**Project Overview**

**SIMSAM** is an integrated Simulation, Measurement, and Stop Action Moviemaking toolkit.

**Motivation**
- Simulation and data analysis are tools of scientific discourse - ways to think about, engage critically with, and communicate understandings of science.
- Like classroom argumentation, simulation and data analysis should be seen as ways for students to posit, test, and refine their own scientific ideas.
- It’s important to support a continuum between conceptualization and simulation: students should program their own objects, and their own measures to test their model’s predictive power.

**Design Studio Workshop**
We held a preliminary workshop held to develop our technological, theoretical and analytic tools.

- "Design studio" using SAM Animation and StageCast Creator.
- Five sixth-grade girls, three workshop facilitators (the poster authors).
- Four sessions in Fall 2012, 1-2 weeks apart.
- Participants explored modeling activity about how smell spreads through a room.

**Sequence of Activities**
Day 1 Discussed smell diffusion, drew models on paper and created SAM animations.
Day 2 Refined models during discussion, revisited animations, and introduced StageCast Creation.
Day 3 Worked in small groups to better understand the details of StageCast as a programming tool.
Day 4 Challenged and revised StageCast sims. Participants evaluated sims based on measurable outcomes.

**Data Collected**
We collected video data and student artifacts during each workshop session. Video segments of particular interest are transcribed for deeper analysis.

**Claims**
Different types of scientific discourse emerged in the context of different representational and computational media. By positioning student-generated representations as the focus within each medium, the same ideas and debates percolated across these different types of discourse. These supports allowed sustained, focused theory-building and refinement over the course of the design workshop.

1. **Certain forms of scientific discourse emerged as engaged with different media.**
   - Increasing "medial" of explicit talk about causal mechanisms as students moved from discussion to animation, to simulation.
   - Shifts in particular modeling practices that co-occur with different media.
   - Cycle of elaboration, refinement, and encapsulation of content-related ideas over time.

2. **Student representations allowed ideas and debates to persist and re-emerge across media.**
   - Simulation objects such as "oogies" were used as editable, persistent notications of earlier ideas and debates.
   - Students’ gradual uptake of different computational forms were reflected in shifting use of representational objects such as arrows.

3. **Design principles to support simulation as discourse.**
   - Prompts should support sustained theory-building activity that can be embedded within and persist across multiple media.
   - Content exploration should be intertwined with, not separated from, learning to use the tool.
   - Delicate balance between when and what students feel authority over aspects of modeling task.

**Data Analysis**

- **Student representations allowed ideas and debates to persist and re-emerge across media.**
- **Prompts should support sustained theory-building activity that can be embedded within and persist across multiple media.**
- **Content exploration should be intertwined with, not separated from, learning to use the tool.**
- **Delicate balance between when and what students feel authority over aspects of modeling task.**

**References**
- Chang, H-Y, Quintana, C., & Krajcik, J. (2010). The impact of designing and evaluating molecular animations on how well middle school students understand the particulate nature of matter.
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