

Ontology in the flesh: Embodied learning activities for conceptual understanding of energy

Sarah B. McKagan, Rachel E. Scherr,
Eleanor W. Close, and Hunter G. Close

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Seattle Pacific University

Physics Education Research Group



Faculty Members:

Hunter Close
Eleanor Close
Lane Seeley
Stamatis Vokos

Master Teacher:

Lezlie DeWater

Researchers:

Rachel Scherr
Sam McKagan

Project Coordinator:

Julie Glavic

High School Intern:

Emma Kahle

Claim

Embodied learning activities (ELAs) can uniquely promote scientific reasoning.

Using the body symbolically to engage a scientific problem

Example: “Energy Theater”

Context: Summer professional development workshops for secondary and elementary teachers at SPU

Challenge: Show what's going on with the energy

Scenario: **Box pushed across floor at constant speed.**



- Energy flows from hand to box, box to air/floor.
- Constant amount of kinetic energy in the box.
- Constantly decreasing chemical energy in hand.
- Increasing thermal energy in box, air, and floor.

“Energy Theater”

- You are a chunk of energy.



“Energy Theater”

- You are a chunk of energy.
- **Objects in scenario correspond to areas on floor.**



“Energy Theater”

- You are a chunk of energy.
- Objects in scenario correspond to areas on the floor.
- **You indicate your form in some way.**

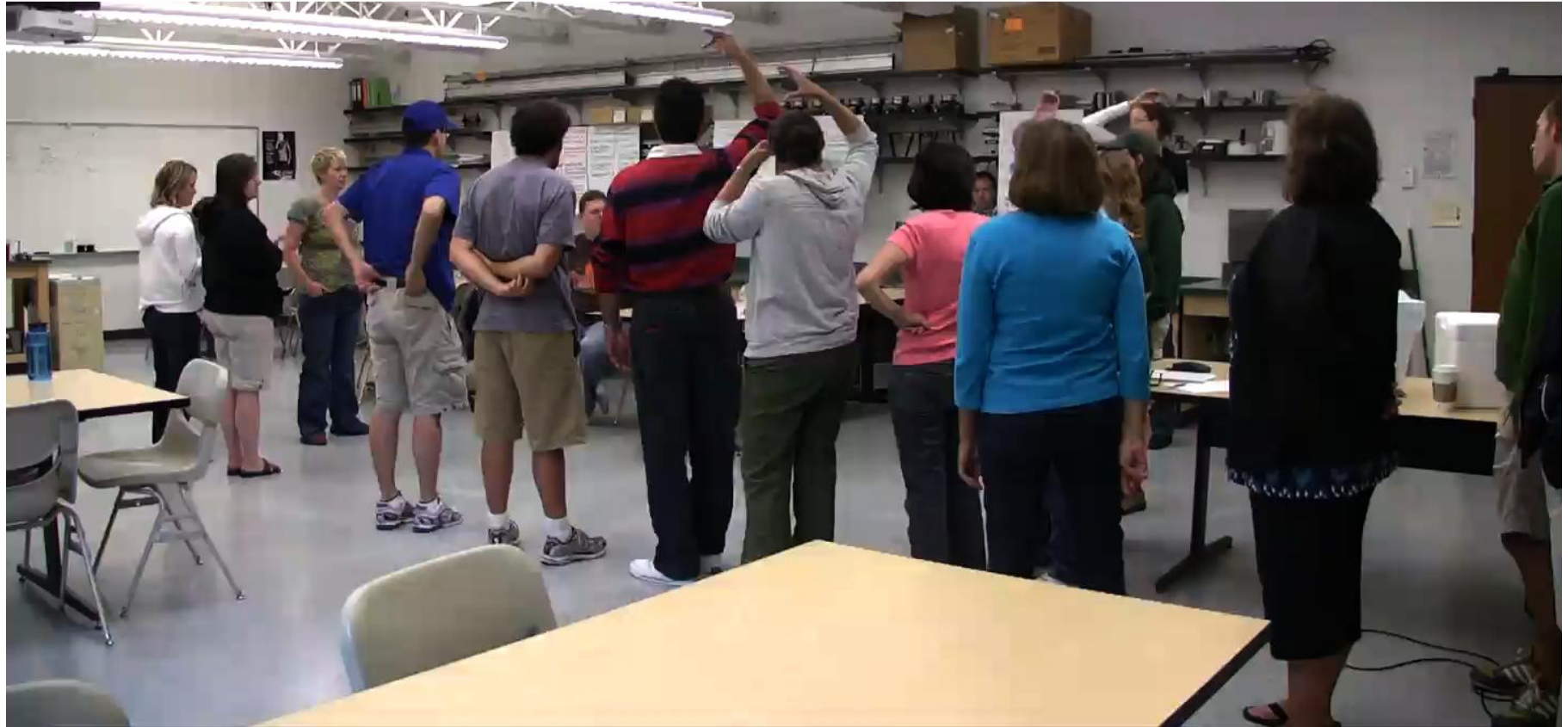


“Energy Theater”



- You are a chunk of energy.
- Objects in scenario correspond to areas on the floor.
- You indicate your form in some way.
- **As energy is transferred among objects, you move to different locations on the floor.**



“Energy Theater”



Two Models of Energy

Energy as:	Afforded by using the body to represent:	Supports thinking about:	
“Activation”	an object that “has energy” OR a “type” of energy	what kind of thing energy is (qualitative)	
“Substance”	a chunk of energy	conservation, movement, transformation (quantitative)	

Conceptual Advantages (Affordances) of Energy Theater

- **Energy is conserved**
(people don't appear or disappear)
- **Energy is a thing located in an object** (bodies are things; they place themselves on object-locations)
- **Energy flows among objects**
(they move from one object-area to another)
- **Energy can accumulate in objects**
(they crowd into object-areas)
- **Energy has one form at a time**
(if they use only one sign at once)
- **Energy can change form** (people change signs)

Theoretical perspective

- I. We understand our world in terms of bodily experiences. (*Lakoff & Johnson*)
- II. Mentally taking on the role of an entity is valuable for figuring things out. (*Ochs*)
- III. Every representation is limited, yet we tend to treat representations as if they were the things they represent. (*Lakoff & Johnson*)

Deliberate embodiment is a promising approach for conceptual learning in physics.

Different kinds of “Kinesthetic Activities”

1. “Embodied Learning Activity”

Bodies represent abstract entities

Conceptual understanding informs movement

Structure supports learning specific concepts



2. “Feeling the Physics”

Using a physical sensation to help internalize intuition about a science concept



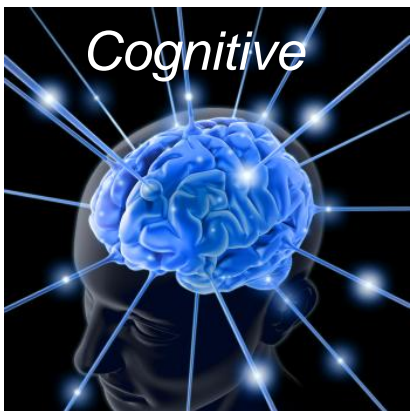
3. “Wiggling”

Getting blood flowing to brain by moving body

Movement not directly related to target concept



Embodied learning activities: *a unique combination of benefits*



- ✦ Sensory-motor feedback loop
- ✦ Perspective-taking
- ✦ Embodied metaphors



- ✦ Life-size for big group involvement
- ✦ Forced participation
- ✦ Forced consensus
- ✦ Prompts for indiv decision-making
- ✦ Public construction of symbols



- ✦ Body is a free multimedia technology
- ✦ Naturally dynamic
- ✦ Flexible suite of tools