The work of the Science Learning Activation Lab was borne out of a quest for a coherent, research-based approach to considering how best support science learning opportunities across settings. The following questions motivated this work:

- How can we effectively and efficiently support children in grades K-5 to learn science in ways that develop and retain their ability to engage in critical inquiry?
- What intervention outcomes tend to have a persistent impact over time and across settings?
- What types of learning opportunities are effective? Efficient? For whom? Under what conditions? In what combination & sequence?
- What is the role of setting in supporting/constraining learning opportunities?
- What trajectories of opportunities best support learning?

In collaboration with many across the field, we sought a coherent conceptual framework to organize the investigation and design of science learning experiences. We developed the concept of Science Learning Activation and a central question to guide all of our work:

**How can we activate children’s interest and curious minds in ways that ignite persistent engagement in science learning and inquiry?**

### Theoretical Background and ALES11 Study Methods

#### The Science Learning Activation Lab

**The Lawrence Hall of Science, University of California, Berkeley**

**SRI International**

#### Our Approach

**Ways of refining activation**

- **Factors:**
  - Exposure
  - Duration
  - Time
  - Strengths
  - Interactions

**Methodology:**

- Historical / prospective
- Retrospective interviews
- Years
- Complete
- Partially complete
- Forgetting, confabulation

**Characteristics:**

- Months
- Validity
- Partially complete
- Incomplete

#### 2010-2012 Research Activities

**STEM Pathways**

- Literature Review
- Defining and scales
- Secondary data analysis
- Identifying potential early indicators
- Relation general scientific literacy to STEM and state
- Life history interviews with STEM professionals

**Measuring Activation**

- Literature review
- Stability of activation over 6 months
- Measures validation
- Change in activation over environments
- Topic effects
- Activation in children’s lives

**Success in Learning Experiences**

- Literature review
- Inventory for learning environments
- Profile of learner-centered documentation
- Study of relationship between environment & experience
- Case studies of experiences across children’s lives

### Activation Lab 2011 Enables Science (ALES11) Study Design

#### ALES11 High Level Findings

<table>
<thead>
<tr>
<th>Construction</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Background</td>
<td>Self-report of gender, ethnicity, home resources, prior science experiences</td>
</tr>
<tr>
<td>Values</td>
<td>Self-report survey (7 items)</td>
</tr>
<tr>
<td>Fascination</td>
<td>Self-report survey (1 item)</td>
</tr>
<tr>
<td>Maintains Focus</td>
<td>Self-report survey (9 items)</td>
</tr>
<tr>
<td>Scientific Sensemaking</td>
<td>Self-report survey (2 items)</td>
</tr>
<tr>
<td>Engagement</td>
<td>Self-report survey (4 items) &amp; observation</td>
</tr>
<tr>
<td>Choice</td>
<td>Self-report survey (4 items) &amp; gift choice</td>
</tr>
<tr>
<td>Learning</td>
<td>Multiple choice test (pre, 2 intermediate quizzes, post)</td>
</tr>
</tbody>
</table>

#### The Activation Lab Framework

- **Learning experiences**
  - Values
  - Fascination
  - Maintains Focus
  - Scientific Sensemaking

#### Standardized multiple regression:

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Time 1</th>
<th>Time 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Values</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Fascination</td>
<td>0.00</td>
<td>0.00</td>
</tr>
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</tr>
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<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

#### Choice Preference

| Values | 0.00 |
| 45%    |      |
| 48%    | 68%  |
| 0.07   | 0.23 |
| -0.03  |      |

#### Current analytic focus

- Measure reliability
- Dimension stability
- Predicting proximal success
- Activation profiles analyses

#### Next analytic focus

- Longer term stability
- Other aggregates/profiles
- For whom quantitative analyses
- Experiences predicting activation change

#### Dimension Stability

- Location 2 only
- 1 month lag
- Pre-post visit dolphin-mouse

#### Activation Profiles

<table>
<thead>
<tr>
<th>Time</th>
<th>Values</th>
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<tr>
<td>Time 1</td>
<td>0.00</td>
<td>0.00</td>
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<td>0.00</td>
</tr>
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<td>Time 2</td>
<td>0.00</td>
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#### Engage Learning Lab 2011 Enables Science (ALES11) Study Design

<table>
<thead>
<tr>
<th>Geographic area</th>
<th>Location 1</th>
<th>Location 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grades</td>
<td>6th grade</td>
<td>5th grade</td>
</tr>
<tr>
<td>Time 1 – Time 2 duration</td>
<td>5 months</td>
<td>1 month</td>
</tr>
<tr>
<td>Observation context</td>
<td>Hands-on curriculum science classes</td>
<td>Science Center field trip</td>
</tr>
<tr>
<td># of observations</td>
<td>2 blocks of 3 consecutive days</td>
<td>2 exhibits (Dinosaur + Engineering)</td>
</tr>
<tr>
<td>N</td>
<td>10 schools = 692 consented kids</td>
<td>4 schools/programs = 235 consented kids</td>
</tr>
</tbody>
</table>

#### ALES11 High Level Findings

- 0.5% of 0.5% of 0.5% of 0.5%
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