

The Necessity of Stimulating An Emotional Response in Logical Engineering Lectures

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Type of Strategy: in-class active learning

Learning Outcomes

- [1] To facilitate critical thinking through a focused active learning exercise
- [2] To engender an emotional response (positive or negative) to a logical lesson

Overview

Relatively simple, hands-on demonstrations impact the learning of students in the classroom that typically passively absorb information (not very successfully in many cases). The demonstrations are even more effective if one makes a statement of fact in a way that grabs a student's attention or sounds outrageously wrong to most of the class. (ie – it 'dings' their intuition)

Step-by-Step Instructions

In introducing a fundamental concept, find a fact that is not intuitively obvious, or better yet one that goes against intuition. Google is an excellent resource for this.

Examples that I have used in class:

- **“There is no such thing as a toxic chemical”**
- **“There is no such thing as bad radiation”**
- **“The human body is not directly temperature sensitive”**

The claims sounds outrageous and wrong. Everyone KNOWS that there are toxic chemicals out there in our food! (after all, I see posts on Facebook DAILY that this is so!)

Everyone KNOWS that you can die from radiation exposure! (and I don't even need Facebook to tell me that!)

Everyone KNOWS that you can tell when it is hot or cold!, the reasoning will go.

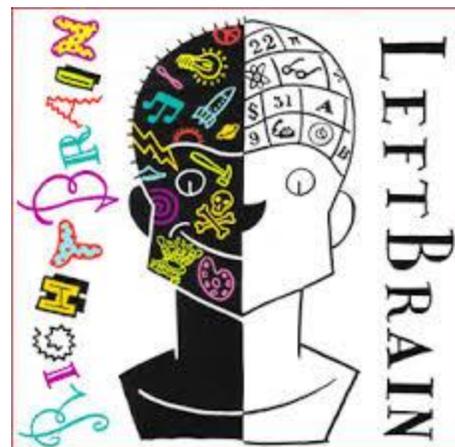


But then all of these **true, scientific facts** are followed with the claim that you will **prove** it. Some can only be done with discussion (toxic chemicals, radiation¹). But for others, this is where a demonstration comes in handy (if pressed for time, one small demo and a properly structured discussion of the other possible events can have a similar effect).

- Demo #1: Bring a piece of ceramic tile and a piece of rigid insulation to class (can be found free on Craigslist or costs very little at hardware stores). Have students either put each hand on one material and ask which is warmer (they are both at the same temperature but the tile feels colder). Draw on their experience getting up in the morning on a carpeted floor, and then walking into their tiled bathroom.
- Demo #2: Bring a small fan, ideally battery powered but a plug in works even better. Turn it on after you ask a student to sit in front of it. Have the student indicate how much colder the air feels as the fan is adjusted to higher speeds (the temperature of the air never changes and such can be shown by direct measurement). Draw on their experience with wind chill factors in winter weather.
- Demo #3: Bring a small tub of water in the class. Ask a student to put their finger or hand in it and relate how much colder it feels (the temperature of the water is the same as the air). Draw on their experience entering a swimming pool or lake on a warm, summer day.

The above demonstrations, either individually or together, are a powerful tool to get fundamental concepts involved. In this case, to introduce the sensitivity of the human body to how fast heat is leaving rather than directly on temperature (heat transfer, bioengineering), as well as the concept of convection heat transfer (heat transfer from a surface to a gas or liquid)

The key nugget for what this is all about: **To engender a strong, negative emotion** in what would typically be a dry, engineering lecture. This forces the right brain to participate in what is typically a left-brained activity



¹ I am pretty sure that our Risk Management Department would not take too kindly to my bringing in mercury, lead paint chips, or x-ray emitters into my classroom, but I have been too afraid to ask them directly.

(logic). (and yes, weaponizing facebook memes in the fight for student attention is a good way to do it!)

Course Information

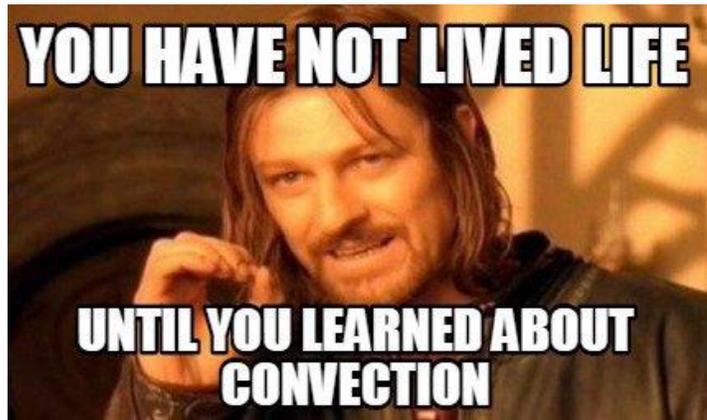
EGR 2500: Introduction to Thermal Engineering. (but the strategy can be employed in any course that touches on these topics)

An introductory course on energy, the conversion of one form of energy to another, and the transport of energy from one place to another. Concepts of heat transfer (conduction, convection, thermal radiation) are also covered.

Ease of Application to Other

Courses [

EASY MODERATE depending on the subject matter and extent of demonstration



Additional Comments

After doing these demonstrations over many years, I have had students years beyond their graduation reminisce about how they remember some of the demonstrations we did in class, and how the key nugget of those lessons stuck with them long-term.

Caution: these should be short, low-cost but high-concept. If K-12 schoolchildren can learn something from these demos, then they are great for the college classroom.

Resources Google, bouncing ideas around with colleagues. The strategy works, can be combined with storytelling and other learning strategies, and should not take much time away from a normal lecture. Much time, however, is spent on finding counterintuitive facts, and it also takes time in learning how best to seed these in the classroom (when, context, etc)