Hybrid Spaces & Third Places

For Scientizing with Mobile, Wearable, & Community Technologies

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1. Intro & Goals
2. Hybrid Spaces
3. Third Places
4. Future Work
Intro & Goals

Learning Sciences & HCI Researcher

① Intro & Goals
Seeing the World through Scientific Lenses

Finding practical applications

Using Science to Achieve goals

Scientizing daily life activities
Procedural & Conceptual Understanding

Social Interactions

Interest

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?
Intro & Goals
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
- Leyla Norooz
- Seokbin Kang
- Virginia Byrne
- Rafael Velez
- Amy Green

**GRAD STUDENTS**

**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
Moving Graphs
BodyVis
Model-based Representations
Norooz et al., 2015; Norooz et al., 2016
Leveraging the Body as a Platform for Inquiry
Leveraging the Body as a Platform for Inquiry

Asking questions, collecting and analyzing data, making claims
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

LPSV tools & Supporting Artifact

Rules

Division & Labor Facilitator Roles

Classroom Governance

Social Context Collaboration

Life-Relevant Object Scientific Inquiry

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

LPSV tools & Supporting Artifacts

Learners

Classroom Governance

Social Context Collaboration

Life-Relevant Scientific Inquiry

Teacher & Facilitator Roles
Activity Theory

LPSV tools & Supporting Artifacts

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Life-Relevant Scientific Inquiry

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Life-Relevant Scientific Inquiry

Teacher & Facilitator Roles
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.
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.
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
Video Data

Pre & Post Assessments

Teacher Interviews

Supporting Artifacts

Child Focus Groups

Facilitator Post Observation Field Notes

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

Facilitator Post Observation Field Notes

Child Focus Groups

Saldaña, 2015
Meta-Matrix
Axial Coding Round

Miles & Huberman, 1994
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
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Findings

Scientific Inquiry
Difference Between Grades

LPSV Tools

Life-Relevant Scientific Inquiry

Social Context Collaboration
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

- Classroom Governance
- LPSV Tools
- Life-Relevant Scientific Inquiry
1st & 2nd Grade: Free Space

4th Grade: Limited 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

Life-Relevant Scientific Inquiry

Social Context Collaboration

Teacher & Facilitator Roles
Supporting Artifacts

Teacher: Access to Resources

Community Aspects

Pop Culture
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.
Integrating LPSV Tools into the Classroom Environment

Implications

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
Need More Ecosystem Analyses of SBL Environments

Messy  Complex  Hard
NatureNet Science Everywhere

③ Third Places
My own experiences engaging in STEM
Tensions

Being Smart

Being Cool
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
Tangible, community displays

Mobile social media
Youth Designing with the Community
Parents

Designing with the Community
Teachers

Designing with the Community
Community Volunteers

Designing with the Community
ABSTRACT

Partnering with parents and children in the design process can be important for predicting 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-responsive 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 parent 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 activities

ACM Classification Keywords

H.5.10. Design; Methodologies

INTRODUCTION

Interview: What do you think about designng 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 you get to see 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, how a book should look like, now, what it should have and stuff like that.

This is how one of our youth participants (Amy, age 12, pseudonym) reflected on a 16-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 conflict, but also deeper social bonding, with her father, and underscores the importance of spending time designing with her parents. Amy’s reflection illustrates a prime 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 others (Smith 17,28,20,23,27,33,36,30). While existing research has focused on the process that arise out of family co-design (30,23,27) and the co-design methods used (23,33,36), a key question that HCI researchers have not fully explored is, “How do the design processes between children, parents, researchers, 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 interactivity of the parent-child relationship must be taken into consideration to deeply understand design partnerships within and across families. For instance, During and Sturhahn (14) suggest that to better understand the socialization process of parents and children, we must differentiate between parenting practices and style. Parental practices (e.g., discipline, expectations, teaching) are specific behavior patterns that socialize their children, while parenting styles (i.e., authoritative, permissive, neglected, and authoritarian) are dimensions of parental requirements and emotional climate in which parents raise their children (8,14). Parental styles are attributed to influencing adolescent academic achievement (4,25), children’s physical activity (15), children’s behavior (15), and other aspects. Parental practices and styles might also
Science Everywhere App

Multi-media
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

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

Mills et al., Submitted
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.
I’ve seen videos where it took days and days and months and they had to use these big trucks to 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.

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.
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.

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
Leveraging new social media features for scaffolding science

Mills et al., Submitted
Stories
Time Lapse
Protocols for asking children about their posts

Mills et al., Submitted
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
Self-expression & seeds for science practice
Large Displays

Ahn et al., CHI 2018
Field Study
Ahn et al., CHI 2018

Displays: Church, Middle School, After-school

Feb – July 2017

Video
Audio
Field Notes
Interviews
Science Everywhere: Designing Public, Tangible Displays to Connect Youth Learning Across Settings

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Hybrid Spaces & Third Places

Hybrid Spaces inspire & enable new scientizing experiences. Third Places learners capture, share, & build upon scientizing experiences.
Future Work

Going deeper into communities
New life-relevant learning contexts

Football

Churches

Going to Learners
Co-PI: June Ahn
Co-PI: Jason Yip
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Technologies to support community-driven environmental learning
Social Media App

Website & Kiosk
Participant Observations
Focus Groups
Participatory Design

Three years
Managing community expectations

Learning From Challenges
Engaging Community Leadership

Learning From Challenges
Learning From Challenges

Tailoring app to community needs and seasonal participation

Learning From Challenges
Website & Kiosk