Applying the Fundamentals of Teaching

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Session Objectives

By the end of this session, you will be able to

1. develop learning objectives for your class
2. use ConceptTests and open-ended questions to assess prior knowledge, student understanding, and gain feedback on your instruction
3. apply elements of acting to creating an effective learning environment
Fundamentals

1. Prior knowledge
2. Knowledge organization
3. Integrating knowledge
4. Feedback
5. Learning climate
6. Self-evaluation and self-direction
Fundamentals

1. Prior knowledge
2. Knowledge organization
3. Integrating knowledge
4. Feedback
5. Learning climate
6. Self-evaluation and self-direction
Preparation

Nothing makes you feel confident like being well prepared.

- Teaching aspects
- Technical aspects
- Timing

Was the interview too early for you?
Preparation – Teaching Aspects: Learning Objectives

Before you start your class, consider the following question:

- What are your goals (objectives) for the class?
## Preparation - Teaching Aspects: Learning Objectives

<table>
<thead>
<tr>
<th>Learning objectives</th>
<th>Examples of learning objectives: Students will</th>
</tr>
</thead>
<tbody>
<tr>
<td>Should be:</td>
<td></td>
</tr>
<tr>
<td>▶ student focused</td>
<td>understand why objectives matter</td>
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<tr>
<td>▶ specific</td>
<td>develop a plan to teach around objectives.”</td>
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<tr>
<td>▶ simple</td>
<td>Apply values, inquiry, and passion to classes.”</td>
</tr>
<tr>
<td>▶ active</td>
<td></td>
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<tr>
<td>▶ measurable</td>
<td>(Paraphrased from Jed Diamond.)</td>
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</tbody>
</table>
Preparation-Teaching Aspects: Learning Objectives

Develop three learning objectives for a class or lab that you might teach.
Preparation – Technical Aspects

What do you need to work during the class?
- Lab equipment
- AV equipment
- Check everything works ahead of time!

What do you do if something fails?
- Electrical/AV – Brad Gardener
Preparation - Timing

Case Study: You are preparing a recitation for introductory physics. It is on Newtonian Mechanics. How do you go about preparing for it?

- For a lab class this can be difficult. Need to run experiment yourself, but then it may take the students much longer.
- For presentations (mini-lectures) make sure you have a timed run-through. For seminars etc., 1 slide/minute is normal, but for classes you should allow much more time.
- With experience this gets easier.
Application – 1. Prior knowledge

How can you find out what your students know at the beginning of the semester?

- Questionnaire/Surveys (anonymous)
- Concept Tests (also useful for feedback)
- Quiz
- Read prerequisite syllabi
Question

If the sun was replaced by a one-solar-mass black hole

a) Earth’s orbit would not change.
b) Earth would be pulled into the black hole.
c) Earth would fly off into space.
d) Earth would be torn apart from the tidal force.
e) life would be unchanged.
The force of gravity depends only on mass and distance, not the type of matter, or its size.
The force concept inventory

DAVID HESTENES, MALCOLM WELLS, GREGG SWACKHAMER, THE PHYSICS TEACHER VOL. 30 (1992)
A heavy ball is attached to a string and swung in a circular path in a horizontal plane as illustrated in the diagram to the right. At the point indicated in the diagram, the string suddenly breaks at the ball. If these events were observed from directly above, indicate the path of the ball after the string breaks.
(b) In the absence of the force provided by the string, the ball continues to move in the direction it had been moving.
The accompanying diagram depicts a semicircular channel that has been securely attached, in a horizontal plane, to a table top. A ball enters the channel at "1" and exits at "2". Which of the path representations would most nearly correspond to the path of the ball as it exits the channel at "2" and rolls across the table top.
Similar question posed in a different way

The accompanying diagram depicts a semicircular channel that has been securely attached, in a horizontal plane, to a table top. A ball enters the channel at "1" and exits at "2". Which of the path representations would most nearly correspond to the path of the ball as it exits the channel at "2" and rolls across the table top.

Again answer is b. Misconception “circular impetus”. Objects moving in a circle will continue to move in a circle.
23. A bowling ball accidentally falls out of the cargo bay of an airliner as it flies along in a horizontal direction. As seen from the ground, which path would the bowling ball most closely follow after leaving the airplane?
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(d) constant velocity in direction of plane, accelerating down due to gravity.

Does this question confuse? It looks like the ball is moving ahead of the airplane.
Open ended question

What is an atomic nucleus?

Use words, diagrams, pictures, equations etc..
✧ You don’t have to be comprehensive, try to describe just one aspect.
✧ Try to be imaginative, come up with something other groups will not think of.
Nuclear structure

Nuclear reactions

Hot and dense quark-gluon matter

Hadron-Nuclear interface

Nuclear astrophysics

New standard model

Applications of nuclear science
Activity

- Write an open-ended question on something that interests you.
Integration of Knowledge:

- You are teaching a lab with a recitation. What do you need to do to connect the lab material with what has been covered in the lecture?
- Meet with the instructor
- Attain syllabus
- Attain lecture notes
- Attend class
5. Feedback

- What kind of feedback do you think you can use in your instruction?
- Concept Tests
- Questionnaires
- Clearest/muddiest points
- Asking questions
  - Wait ……
- Tests
6. Learning Climate

What do the students and I need to do in order to create the learning environment that is most effective?

- As a TA, you are in control of your classroom/laboratory space.
- Make your expectations clear in the syllabus.
- Start off strict, you can always relax rules, but much harder to strengthen them later on.
- Make decisions, what will you tolerate, what won’t you?
- Rules are to enhance respect: students need to respect each other as well as respect you!
- Students know when you don’t respect them.
Aspects of acting applied

Given Circumstances

- Everything “given” to your teaching circumstance.
- Includes content, students, room layout, external factors, time of class, equipment etc.
- Students e.g. age differential, prejudices about course.
- Length of session.

Need to do what you can to make best of your given circumstances?

- Find best position to address students from, stationary, moving?
- Check everything works beforehand.
- Make sure no trip hazards.
- Breaks?
Activity

4 "volunteers"
Aspects of acting applied

Presence

- Personal openness toward students, intentional, calm.
- Some people naturally have it, some have to work hard. Either way, can be improved with practice.
- Posture, breathing. Don’t hold breath, but release.
- Entrances are important.
Activity

Everyone stand up.
Aspects of acting applied

Redirecting Fear

- “Fear is the largest obstacle to effectiveness.”
- Confidence in material and in presentation helps.
- Exercise helps, caffeine doesn’t.
- Make your objectives more important than your fear.
- Take care of your given circumstances.
- Cultivate presence with your audience.
Feedback/Assessment

- Take a few minutes to write about two concepts that you learned about in this session and how you will use them in your instruction.
Summary

- Discussed the importance of learning objectives and practiced writing them

- Considered different assessment tools (Concept Tests, Forced Concept Inventory, etc...) and how they are used in instruction

- Practiced acting techniques to enhance instruction
Questions/Comments?
Thanks!