

# Learning to Argue about Science: Understanding the Influence of Family, Friends & Instruction

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However, all opinions are strictly our own.

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## everyday science & technology group [everydaycognition.org](http://everydaycognition.org)

### *Members*

- Philip Bell
- Leah Bricker
- Tiffany Lee
- Maisy McGaughey
- Suzanne Reeve
- Heather Toomey Zimmerman

### *Upcoming Presentations*

- NARST Session 8G: families learning in a science museum (today, 2:30, Zimmerman)
- AERA
  - Session 34.025: The LIFE Center (Tues)
  - Session 58.052: Teens & instant messaging (Thurs, Zimmerman)
- EARLI: Historical argumentation (August; Bell)
- ISCAR: Argumentation in everyday contexts (September; Bell, Bricker, Zimmerman)

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**LIFE: Learning in Informal & Formal Environments**

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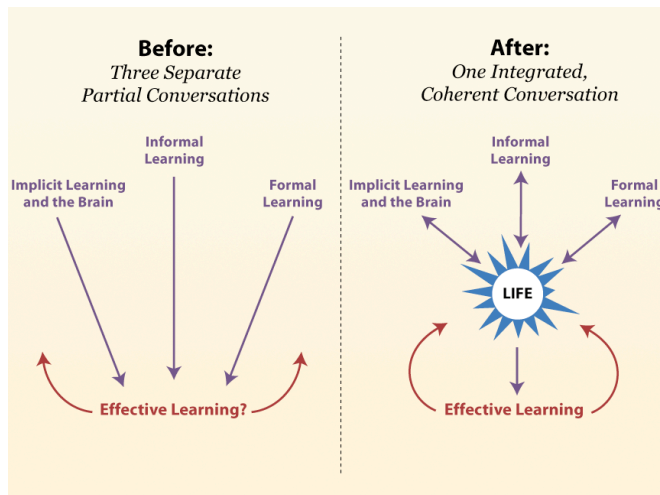


## LIFE Leadership



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**LIFE's Purpose:** To transform the sciences of learning by identifying & investigating key research questions that draw on neurobiological, cognitive, developmental and socio-cultural theories & their related methodologies to collectively guide the design of effective learning environments.



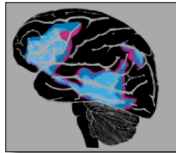
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# Strand 1: Implicit Learning and Brain (including arousal, affect)

Neuroscience

Developmental Studies



fMRI



MEG



ERP



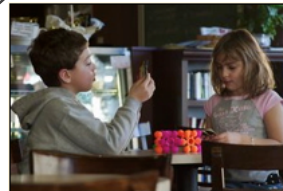
Skin and heart measures



# Strand 2: Informal Learning

Learning in K-12 schools.... only 21% of awake time annually.

What is learned in the other 79% of the time? (with peers, family, community)



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# Strand 3: Designs for Formal Learning and Beyond

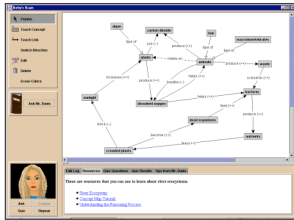
## Tools



## Scaffolded Inquiry



## Teachable Agents



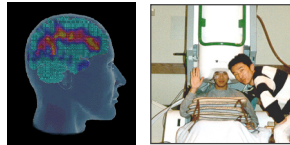
## New learning goals & assessments



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# Each strand has its own language, theory, and methods—need sustained conversation

**Implicit:** social cognition, neural commitment, imitation, early learning, representation



**Informal:** context, distributed participation, interaction, appropriation of tools, culture, improvisation



**Formal:** transfer, preparation for future learning, adaptability, efficiency, design of tools



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## LIFE's interactions

From spontaneous and chaotic to formal and coordinated

increasing formality

- 1. Conceptual Collisions**
  - Discover differences across strands
  - Informal and spontaneous
  - Regular meetings and videoconferences
- 2. Hot Topics**
  - Crystallize emerging issues
  - Formally defined annually
  - Annual Workshop
  - Annual Report
- 3. Signature Projects**
  - Coordinated joint projects
  - Conduct research on issues across strands
  - Highlight contrasting perspectives

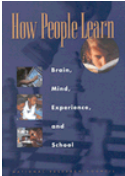
Year 1 Hot Topic is Interactivity & Learning (workshop)

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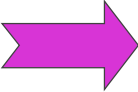



And since today's science of learning concurs that school builds on the constructed knowledge base of *prior experience*...

**How does informal learning (implicit & explicit) affect learning in school?**






?





**How does school affect informal learning?**



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## Theory origins

- ✓ *Socio-cultural theories of thinking and learning* (Mead, Vygotsky, Leon'tiev, Rogoff, Cole, Engeström, Wertsch, Saxe, Nasir, Herrenkohl)
- ✓ *Cognitive anthropology* (Hutchins, D'Andrade, Lave, Scribner, Goodwin, Hunn)
- ✓ *Situated learning theory* (Greeno, Lave-Wenger, Suchman, JS Brown, Stevens)
- ✓ *Distributed cognition, intelligence and expertise* (Hutchins, A.Brown, Pea, Bell)
- ✓ *Social and collaborative approaches to learning* (Barron, Resnick, Miyaki)

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## Range of empirical studies

- ✓ *Aim:* Develop coordinated empirical accounts of social, cognitive, affective, cultural and environmental conditions and processes associated with STEM-related learning in diverse informal cultural contexts. Examine comparative issues of gender, SES, race and ethnicity—seriously under-examined yet both theoretically and practically significant.
- ✓ *K-12*
- ✓ *Adults:* What are the mismatches between what is learned in school (and informally) and what is needed in work life? Comparative studies of: (1) College STEM content/learning processes, (2) Workplace needs for STEM learning content/process.



## ESTG: Toward a comprehensive understanding of science learning in and out of school

### *Existing frameworks*

- Cultural-historical activity theory (Cole; Wenger)
- Repertoires of practice (Gutiérrez & Rogoff)
- Social semiotics (Lemke)
- Identity and agency in cultural worlds (Holland et al.)
- Conceptual ecology (diSessa)
- Islands of expertise (Crowley & Jacobs)
- Theory theory view (Brewer; Gopnik; Meltzoff)

Need to explore the usefulness of specific theoretical lenses in understanding ethnographic accounts of everyday activities.

## everyday science & technology group research themes & studies

### *Research Themes*

- 1) Folk Biology
- 2) Everyday Technology
- 3) Images of Science & Epistemology
- 4) Everyday Argumentation

### *Studies*

- Targeted Studies in Everyday Settings
- Lab & World interplay studies
- Multi-year family ethnography
  - Shadow 5th graders at school, home, elsewhere; 3 communities
  - Design experimentation



## Research Theme: Folk Biology

How do children piece together an understanding of *the living world* across activity contexts—especially about personally consequential topics like personal health and the local environment?

- document the everyday functioning of families and communities on these issues
- understand the conceptual ecologies children bring to school & attempt to trace genesis to particular experiences



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## Research Theme: Everyday Technology

What kinds of *technology* do children have access to across the range of their life activities? How do they learn with and about these technologies?

- document social learning practices / social networks in action
- study reciprocal influence of family practices and child technological practices
- understand issues of access, equity, and implications for social futures



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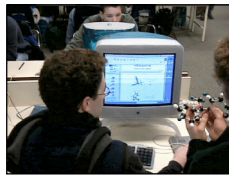
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## Research Theme: Images of Science & Epistemology

What *images of science* do children encounter across activity contexts and how do these influence their understanding of what ‘counts’ as science when? (cf. McDermott & Webber, 1998)

*Characterizing children’s epistemologies:*

- unitary or manifold resources?
- context-bound or general?
- disciplinary-specific or domain general?



What do Scientists DO?

- Mix potions in test tubes.
- Discover new things.
- They estimate, or guess things.
- They see how animals live.
- They look at things with magnifying glasses.
- They look at bugs outside and use traps.
- They teach KIDS!
- They do experiments.
- They explore the ocean.
- They study things.
- They write down what they see.
- They draw what they see.

List generated by kindergartners

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## Research Theme: Everyday Argumentation

What forms of *argument* do children encounter in different everyday settings?  
What competencies do they develop?

- How are such competencies mediated by cultural affiliation, class and/or gender?
- Can everyday argumentation competencies be tapped for educational purposes?



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