Design of Multi-domain Demonstrations

CTL Catalysts: A Conversation Series on Teaching

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Think, Pair, Share:

1. What is a demonstration?

2. Why should one perform a demonstration?

3. What makes a demonstration effective?

What I am all about...

“Room with A VUE”

I strive to create a “classroom” with:

- Accessibility
- Visualization
- Unexpectedness
- Engagement
Today’s Intended Outcomes

1. Be exposed to and be able to define the term 'multi-domain demos'

2. Be exposed to the design process of multi-domain demos (taking a concept to an emotional and thought provoking experience)

3. Gain experience breaking down demos into their learning domain-based components

4. Gain experience aligning demos with Bloom's taxonomy

5. Practice Socratic questioning

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demonstration

/ˌdemənˈstrɑːʃən/

noun

the action or process of showing the existence or truth of something by giving proof or evidence.

“it is not capable of mathematical demonstration”

the outward showing of feeling.

“physical demonstrations of affection”

a practical exhibition and explanation of how something works or is performed.

“a cooking demonstration”
**My definition:**

A demonstration is… a safe learning opportunity delivered by an instructor to:
- enchant, engage, inspire, and
- ignite intellectual curiosity to allow for deep and effective learning of…
- difficult concepts through learner-based discovery.

**OR... a sneaky way to institute Socratic Questioning!**

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**Do’s and Don’ts of Effective Demonstrations**

1. Practice safety
2. Prepare ahead
3. Practice
4. Make it visible
5. Present to the audience
6. Involve the audience
7. Encourage responses
8. Keep it simple
9. Practice showmanship
10. Explain the concept
11. Repeat the demonstration
12. Summarize

*Effective demonstrations... implies REASON, DESIGN, ASSESSMENT*

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Guiding Questions:

For what reason and for whom are we designing?

How do we design?

How do we know if our design was successful?

The Design Process

I want to help you get through here...

So your learners can be here...
THE FIVE PHASES OF DESIGN

EXAMINE
Dig into the problem. Look at the history, the context, the objects, and (most importantly) the people involved.

UNDERSTAND
Go deeper and find patterns. Establish open questions to build on.

IDEATE
Have lots of ideas, good and bad. Don’t stop at the obvious or the impossible.

EXPERIMENT
Try some things out. Make some things. Fail cheap and fast.

DISTILL
Strip your solution down to the essentials and tell the story to others.

Learning Domains

BLOOM’S TAXONOMY

HEAD + HEART + HANDS
Learning Domains

COGNITIVE DOMAIN

- Creating
- Evaluating
- Analyzing
- Applying
- Understanding
- Remembering

Increasing Difficulty

COGNITIVE AFFECTIVE PSYCHOMOTOR
HEAD HEART HANDS
AFFECTIVE DOMAIN

- Internalizing
- Organizing
- Valuing
- Responding
- Receiving

Increasing Difficulty

PSYCHOMOTOR DOMAIN

- Automate
- Articulate
- Develop Precision
- Manipulate
- Imitate

Increasing Difficulty
Concepts

- Multi-domain demonstrations involve the whole brain:
  - **Reasoning and understanding** – all demos should live here
    - demos requiring reflection and critical thought in the *cognitive* domain
  - **Emotion** – demos with elements of surprise trigger the *affective* domain (memories are strong)
  - **Doing** – involvement of learners aids *psychomotor* domain
Concepts

• Engagement can be improved through **visualization** and **internalization** (accessible)

• Difficult concepts can be addressed and **broken down**

• **Memory cues** can be solidified

• Formative assessment can be very efficient

Example

• **Concept:** Thermal transitions in polymeric materials

  As usual, there are really a whole bunch of concepts which plug into the main concept!
  E.g., bonding theory, polymer structure, heat transfer, thermal conductivity, mechanical properties, viscoelasticity, strain rate effects...

• **Outcomes:** Students will be able to:

• **Highest target cognitive level:** Evaluation

• **Target learning domains:** cognitive and affective, psychomotor
Evolution of a demo

• Imagine a scenario
• The Glassy or Rubbery Game
• Aviator Ducky
• Silly Putty Hammer
• Silly Putty Axe

Example: Aviator Ducky

The best & worst demo I have ever done...once.
My observations about demos

• I have done demos:
  • At the beginning of a class
  • At the end of a class
  • In the middle of a class
  • At the start of a unit
  • At the end of a unit
  • In the middle of a unit
  • More than once in a course

• There is no **perfect** time, but there are better times...

• Demonstrations turned into hands on activities are especially effective (example: What’s in the Box?)

Hands-on Labs!
Selection (Think, pair, share)

- Think of a tough concept in one of your courses
  - What is tough?
    - If you don’t know what the problem is your demo will fail
  - Why is it tough?
  - How do you plan to use the concept throughout the course?
    - Is it central?
    - Is it widespread?
    - Is it key to other concepts?
Selection (my experience)

• Spend time to understand **why** the concept is tough

• Often there are multiple important concepts, or details, hidden within the explanation that instructors take for granted, or miss in explanation
  • Identify all the concepts needed for the knowledge you are expecting to be built
    • i.e., which level of higher order thinking (Bloom level) are you targeting?

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DEMOS

• Feats of Strength!
It is not about you...

• Demos are **for** learners, not a showcase of you
  • **But** some theatricality is critical for accessing the affective domain

• Try not to tell learners what they should see, but...
  • It is important to explain what you are doing to develop context
  • Ask what was observed...

It is not about you...but...

• Ask learners what they see, but...
  • don’t template their experience too much by giving things away
  • have a **discussion** about the demonstration – involve the learners
    • Try the Socratic method of question

• When the discussion is closing **summarize** the concepts, learning objectives, and what the students should **know** how to do to meet said objectives!
Socratic Questioning* Refresher

Formative assessment technique: reversed roles/classroom
Goal: discovering student thought process(es) and understanding
Twist: students realize where their understanding breaks down

A. Monitor – students teach the concept until they are stuck
B. Say-back – confirm what was said so students can correct themselves
C. Verify understanding – acknowledge understanding in positive manner
D. Application of knowledge – ask for application to similar situations
E. Model incorrect answers – students are asked to make corrections
F. Strengthen with further examples – prompt for more examples (positive or negative forms)

Questioning is inerably linked to outcomes and Bloom levels!!! WHAT? HOW? WHY?


Practice Exercise

Outcome: gain experience facilitating discussion with open ended questions, and know what such discussions feel like for learners

• Get into groups:
  • “instructor” is person with the closest birthday to today
  • “teaching assistant” is the person with the longest commute to work
  • Remainder are “students”
• Watch the video
• The instructor and TA engage the students in discussion about the video
  • Use Socratic style questioning to facilitate the discussion
  • You don’t actually need to know any extra subject matter here...
    • Try to determine:
      1. WHAT students see and can explain (does everyone agree?)
      2. HOW they think it is happening (what are the concepts?)
      3. WHY they think it is happening (evidence, assumptions, limitations)
Suggestions for Socratic Questions*: WHAT? HOW? WHY?

1. Clarification:
   - What do you mean by ____?
   - Could you explain that further?
   - So, what are you saying is _____. Did I interpret you correctly?
   - Jane, can you summarize in your own words what Richard has said?

2. Questions about the Initial Question or Issue:
   - Can we break this question down at all? How?
   - Is this question easy or hard to understand? Why?
   - Do we all agree that this is the question?
   - Does this question ask us to evaluate something?

3. Assumption Probes:
   - What are you assuming? Do we all agree that such an assumption is correct?
   - You seem to be assuming _____. Do I understand you correctly?
   - What could we assume instead?
   - Is it always the case? Why do you think the assumption holds here?

4. Reason and Evidence Probes:
   - How do you know?
   - What would be an example?
   - Do you see any difficulties with their reasoning here?
   - But is there good evidence to believe that?

5. Origin or Source Questions:
   - Where did you get this idea?
   - What caused you to feel this way?
   - Have you been influenced by any outside sources?

6. Implication and Consequence Probes:
   - Would that necessarily, or probably happen?
   - What are you implying by that?
   - What effect would that have?

7. Viewpoint Questions:
   - You seem to approach the issue from _____. What perspective?
   - Why have you chosen this rather than that perspective?
   - Can/does anyone see this another way?
   - What would someone who disagrees say?
   - What is an alternative?

**Practice Exercise**

**Outcome:** gain experience breaking down a demonstration into domains and Bloom levels

- Think, Pair, Share
- Recall the CREEP video or Feats of Strength Demos...
- Try to determine:
  1. **WHAT** learning outcomes were set for the demo (what level(s) of Bloom?)
  2. **HOW** many learning domains were accessed? Why? How could more be accessed? How could the concept be demonstrated in other ways?
  3. **WHY** is the demo effective or ineffective?

**Demos take time...take the time...**

- **Ideation**
  - Should a demo be used? Why?
  - What should be the demo? Why? Does it already exist? Research it!

- **Development**
  - Demos are living learning opportunities
  - Can take a lot of time to work out
    - Many iterations may be necessary over many years
    - Incarnations or versions work differently in different settings

- **Implementation**
  - Getting to the room, running, **discussing**, and cleaning

- **Plan on a significant portion of face to face time**
  - Online has not worked well in my experience - **discussion** is absent
  - Videos need an interpreter/Socratic facilitator in **real time**...
Summary

• Demonstrations can reach:
  • Multiple learning domains
  • Multiple higher order thinking skills (Bloom levels)
• Effective demonstrations:
  • Are safe
  • Are aligned with student outcomes
  • Are designed for learning (not just a magic show)
  • Provoke curiosity and discussion
  • Are a clever way to implement Socratic Questioning for systematicy in, and depth of, thought

Resources

• Institute for Chemical Education (http://ice.chem.wisc.edu/)
• Ayva Educational Solutions (www.ayva.ca)
• CTL