New Media and Models for Engaging Under Represented Students in Science

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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:

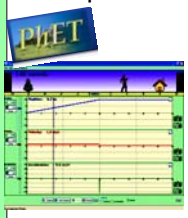
- Individual learning coupled with social, cultural, environmental contexts [4]
- Lack of extensive research on non museum informal science education environments [5]

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

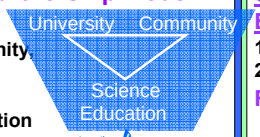
Lafayette Elem. – 23 4th graders on lunch program, 4 University Educators

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 benefits from authentic coordination



Children from under represented populations participate in science activities

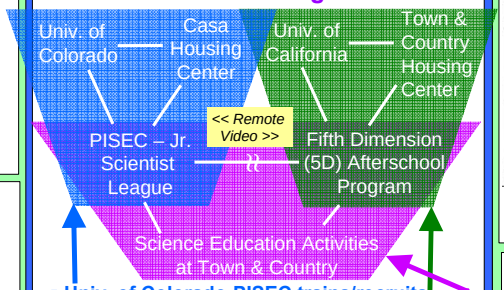
Studies: Benefits to Children

- 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

Distance Learning Model



- Univ. of Colorado-PISEC trains/recruits science University Educators
- Univ. of California LCHC [6] social science University Educators Program at Town & Country (T&C) HUD housing complex Learning Center
- Univ. of Colorado University Educators connect remotely to children and Univ. of California University Educators at Town & Country

Barriers to Programs

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
Reconcile (SAM movies/challenge)

Case Study:

Goal: Understand 1-D acceleration

Environment: 2 remote video, 1 live sessions, 1 Univ. of Colorado science University Educator 2 Univ. of California social science Univ. Ed's

Rubric: Understanding 1-D Acceleration

TABLE 1. Possible Performance Levels	
Level	**Successfully makes a SAM movie of:**
0	Unsuccessful
1	Object moving
2	Object moving with constant speed
3	Object moving with incr. / decr. speed
4	Object moving with constant acceleration

1-D Constant Speed

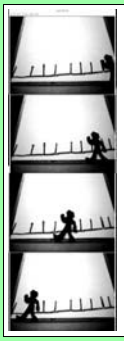
Level 2

"Constant speed … is about anything going…it stays the same speed. It doesn't speed Up. It doesn't go slower. It stays at the same speed."
- session 2: Karl, African American 3rd grader, initially at Level 0

Findings:

1. Karl produced a movie of constant speed and described it in his own words. Level 2
2. Karl used markings to show that his cutout moved in equal increments. Level 2

1-D Acceleration



Findings:

1. Karl made a movie depicting increasing or decreasing speed after being shown how. Level 3
2. Karl could not make such a movie in subsequent sessions without being shown how again. Level 2

6 Months Later

Findings:

1. Karl made a movie of constant speed. Level 2
   - New Background
   - No guiding lines
   - New cut out figures
   - No UE telling him what to do
   - No remote session
2. 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

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5. Professor Eric Cornell, Dir. PFC

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