## Introduction

**Partnerships for Informal Science Education in the Community (PISEC) at the University of Colorado**
- University Educators (UEs: undergrads/grads) in informal science activities with local precollege children.
- New technological tools:
  - Stop action motion (SAM) movies [1]
  - Physics Education Technology (PhET) simulations [2]
  - Video-based mentoring
  - Engage children through play
  - Complementary approach to schools for reaching underrepresented populations

### Case study: African American third grade student learning about velocity and acceleration.

## Background/Need

**Under Represented Populations:**
- Individual empowerment
- Educate citizenry / democracy
- Needed for STEM jobs in future [3]

**University:**
- Fully educate undergrads/grads concerning education, engagement, and diverse populations
- Mission of service and community engagement

**Research:**
- Individual learning coupled with social, cultural, environmental contexts [4]
- Lack of extensive research on non museum informal science education environments [5]

### New Tech Tools

**Stop Action Motion (SAM) software** [1]:
- Kids make movies about science
- Hands-on, engaging
- Alternative medium for assessment and expression

**Physics Education Technology (PhET) [5]** science simulations:
- Engaging
- Provides extension of hands-on activities
- Visualization
- Explore nature
- Play

### Environments

- **Casa de la Esperanza** – 13 Hispanic middle school students in subsidized housing, 5 University Educators
- **Boulder Prep Charter School** - high school students expelled from 3 other schools – 10-20 students/semester, 10 University Educators
- **Lafayette Elem.** – 23 4th graders on lunch program, 4 University Educators
- **San Diego Remote Program** – 10 African American K12 students, 2 University Educators

## Our Models

**Univ.-Comm. Partnership Model**
- Bring together university, community, and children
- Each benefit from authentic coordination
- Children from underrepresented populations participate in science activities

### Studies: Benefits to Children
- Content knowledge
- Attitudes/beliefs about science and nature of science
- Desire to engage in STEM

### Studies: Benefits to University Educators
- Teaching pedagogy
- Ability to communicate in everyday language
- Attitudes/beliefs about informal science activities
- Views about education

## Case Study:

### Goal:
Understand 1-D acceleration

### Environment:
- 2 remote video, 1 live session,
- 1 Univ. of Colorado science University Educator
- 2 Univ. of California social science Univ. Ed’s

### Rubric:
Understanding 1-D Acceleration

<table>
<thead>
<tr>
<th>Level</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>1</td>
<td>1-D constant speed</td>
</tr>
<tr>
<td>2</td>
<td>1-D acceleration</td>
</tr>
<tr>
<td>3</td>
<td>2-D acceleration</td>
</tr>
</tbody>
</table>

### Findings:
1. Karl produced a movie of constant speed and described it in his own words.

## Distance Learning Model

**Environment Barriers:**
- Voluntary informal environment
- Administrative: distractions at site, train University Educators, get to site, etc.
- Cultural, language barriers
- Remote: technological, social barriers
- Time/Space – university & community in different locations & time zones

**Science Education Barriers: 1-D Motion**
- College students struggle w/ 1-D motion [7]

### Pedagogical Approach

**Predict** (SAM movies)
- Observe: hands-on or PhET activities
- Compare (SAM movies)

### Barriers to Programs

### 1-D Constant Speed

**Findings:**
1. Karl produced a movie depicting increasing or decreasing speed after being shown how.
2. Karl could not make such a movie in subsequent sessions without being shown how again.

### 1-D Acceleration

**Findings:**
1. Karl made a movie depicting constant speed.
2. No new guidelines
3. New cut out figures
4. No UE telling him what to do
5. No remote session

### 6 Months Later

**Findings:**
1. Karl used “skin” feature of SAM (superimposed previous frame) to make sure his skateboarder moved in equal increments.

## Conclusions

- Third grader demonstrated constant motion
- Reached underserved populations
- Supported underprivileged youth
- Demonstrated University-Community Partnership Model
- New tools for education and evaluation
- Scalability with science Univ. Educators and children not co-located justifies expensive use of resources

## Acknowledgements

1. LHC: [6]: Michael Cole, Robert Leucy, David Coughlin
2. Shawn Piazza, CU
3. NSF: Grant No. REC 0448176
4. JILA NSF Physics Frontier Center (PFC) for Atomic, Molecular, and Optical Physics
5. Professor Eric Cornell, Dir. PFC

## References