Full Contact Learning

Employing the body as a learning tool

Mary Bridget Kustusch and Susan Fischer

DePaul University

Teaching and Learning Conference

2 May 2014

DePaul University

Embodied Cognition

"In an embodied cognition perspective, all abstractions are understood in terms of basic sensory-motor experiences such as object permanence and movement" (Scherr et al, 2012a)

Our thought is grounded in our sensory experience

- Time metaphors
- Representational gestures
- Perspective-taking

Our thought is grounded in our sensory experience

3.1 (00:38:18;00)	3.2 (00:38:19;30)	3.3 (00:38:29;10)
		
B:{<u>but when you **bind thrombomo::dulin** to the back side of thrombin</u>}	<u>{suddenly that Protein C **Inhibitor is in there (0.5) a:** *THOUSAND}* *FOLD FASTER* (0.5)</u>	**{So there's a lo:tta evidence sugesting} {that so:mething like *this* is going on. (2.0)}**

(Becvar et al, 2008)

We use our bodies to think

"The common thread across these accounts is that gestures are not simply an external manifestation of what is on the gesturer's mind. Instead, the act of gesturing influences the representations and processes that take place in the gesturer's mind." (Alibali, 2005)

Using our bodies to **learn**

"Theories of embodied cognition and cognitive linguistics suggest to us that among all possible objects, a particularly cognitively compelling sense of permanence might be attached to the self, and that use of the human body might have special significance for learning." (Scherr et al, 2012b)

We should allow students to use their bodies to learn

- Kinesthetic activity
- Embodied representation
- Physical mnemonics
- Embodied interaction
- **Embodied Learning Activity (ELA)**

Any activity where the body is used as a tool for learning!

Reasons to use ELAs

Allow students to...

- ... make sense of counter-intuitive scenarios
- ... ground abstract ideas in the concrete world
- ... create their own ideas
- ... develop shared language and community

Motivating the activity

linear momentum = (mass)*(velocity)

$p = mv$

espn.go.com/nhl/tesm/photos

For rotational motion:

angular momentum = (moment of inertia)*(angular velocity)

$L = I\omega$

What is the
moment of inertia
of an object?

Rulers + Binder clips!

What did we learn?

It is harder to "flip" the ruler the further the binder clip is from the pivot point.

"Harder" means a larger moment of inertia.

→ The moment of inertia of an object depends on how the mass of the object is distributed

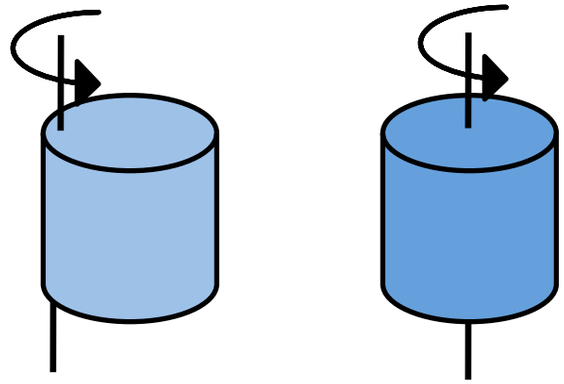
If you change the location of the pivot point, you affect the difficulty in "flipping" the ruler.

→ The moment of inertia of an object depends on where the pivot point (or axis of rotation) is.

What did we learn?

The two identical solid cylinders shown below are spinning about different axes.

Which configuration has the larger Moment of Inertia?



How does this apply?

How does this apply to angular momentum and ice skaters?

Compare what is happening

when the skater first starts spinning, and

when the skater is about to finish the spin.

What changes?

What can we learn about angular momentum?

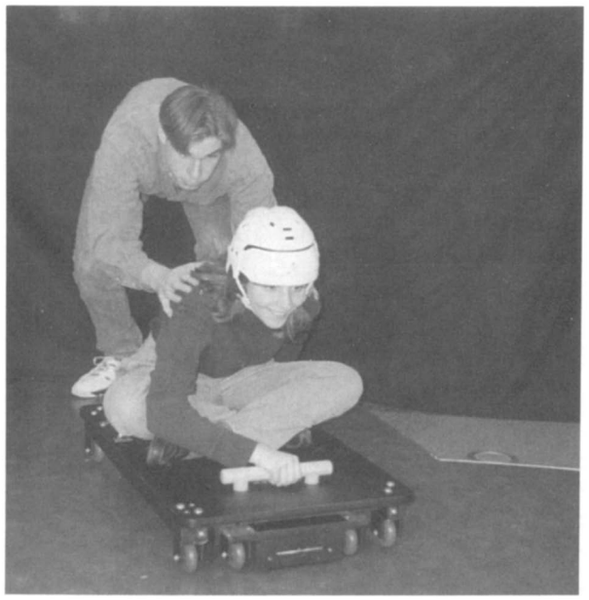
(angular momentum) = (moment of inertia) * (angular velocity)

Activity 2:

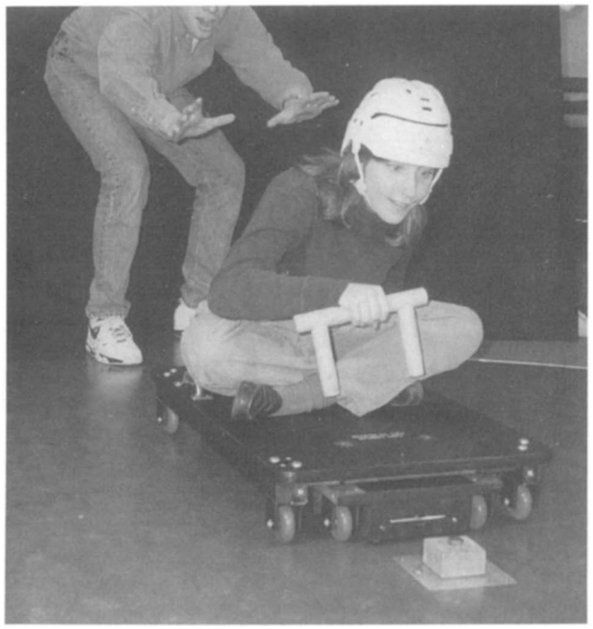
Some ELAs use the body...

... as a sensor

Feeling 1-dimensional motion



Rider is given a constant velocity; upper and lower cart are coupled.



Rider removes coupler on approach to block mounted to floor.

Using a bicycle wheel to feel changes in angular momentum

... to change perspective

Creating non-linear charge density

"building" DNA

Figure 1. High school students building DNA.

Energy Theater

... to explore relationships

Flow of charges in a uniform current density

Sky Time: relationship between time and astronomical motion

Participants try out the Sky Time Experiment at a recent American Astronomical Society meeting.

Energy transfers & transformations for a hand pushing a box across a floor at constant speed.

The life cycle of a star

... to represent abstract ideas

Transverse Waves

A variation of the "wave game" is demonstrated in the author's classroom.

Time evolution of a complex 2-state system

Acting out the meter of a poem

Creating an ELA

I want an ELA that explores...

- ... interactions or transformations
- ... complex or dynamic systems
- ... changes in orientation or perspective
- ... quantities with properties that vary in space
- ... something too abstract for an ELA

Questions to consider:

- What are your goals for the activity?
- What do you want your students to learn?
- How much do you want the students to direct the exploration?
- How much time will it take?
- Can you get all students involved?
- How can you make it safe to participate?