What's the Matter? Under Represented Middle School Students Learning about States of Matter in Informal Science Summer Camp

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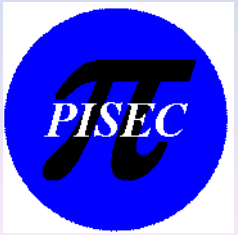


Why Physics Education Research?

- Established sub-discipline of Physics:
  - Study conditions of student learning
  - Backed by APS, NSF, National Academies
  - Own journal lines (e.g. Physical Review)
  - Exists in many physics departments across US
- Traditionally focused on:
  - Student conceptual understanding
  - College level
- New Areas of Interest:
  - Beyond concepts (e.g. attitudes and beliefs)
  - Upper division / graduate
  - K-12

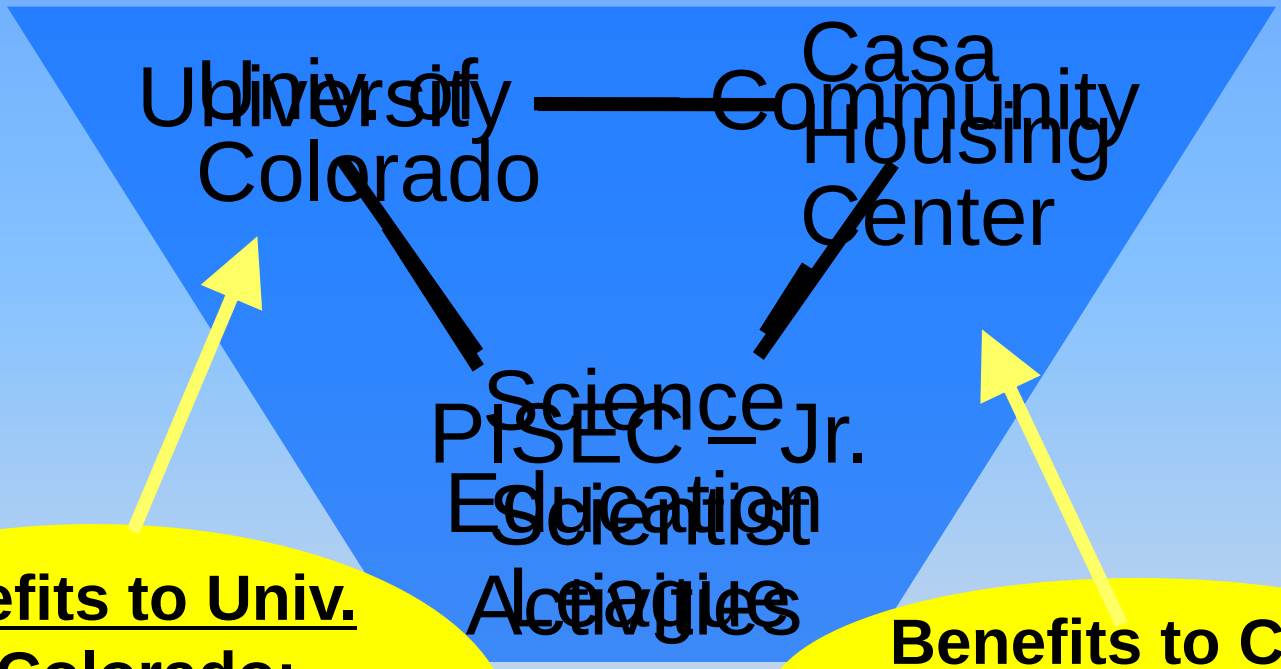
Why Informal Science Education?

- Reach under represented populations
- Extended relationship with children
- Complement school activities
  - Some ESL students sacrifice science
  - Work with students in their cultural context

Summer Camp Demographics

- Casa de la Esperanza, Longmont, CO
- Subsidized Housing, Predominantly Hispanic
- 32 apartments
- 85 children and 70 adults
- Casa de la Esperanza Goals:
  - Promote post secondary education
  - Promote computer knowledge and skills
- 13 children, grades 5-8

Model



Benefits to Univ. of Colorado:

1. University mission of service
2. Educate grad/undergrad

Benefits to Casa:

1. Science and Education
2. Univ. resources

Camp Details

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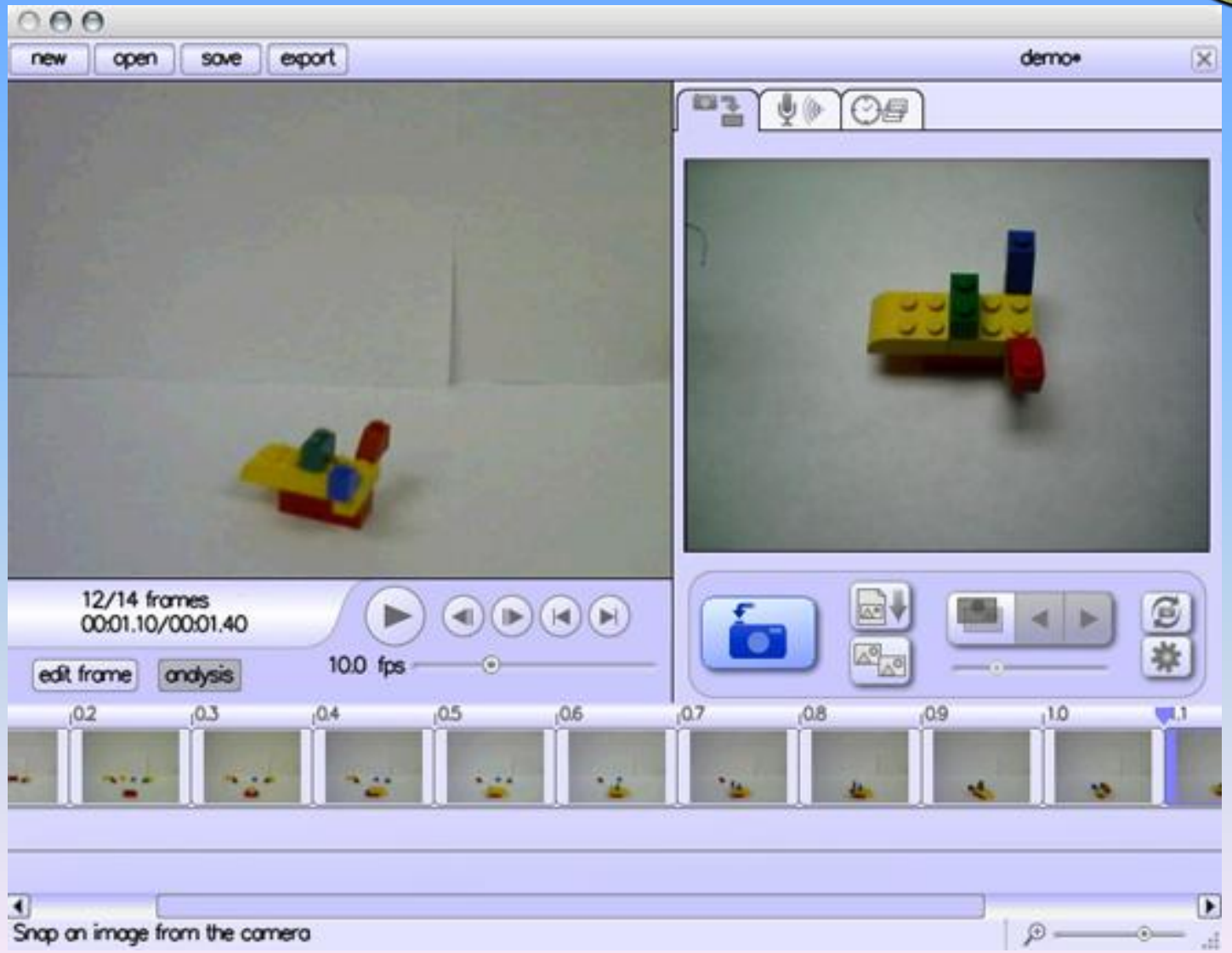
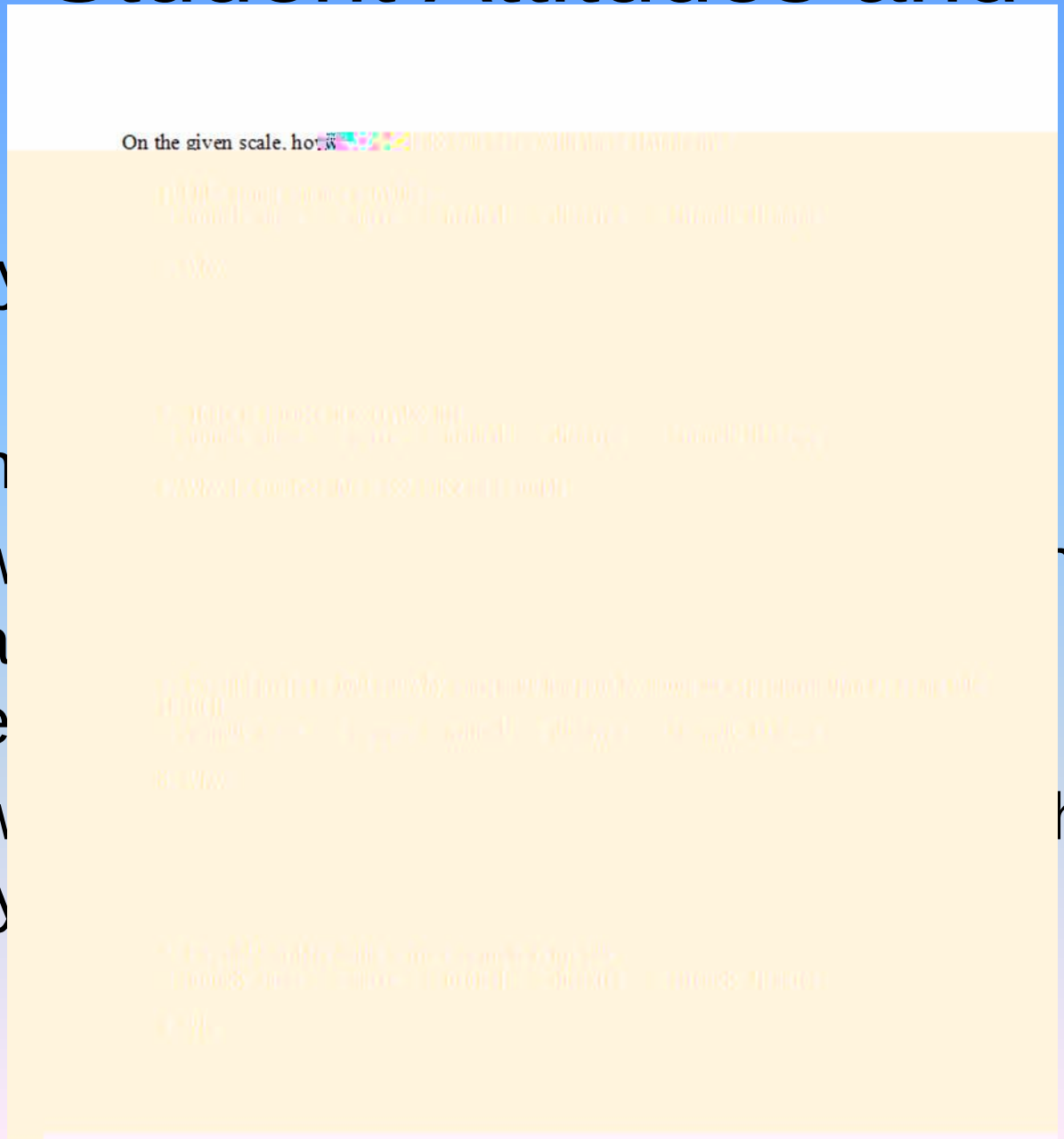


Research Methods

- Methods
  - Pre/Post survey
  - Pre/Post SAM Movies
  - Lab notebooks
  - Video

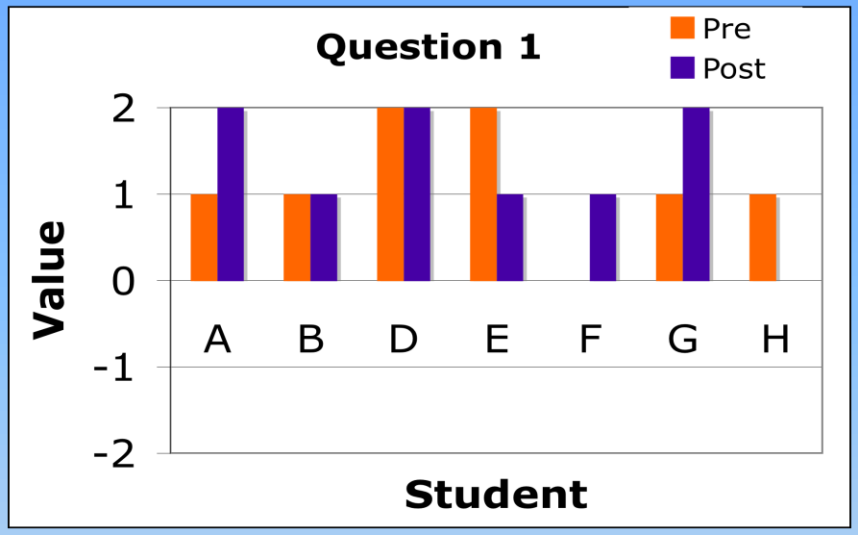
Student Attitudes and

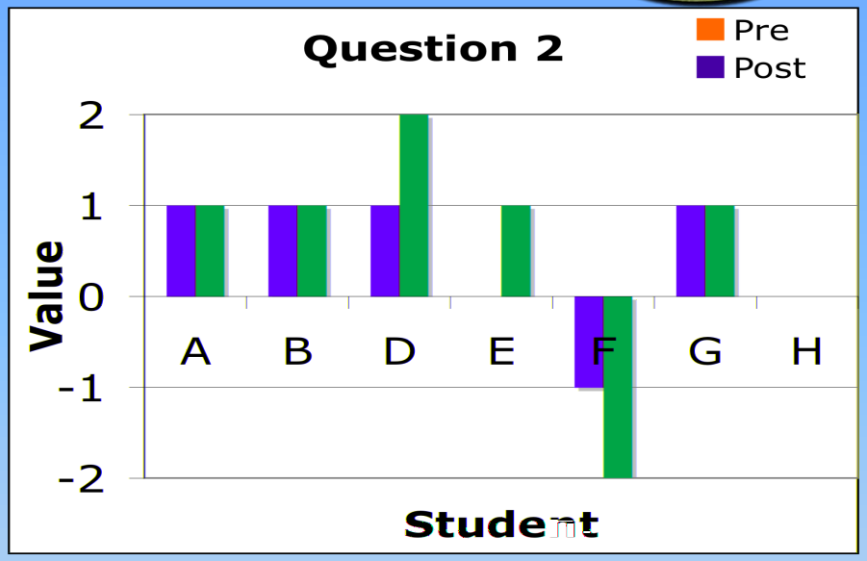


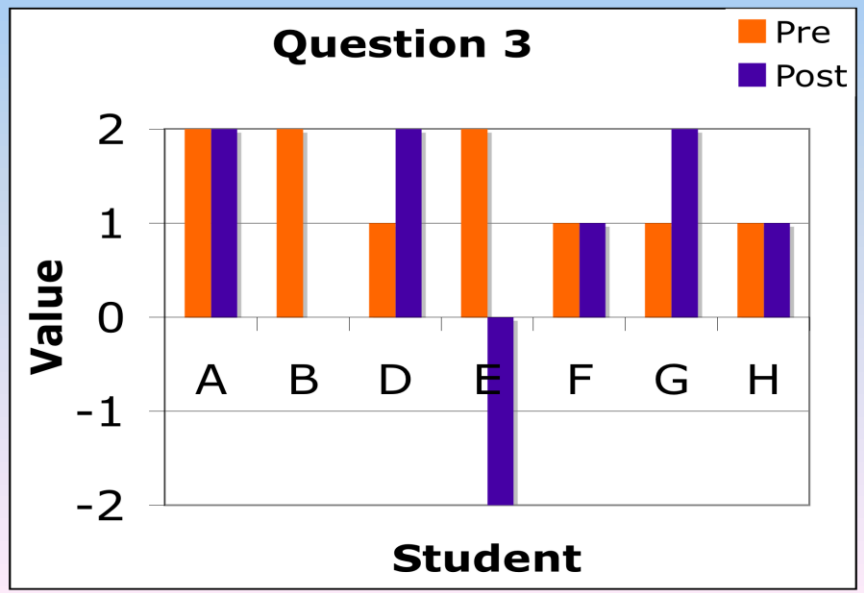
Survey

1. I li
2. Th
3. I w ng ha by be
4. I w h as my

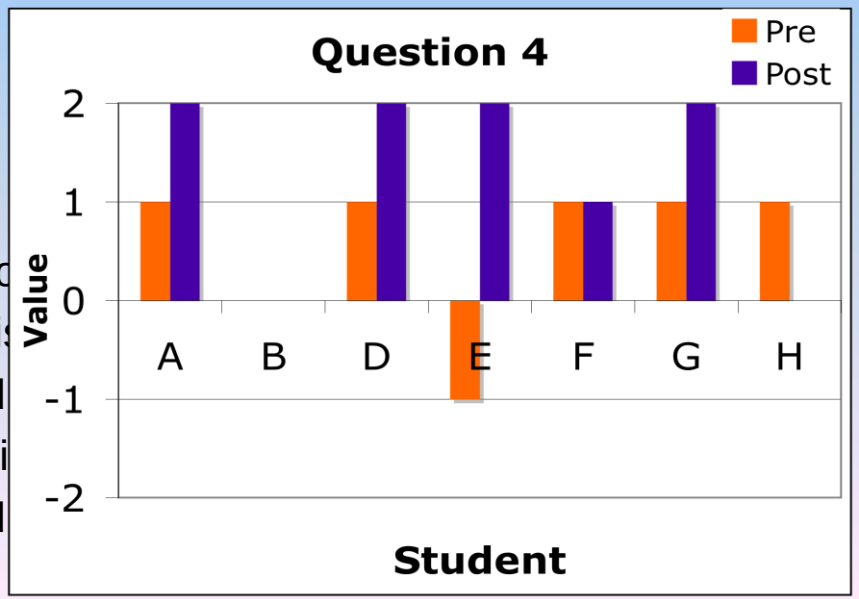
Results for Survey



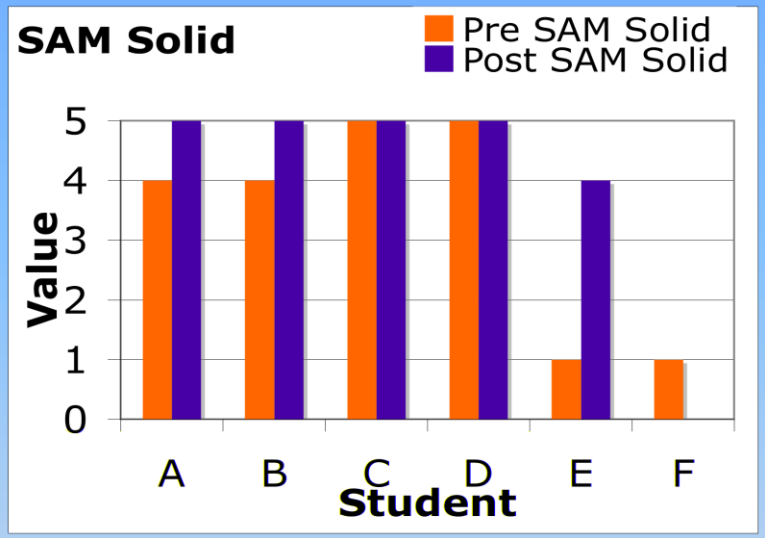


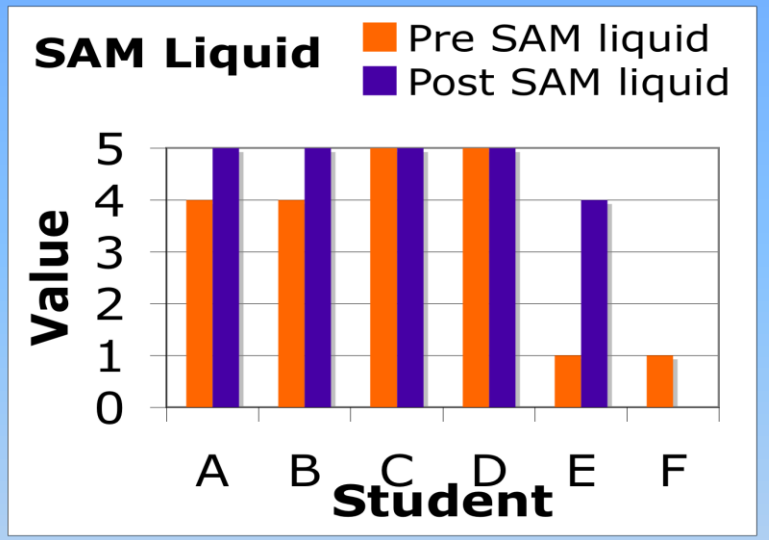


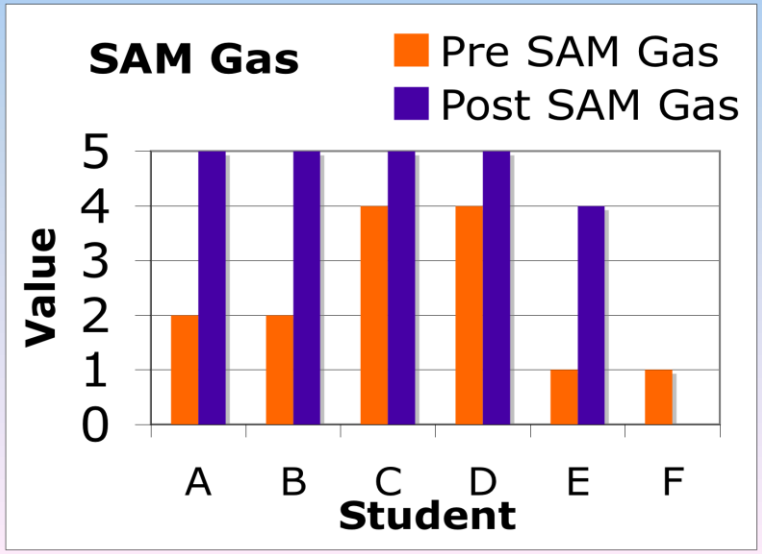
1. I like do
2. There is
3. I would
   by doi
4. I would



SAM Evaluation
Solid, Liquid, Gas

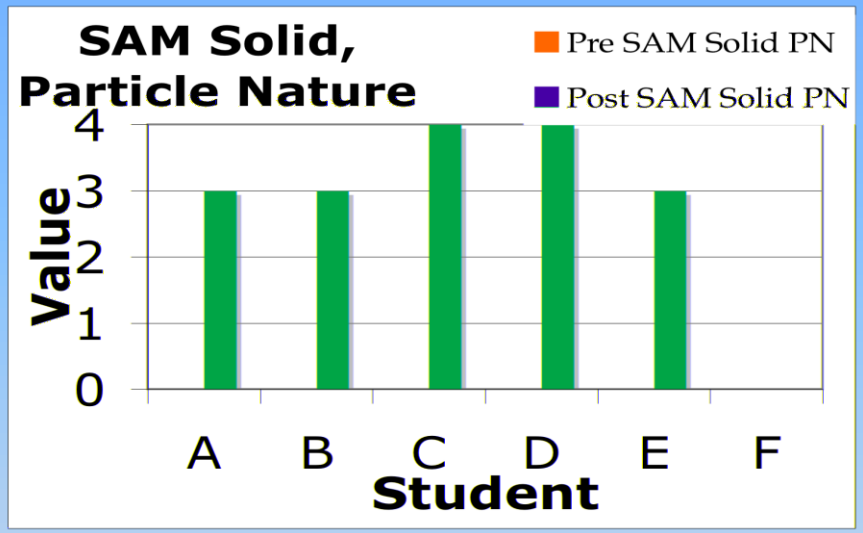


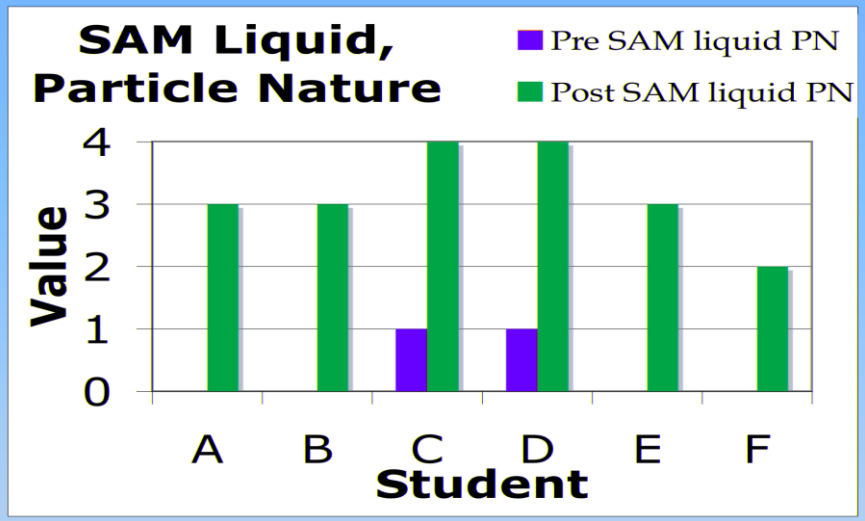




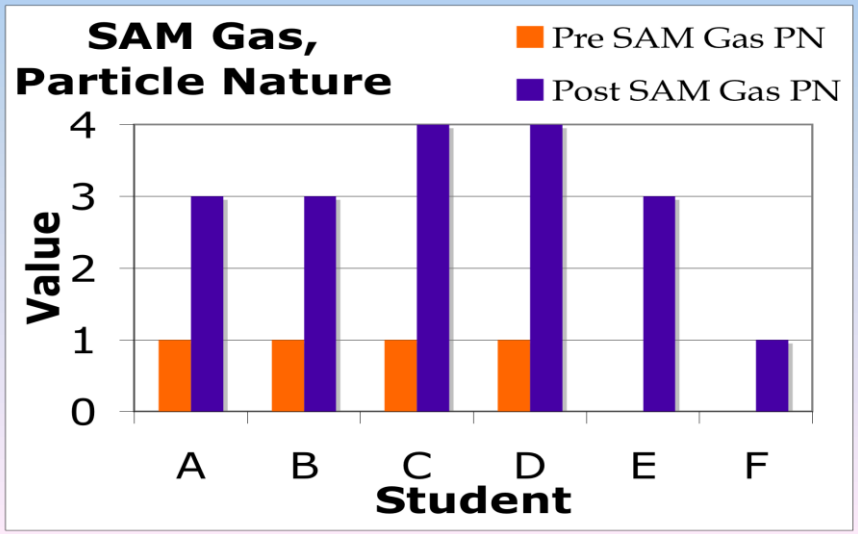
0 Don't know the difference between S/L/G
1 Identifies most S/L/G (80%)
2 Identifies all S/L/G
3 Can articulate how they know (80%)
4 Can articulate how they know (100%)
5 Able to defend how they identified

SAM Evaluation Particle Nature





Movies



0 No evidence of particle nature
1 Some evidence, not definitive
2 Evidence of particle nature, not clear on interaction/density
3 Clear on density, maybe not interaction
4 Clear in interaction

Conclusions

- **Observations**
  - **Measuring gains in student performance is difficult**
  - **Engaging middle school students is difficult**
- **Research Results**

  Survey:
  - **Q1: (liking science) effectively no change**
  - **Q2/3: (nature of science) effectively no change**
  - **Q4: (career choice) 4/7 increased, 6/7 increased or same**

  Solid, Liquid Gas: SAM
  - **4/6 could initially identify a solid and liquid, 1 learned how**
  - **2/6 could initially identify a gas, 3 learned how**

  Particle Nature: SAM
  - **Solid: Pre: Almost no one, Post: 5/6 learned how**
  - **Liquid: Pre: Almost no one, Post: 6/6 learned how**
  - **Gas: Pre: Almost no one, Post: 6/6 improved**

Acknowledgments:

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