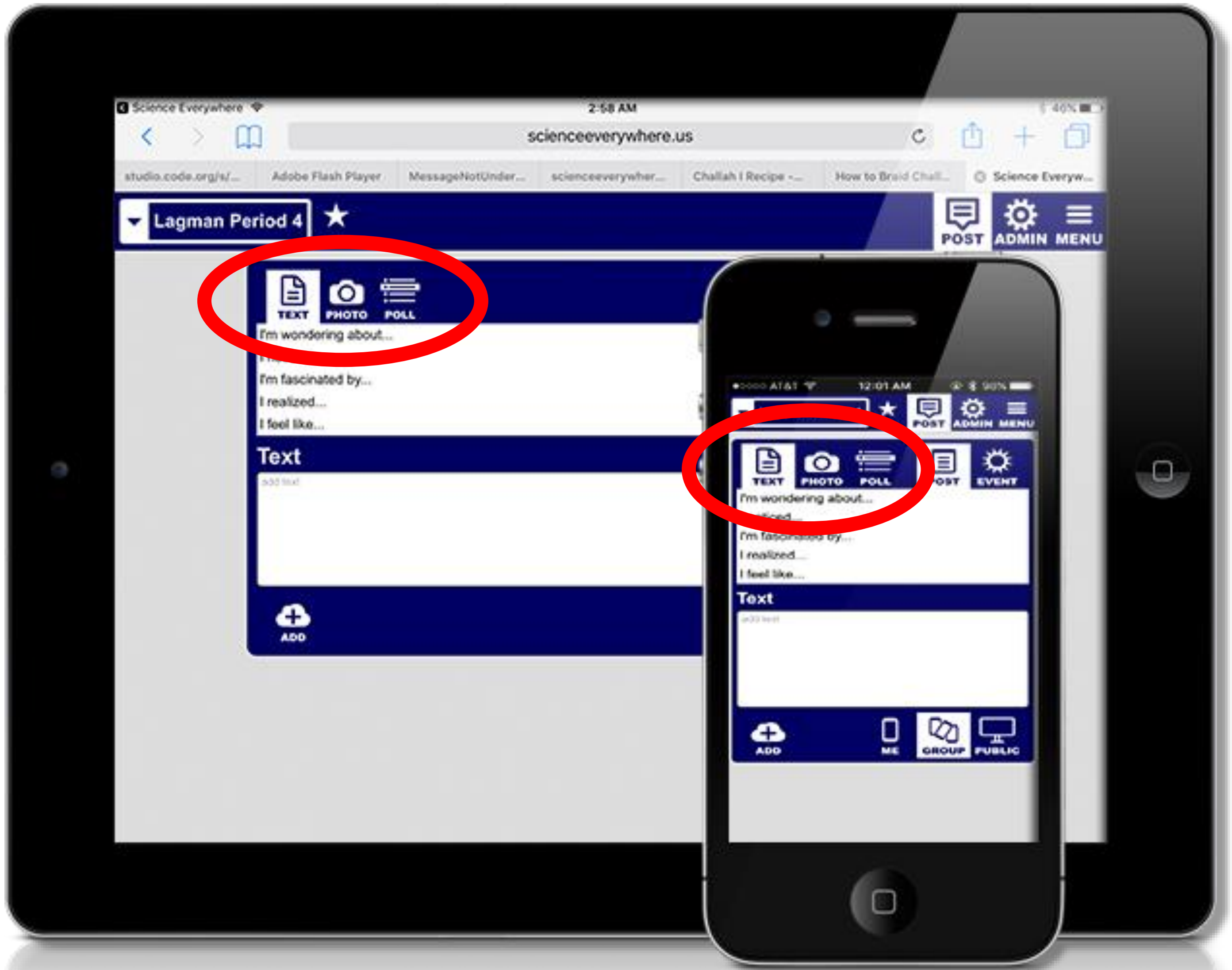
Without an in-depth understanding of the evolutionary process of design partnerships between researchers, children, and adults, we risk overlooking complex relationships that ultimately affect co-design work. The enormity of the parent-child relationship must be taken into consideration to deeply understand design partnerships within and across families. For instance, Darling and Steinberg [14] suggest that to better understand the socialization process of parents and children, we must differentiate between parenting practices and styles. Parental practices (e.g., discipline, affection, teaching) are specific behaviors parents enact to socialize their children, while parenting styles (i.e., authoritative, permissive, neglectful, and authoritarian) are dimensions of parental responsiveness and emotional climate in which parents raise their children [6,14]. Parental styles are attributed to influencing adolescent academic achievement [4,54], children's physical activity [15], children's behavior [3], and other aspects. Parental practices and styles might also

CHI'16, May 07 - 12, 2016, San Jose, CA, USA

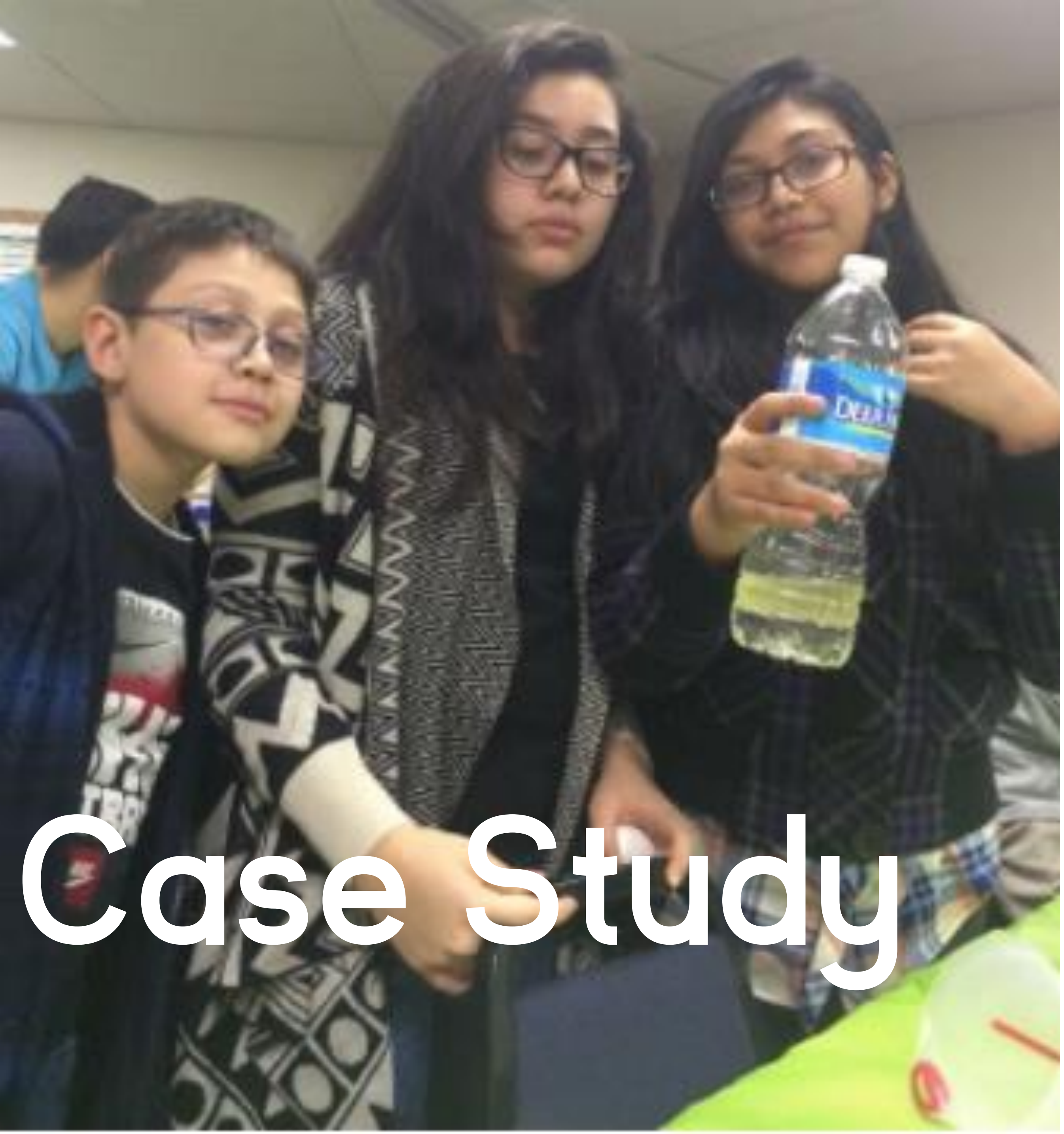
ACM 978-1-4503-3362-7/16/05…$15.00
DOI: http://dx.doi.org/10.1145/2858036.2858380

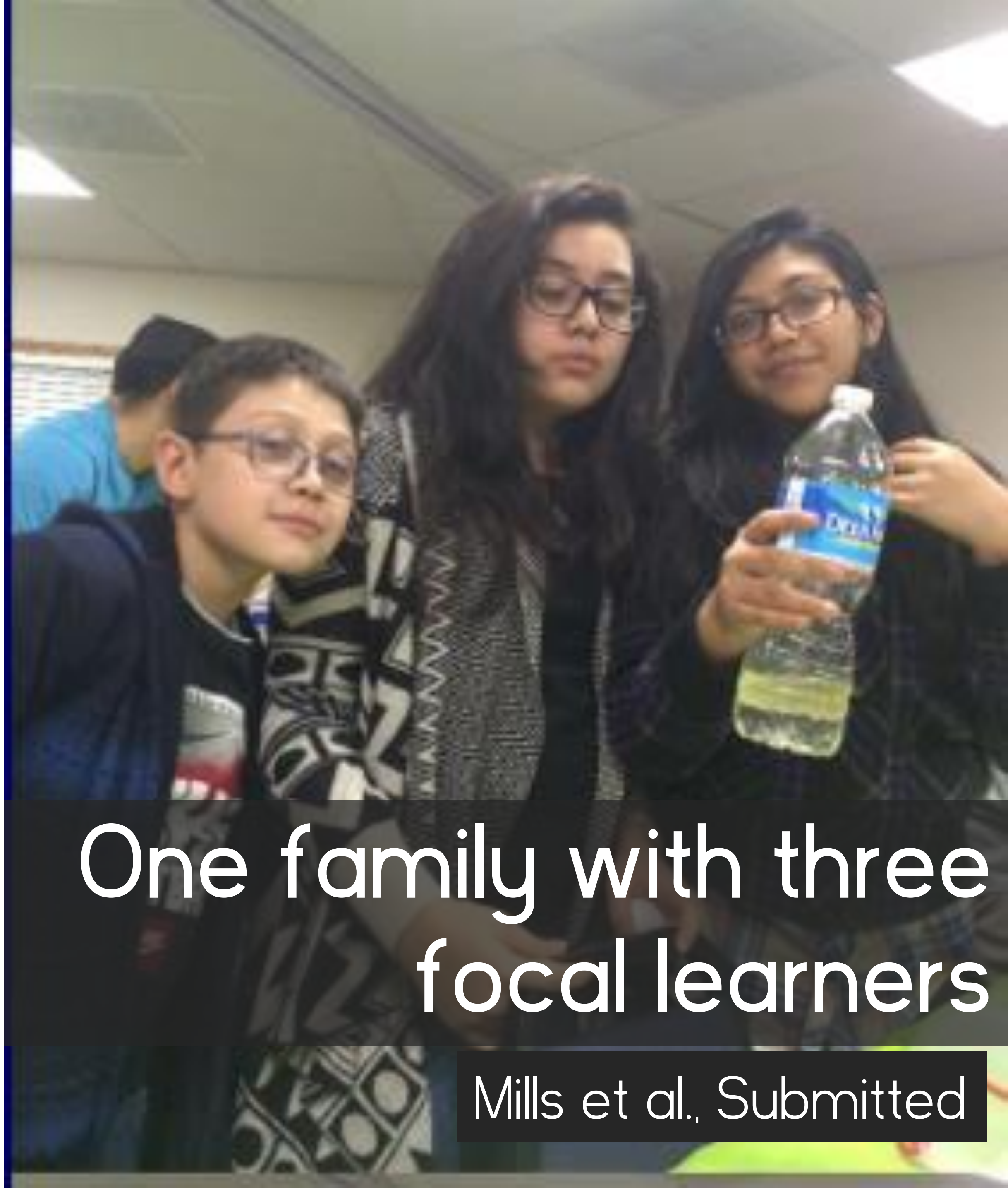
Science Everywhere App

Multi-media

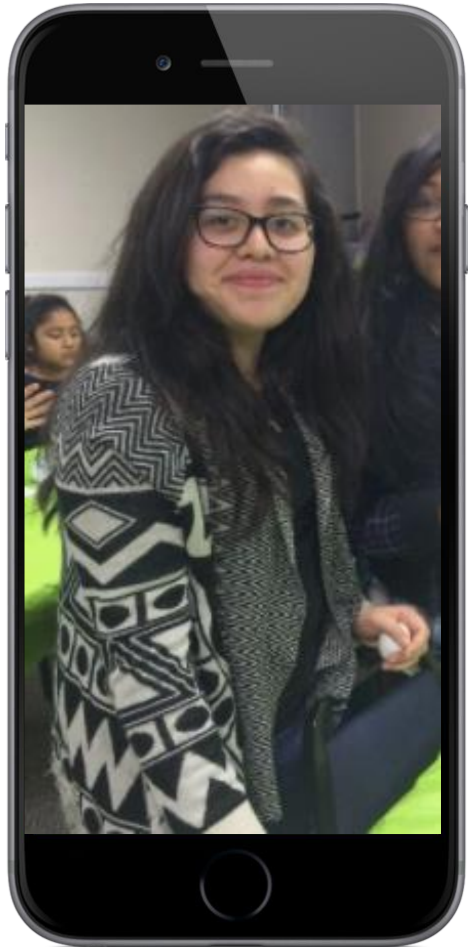


Science Everywhere App

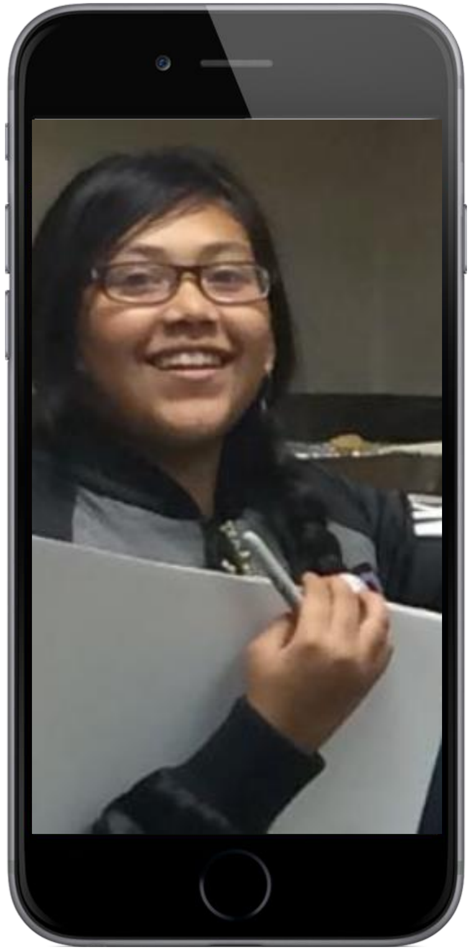

Case Study


One family with three focal learners
Mills et al., Submitted

Data Collection and Analysis

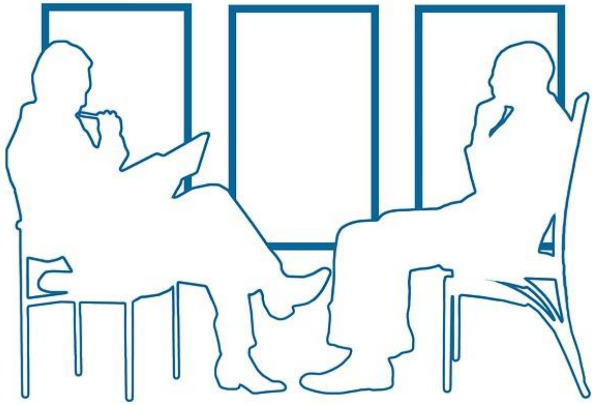


Emma
15 years old

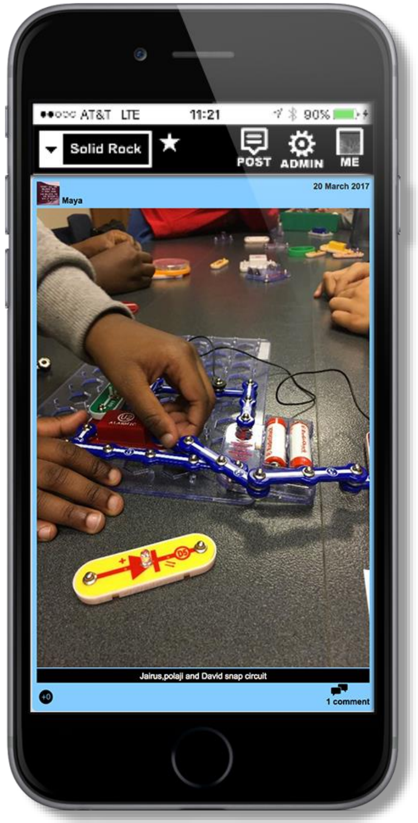


Kayla
14 years old

Jax
10 years old



Learner,
Parent, &
Teacher Interviews



Posts

Field Notes

Data Collection and Analysis

Mills et al., Submitted

Findings

1

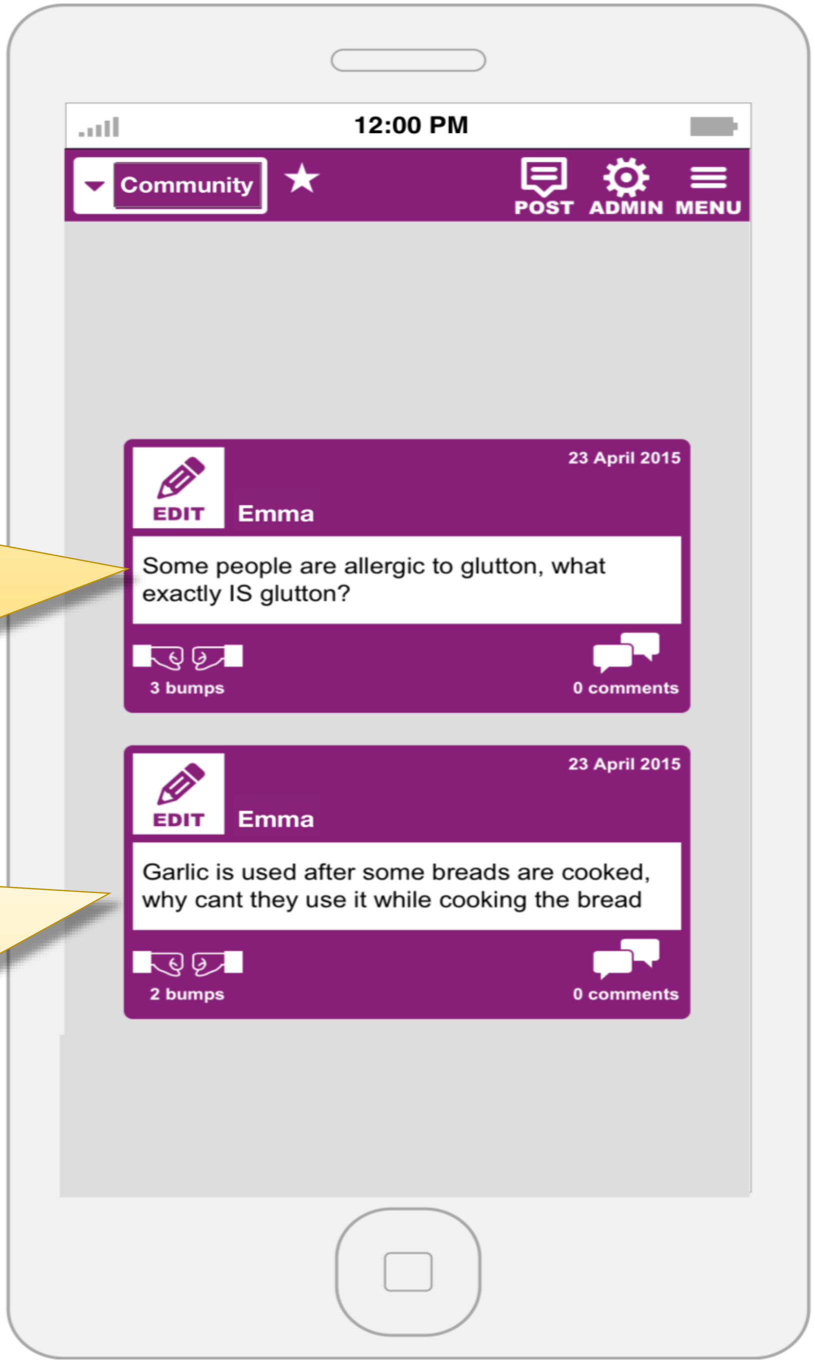
Learners were making **rich connections** between their scientific funds of knowledge and their efforts to engage in **scientific inquiry**

Mills et al., Submitted

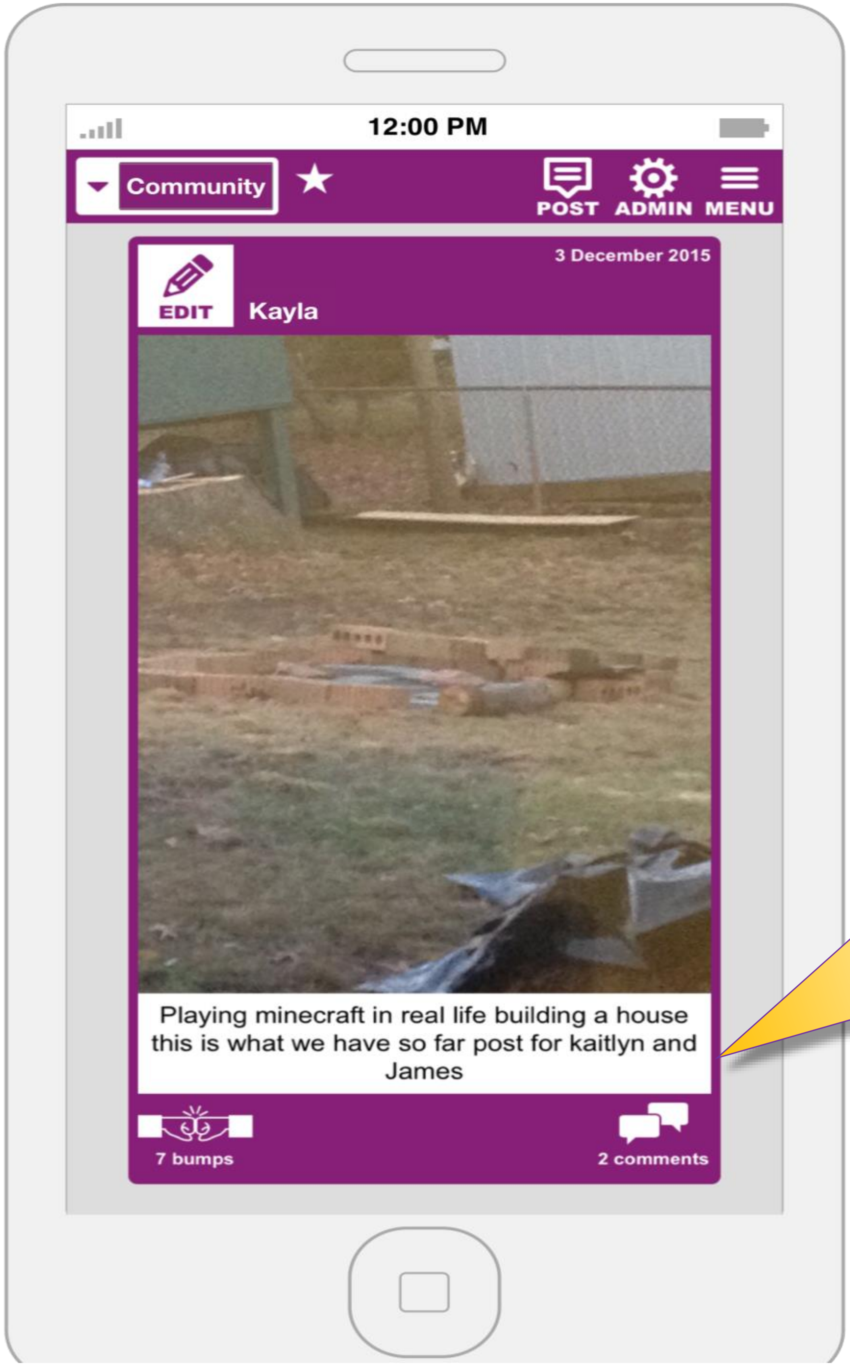
Connections

So I had a tutor at the time that was allergic to glutton [sic]. And I didn't know what glutton was. Was it the sugar in it? Was it the fat?"

My aunt likes to cook a lot and I would see how she sprinkled garlic on the bread after it cooked and I would ask why wouldn't it be in the bread instead of like on it afterwards.

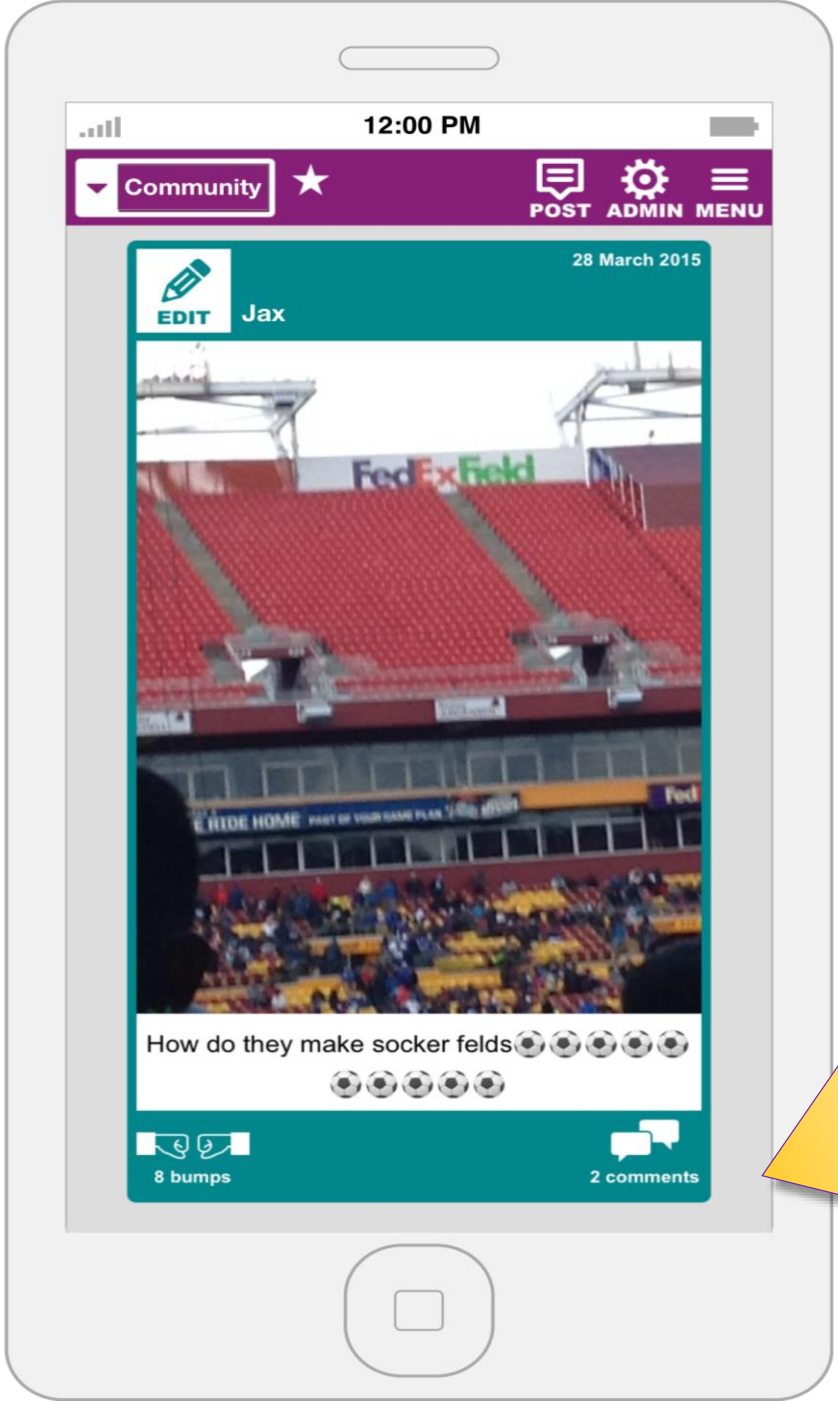


Processes



Kayla’s father explained that this was a shed that he built in their backyard.

I was really proud of it because I can show people that you can create some of these things in real life.



Emotion

Jax's father explained that this particular game, El Salvador versus Argentina, was an important game to the family because they are from El Salvador.

I've seen videos where it took days and days and months and they had to use these big trucks to like staple, tape and super glue them to the ground. These were these special seats that were made out of something slippery plastic so I had plastic seats before but these were really slippery so I could slide down easily.

Findings

1

Learners were making **rich connections** between their scientific funds of knowledge and their efforts to engage in **scientific inquiry**

2

Explicit connections to scientific funds of knowledge were often **missed** by observing these **posts alone.**

Mills et al., Submitted

Findings

Learners were making **rich connections** between their scientific funds of knowledge and their efforts to engage in **scientific inquiry**

Explicit connections to scientific funds of knowledge were often **missed** by observing these **posts alone.**

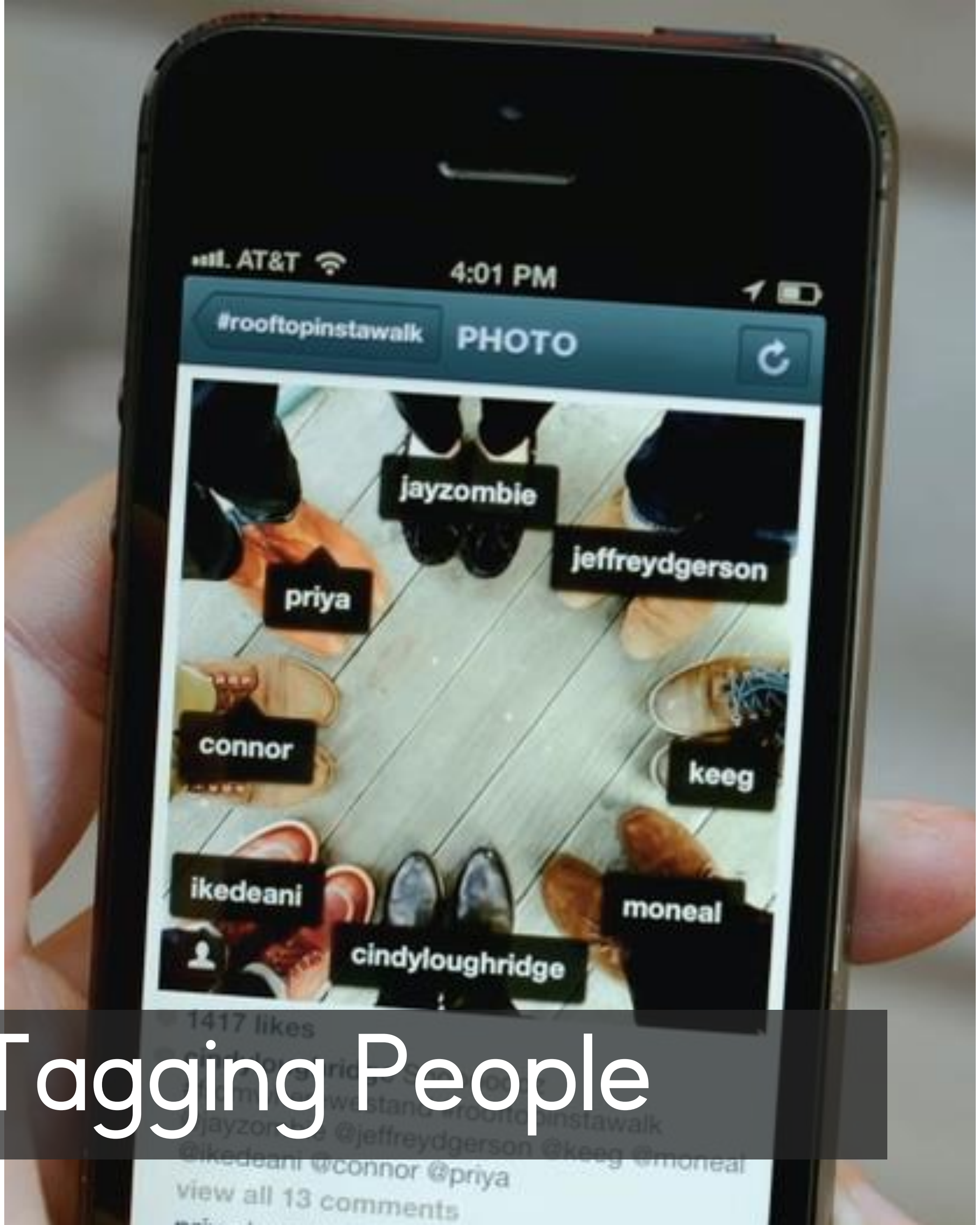
Interaction features and **connected practices** may make the children's implicit and more unconventional scientific funds of knowledge more apparent.

Mills et al., Submitted

Connecting posts to other posts, community members, locations, and experiences

Interaction Features

Mills et al., Submitted



Tagging People

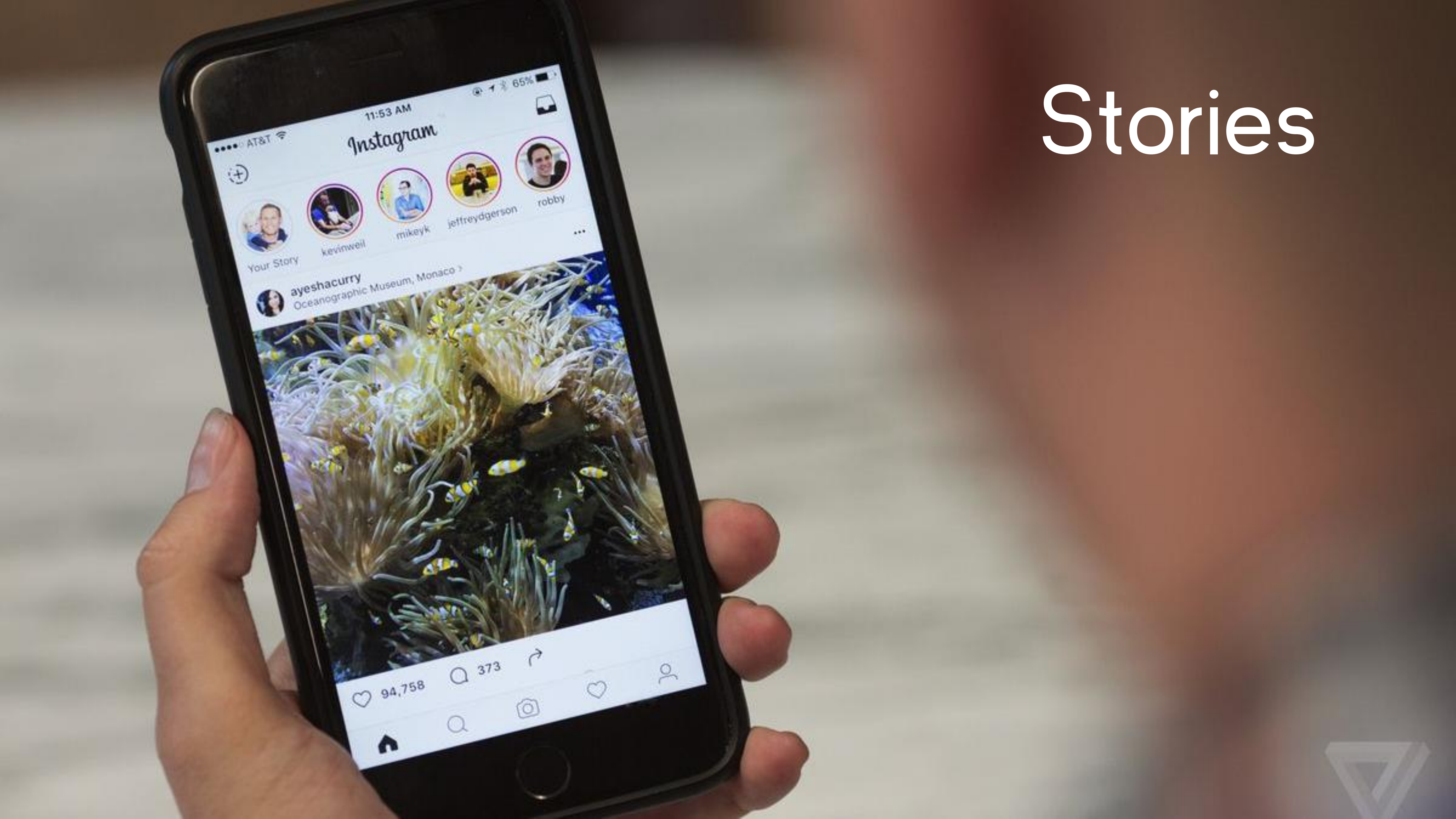
GPS Mapping

Leveraging new social media features for scaffolding science

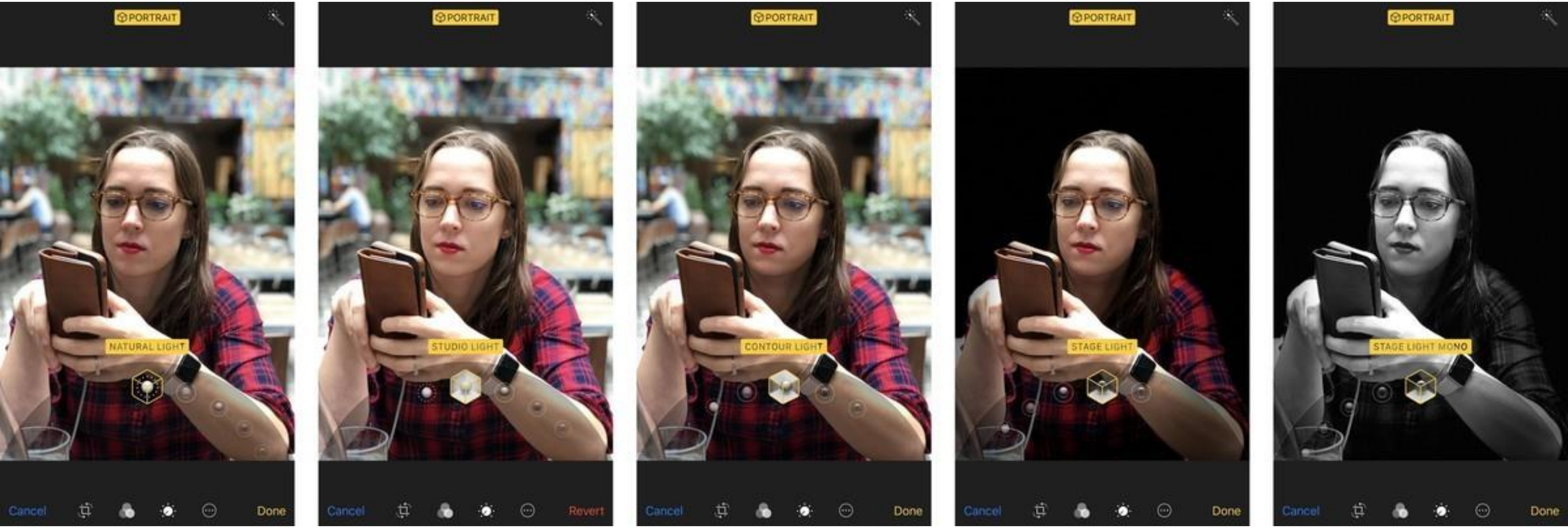
Interaction Features

Mills et al., Submitted

Stories



AT&T
11:53 AM
65%
Instagram
Your Story
kevinweil
mikeyk
jeffreydgerson
robby
ayeshacurry
Oceanographic Museum, Monaco
94,758
373

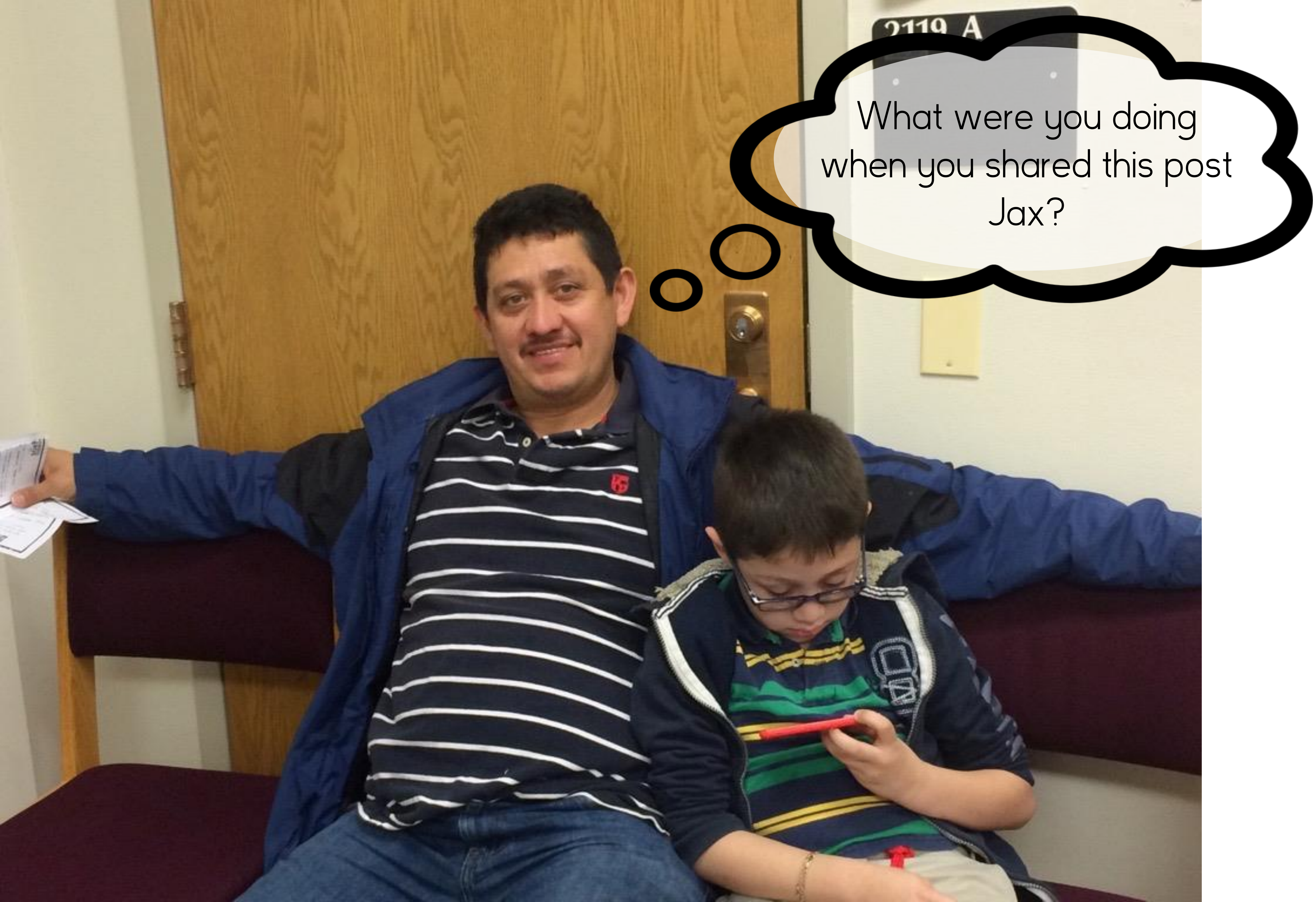

PORTRAIT
NATURAL LIGHT
Cancel
Done
PORTRAIT
STUDIO LIGHT
Cancel
Revert
PORTRAIT
CONTOUR LIGHT
Cancel
Done
PORTRAIT
STAGE LIGHT
Cancel
Done
PORTRAIT
STAGE LIGHT MONO
Cancel
Done

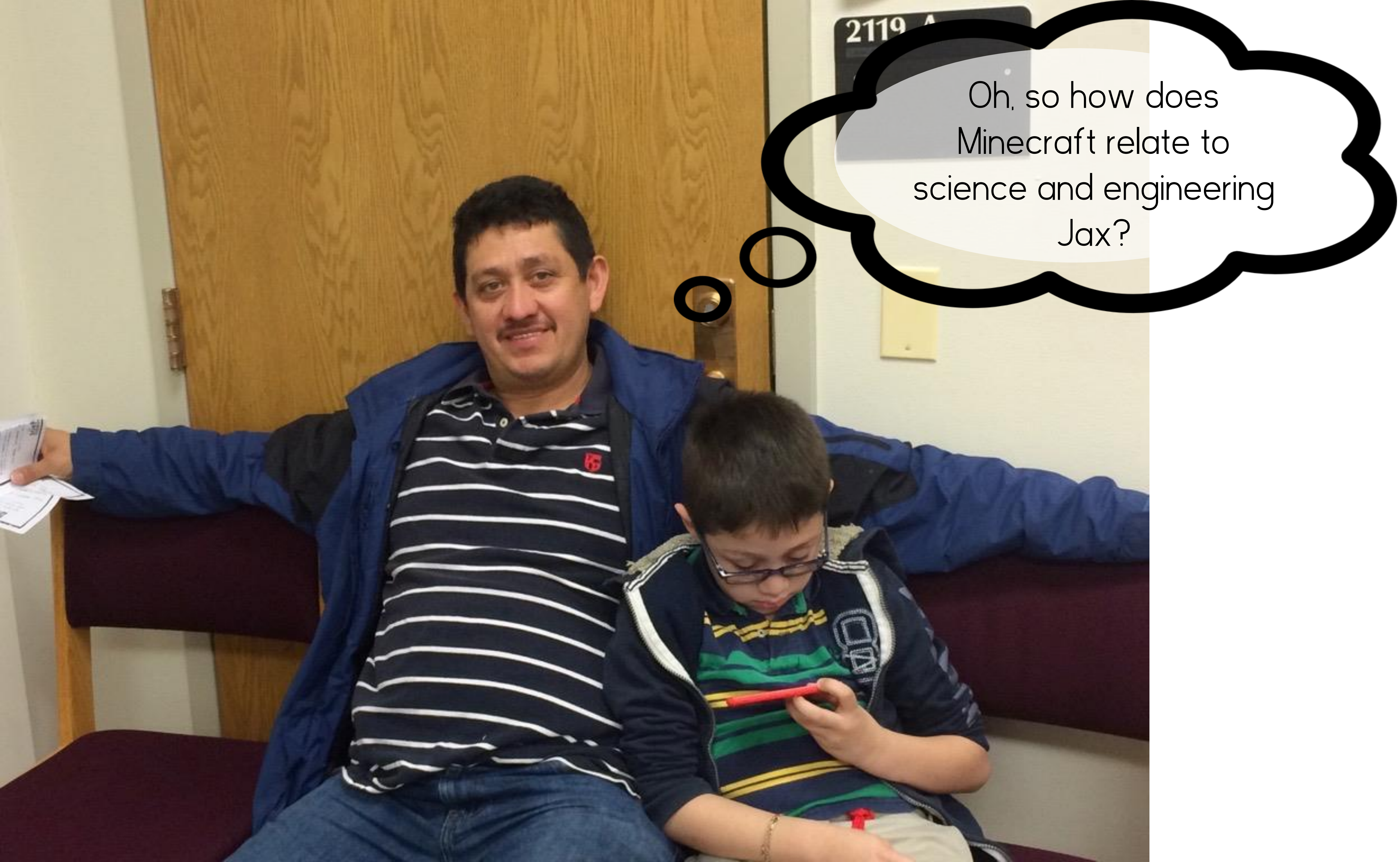
Time Lapse

Protocols for asking children about their posts

Connected Practices

Mills et al., Submitted


2119 A
What were you doing when you shared this post Jax?

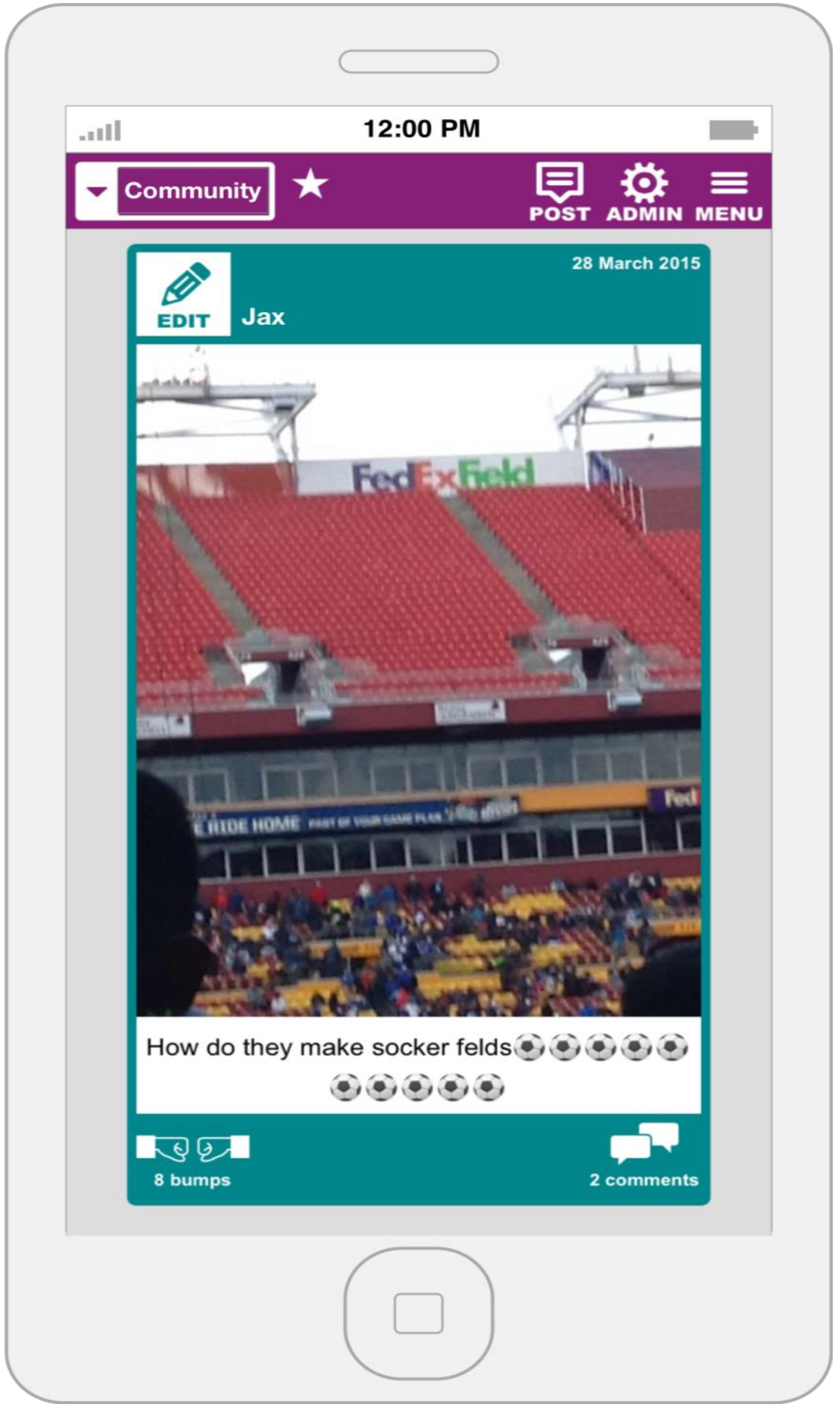

Oh, so how does Minecraft relate to science and engineering Jax?

Allow and encourage some "non-science" posts

Connected Practices

Mills et al., Submitted

Self-expression & seeds for science practice



Large Displays

Ahn et al., CHI 2018


Video
Audio
Field Notes
Interviews
Feb – July 2017
KATIE ETHRIDGE
SCREENSAVER
Field Study
Ahn et al., CHI 2018
Displays:
Church
Middle School
After-school
June Ahn | @ahnjune | New York University

Science Everywhere: Designing Public, Tangible Displays to Connect Youth Learning Across Settings

June Ahn[1], Tamara Clegg[2], Jason Yip[3], Elizabeth Bonsignore[2], Daniel Pauw[2], Lautaro Cabrera[2], Kenna Hernly[2], Caroline Pitt[3], Kelly Mills[2], Arturo Salazar[3], Diana Griffing[3], Jeff Rick, & Rachael Marr[2]

New York University[1], University of Maryland-College Park[2], University of Washington-Seattle[3]

Hybrid Spaces & Third Places

Hybrid Spaces **inspire & enable** new scientizing experiences

In Third Places learners **capture**, **share**, & **build upon** scientizing experiences

BodyVis

NatureNet

Science Everywhere

Going deeper into communities

4 Future Work

Going to Learners

New life-relevant learning contexts

Football

Churches

Co-PI: June Ahn

Co-PI: Jason Yip

Beth Bonsignore

Latauro Cabrera

Kelly Mills

Daniel Pauw

Caroline Pitt

Rachael Marr

NSF #1441523






Science Everywhere Team

ADVANCING SCIENCE LEARNING & INQUIRY EXPERIENCES THROUGH WEARABLES

BODYVIS & SHAREDPHYS TEAM

PROFESSORS

Jon Froehlich

Tamara Clegg

GRAD STUDENTS

Leyla Norooz

Seokbin Kang

Virginia Byrne

Rafael Velez

Amy Green

UNDERGRADUATE STUDENTS

Monica Katzen

Angelisa Plane

Vanessa Oguamanam

Thomas Outing

Anita Jorgensen

HIGH SCHOOL STUDENT

Sage Chen


NSF
NSF #1441184
Vocabulary
SALISBURY

NatureNet
CITIZEN SCIENCE COMMUNITY

Technologies to support community-driven environmental learning

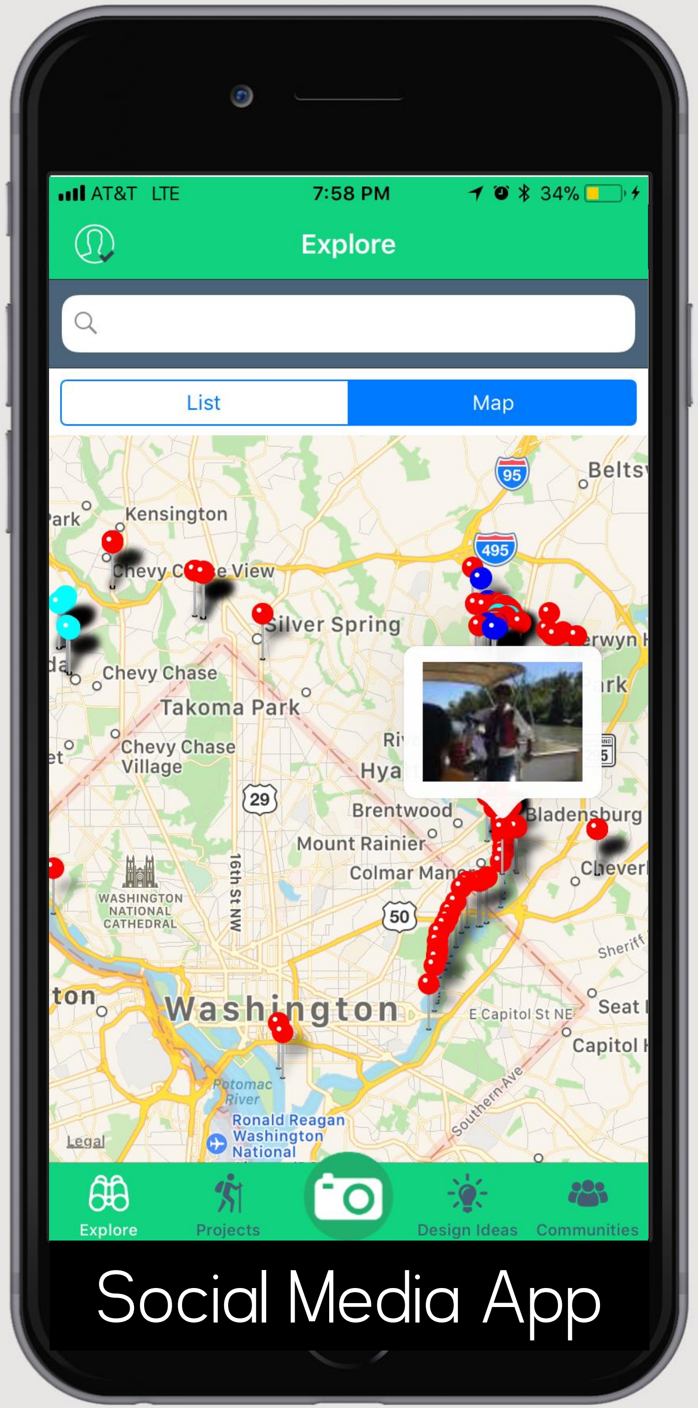
UNC CHARLOTTE

University of Colorado Boulder

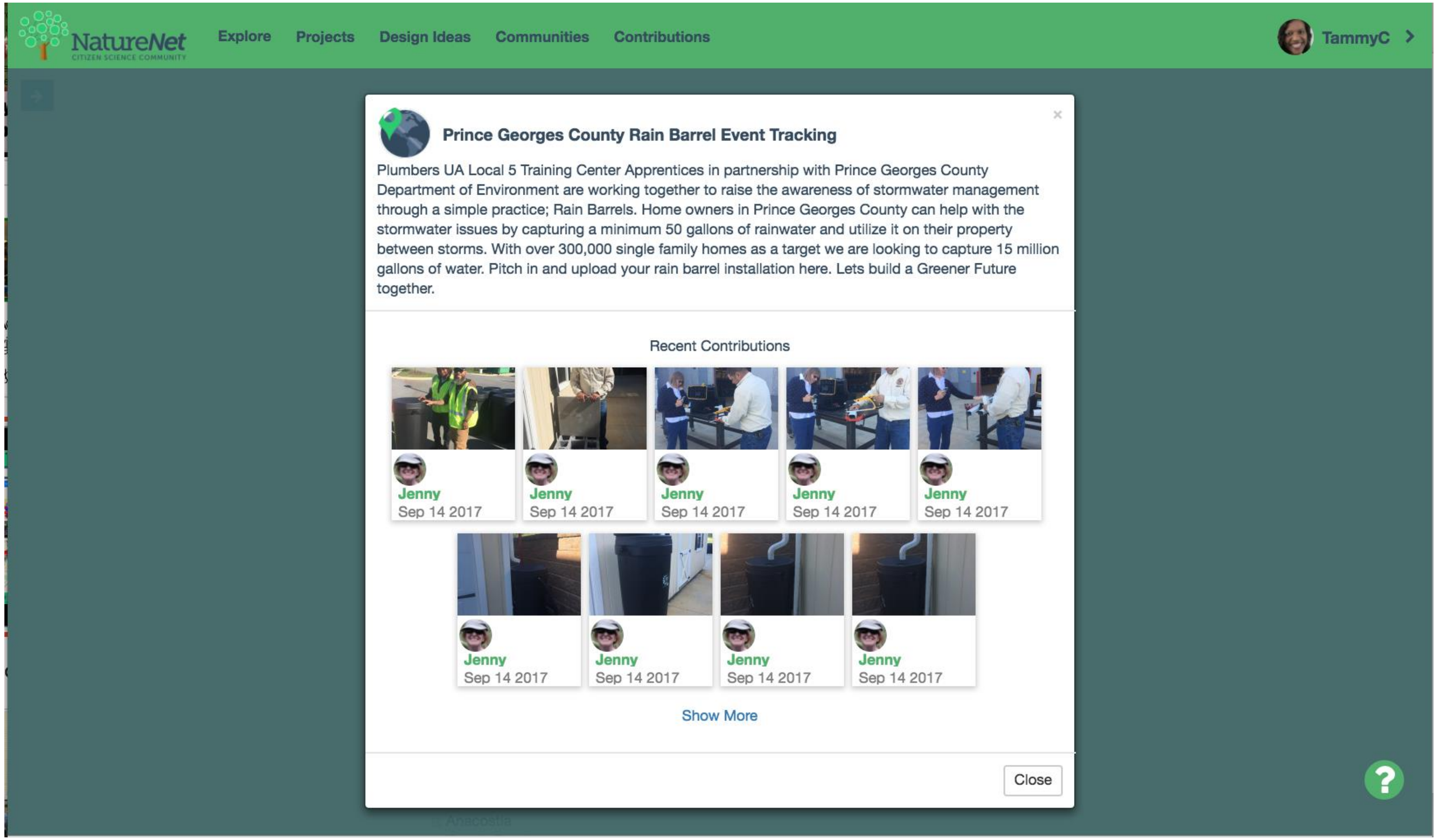
UNIVERSITY OF MARYLAND

NSF Grant #1423207

NSF



Social Media App



Website & Kiosk

NatureNet
CITIZEN SCIENCE COMMUNITY

Watershed Stewards Academy

Recreational Nature Center

NatureNet
CITIZEN SCIENCE COMMUNITY



Participant Observations

Focus Groups

Participatory Design

Three years

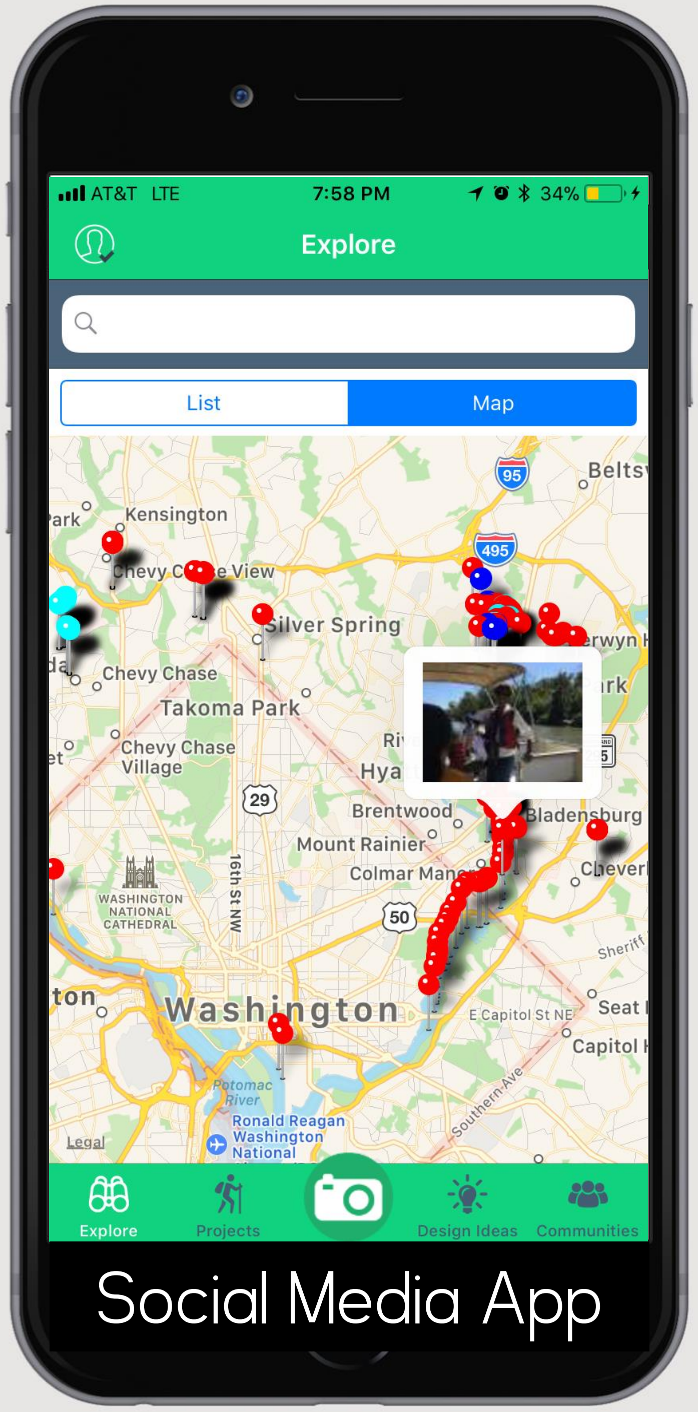

Managing community expectations
Learning From Challenges

Engaging Community Leadership

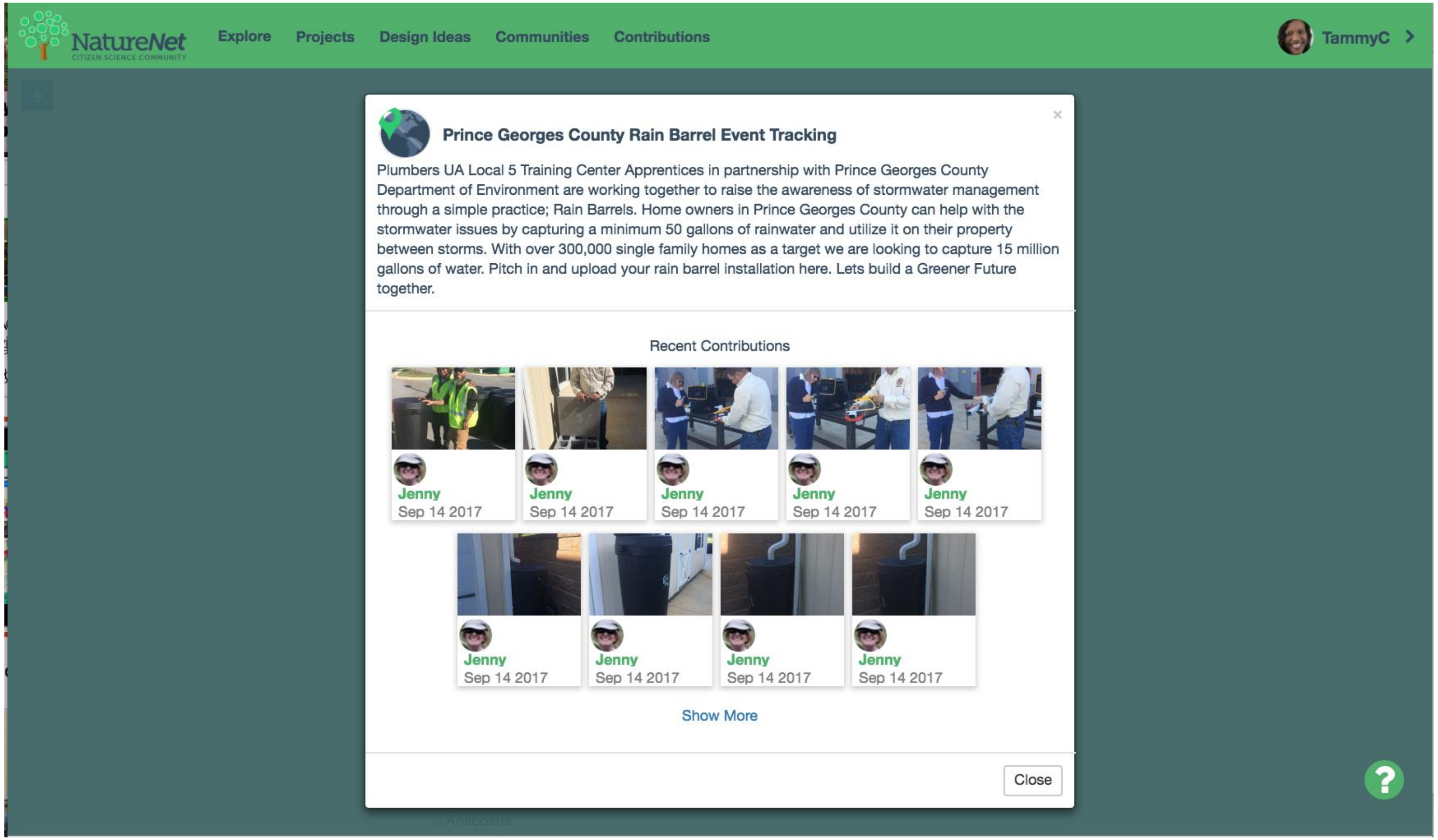
Learning From Challenges

Tailoring app to community needs and seasonal participation

Learning From Challenges



Social Media App



Website & Kiosk

NatureNet
CITIZEN SCIENCE COMMUNITY