Applying the Fundamentals of Teaching

DR. KATE JONES

DR. FERLIN MCGASKEY

Session Objectives

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

- 1. develop learning objectives for your class
- 2. use ConcepTests 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

Updated Covid Guidelines

- https://www.utk.edu/coronavirus/
  - Students, faculty, and staff will be required to wear masks in classrooms and labs, and for indoor academic events required for students such as orientation.
  - Outside the aforementioned contexts, students cannot be required to wear masks (e.g. office hours).
  - Refer to above link regularly for any updates.

Fundamentals

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

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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 objectives for the class?

Preparation – Teaching Aspects: Learning Objectives

Learning objectives

Should be:

- student focused
- specific
- simple
- active
- measurable

Examples of learning objectives:

Students will:

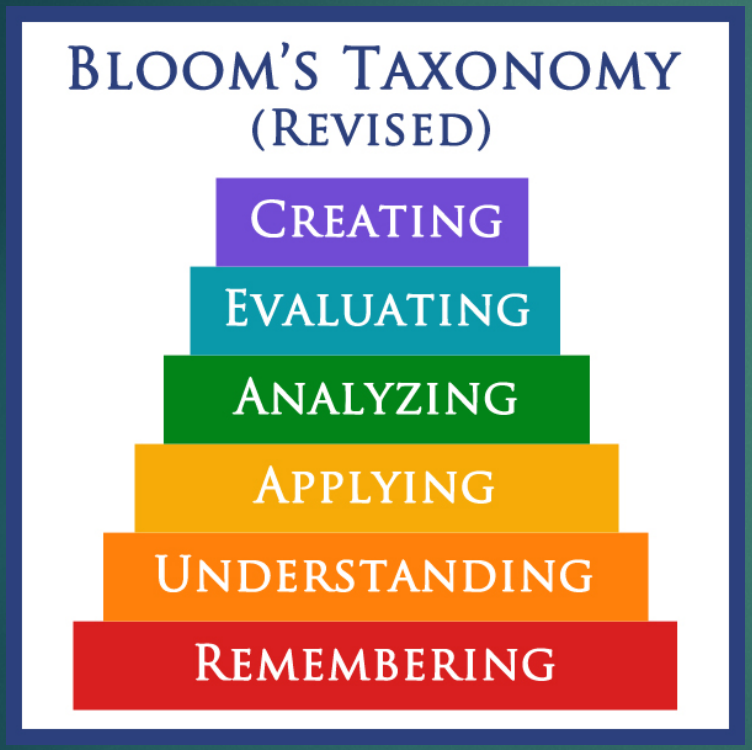
"describe why objectives matter"

"develop a plan to teach around objectives."

"apply passion for physics to classes."

(Paraphrased from Jed Diamond.)

Developing SLOs using Bloom's Taxonomy



- Bloom's Taxonomy is a classification system of "the goals of the educational process" composed of three domains:
  - Cognitive
  - Affective
  - Psychomotor

Learning Outcomes by Category: What students do

Remember	Understand	Apply	Analyze	Evaluate	Create
Count	Associate	Apply	Analyze	Appraise	Compose
Define	Compute	Calculate	Arrange	Assess	Create
Describe	Convert	Change	Breakdown	Compare	Combine
Draw	Defend	Classify	Categorize	Conclude	Connect
Identify	Discuss	Complete	Combine	Contrast	Design
Label	Distinguish	Compute	Design	Criticize	Devise
List	Estimate	Demonstrate	Detect	Critique	Group
Match	Explain	Discover	Develop	Determine	Integrate
Name	Extend	Divide	Diagram	Grade	Modify
Outline	Extrapolate	Examine	Differentiate	Interpret	Order
Point	Generalize	Graph	Discriminate	Judge	Organize
Quote	Give examples	Interpolate	Illustrate	Justify	Plan
Read	Infer	Manipulate	Infer	Measure	Prescribe
Recall	Paraphrase	Modify	Outline	Rank	Propose
Recite	Predict	Operate	Point out	Rate	Rearrange
Recognize	Rewrite	Prepare	Relate	Relate	Reconstruct
Record	Summarize	Produce	Select	Support	Reorganize
Repeat		Show	Separate	Test	Revise
Reproduce		Solve	Subdivide		Rewrite
Select		Subtract	Utilize		Transform
State		Translate			
Write		Use			

A template to use to write SLOs

- By the end of the **(program, course, unit, or class),** the participant/student/learner/ will be able to (**Bloom active verb**) **(specific description of the relevant and attainable topic/subject/idea/concept that is to be learned).**
- **Example:**

  "By the end of the **class**, the participant will be able to the student will be able to **write** a lab report following the Physics department's lab report format."

Preparation-Teaching Aspects: Learning Objectives

Develop three learning objectives for a class or lab that you might teach using Bloom's Verbs and learning outcome template.

Use Rubric to assess a partner's objectives

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

Preparation - Timing

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

- Develop (or identify) learning objectives
- 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)
- ConcepTests (also useful for feedback)
- Quiz
- Read prerequisite syllabi
- KWL

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.

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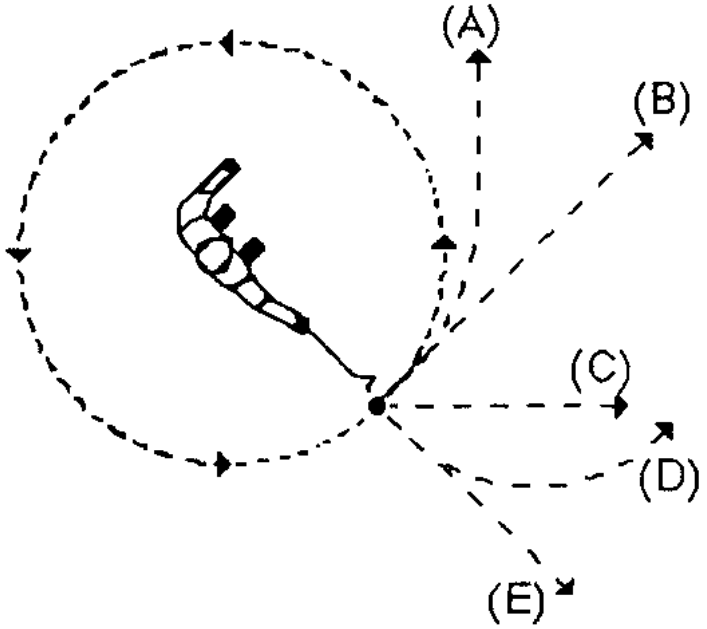
The force concept inventory

DAVID HESTENES, MALCOLM WELLS, GREGG SWACKHAMER,
THE PHYSICS TEACHER VOL. **30** (1992)

Force concept inventory

4. 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.



Force concept inventory

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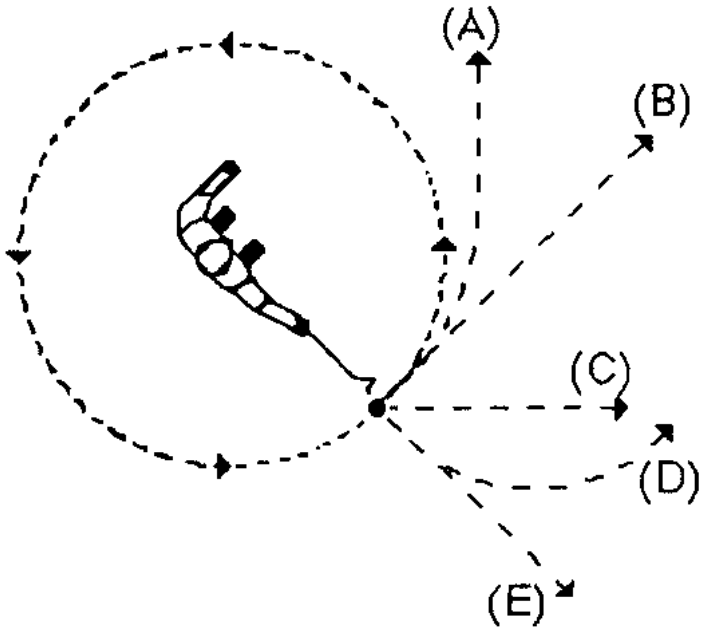
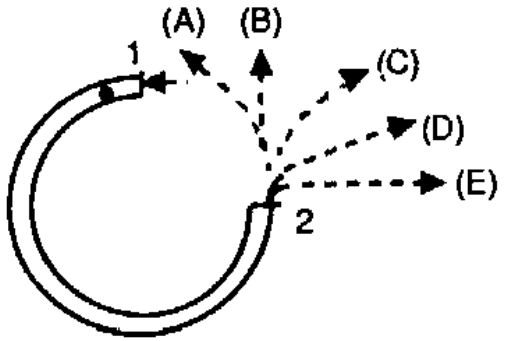


(b) In the absence of the force provided by the string the ball continues to move in the direction it had been moving.

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.



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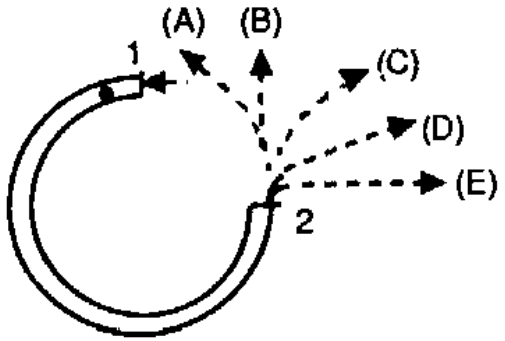
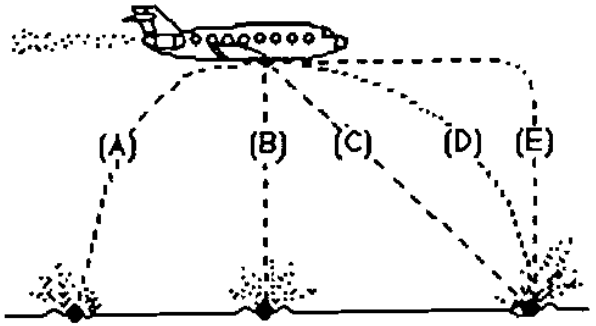


Again answer is b

Misconception "circular impetus". Objects moving in a circle will continue to move in a circle.

Force concept inventory

23. A bowling ball accidently 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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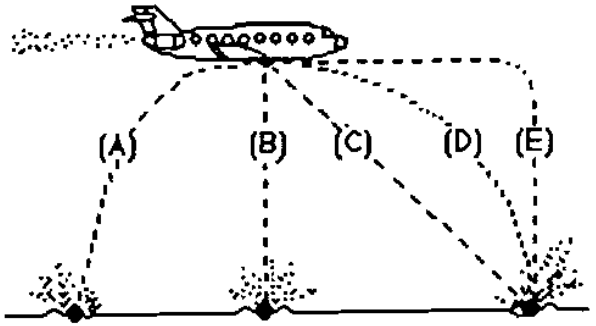


(d) constant velocity in direction of plane, accelerating down due to gravity.

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

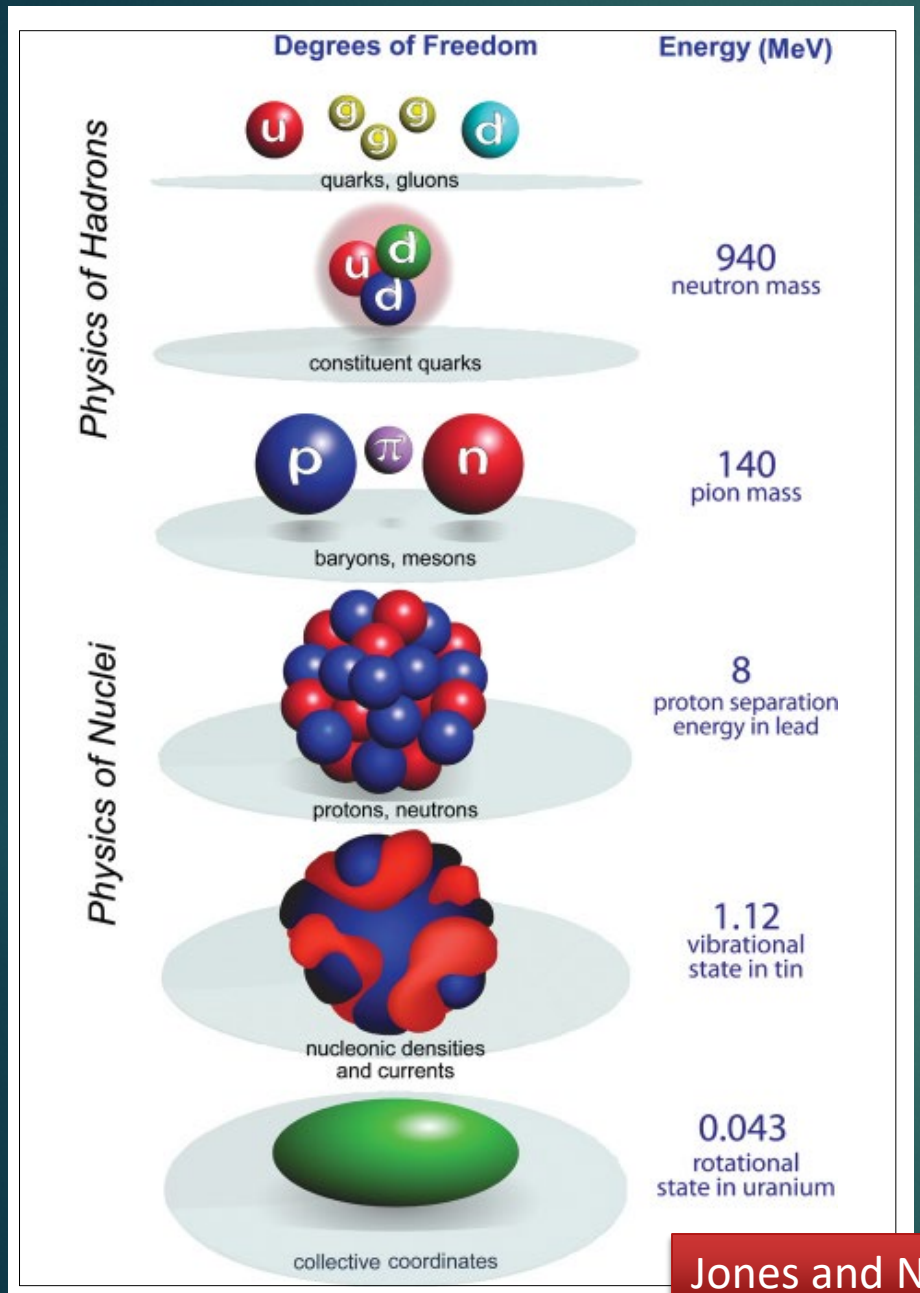
Open ended question

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.



Hot and dense quark-gluon matter

Hadron structure

Hadron-Nuclear interface

Nuclear structure
Nuclear reactions

Nuclear astrophysics
New standard model

Applications of nuclear science

Jones and Nazarewicz, The Physics Teacher, **48** (2010).

Activity

- Write an open-ended question that you might ask a student to explain more about a topic or idea.

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?
- ConcepTests
- Questionnaires
- Clearest/muddiest points
- Asking questions
  - Wait ……
- Wrappers

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?

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.

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.
- Write down one or two concepts that you are still unclear about or would like to learn more about.

Summary

- Discussed the importance of learning objectives and practiced writing them
- Considered different assessment tools (ConcepTests, Forced Concept Inventory, etc…) and how they are used in instruction
- Practiced acting techniques to enhance instruction

Questions/Comments?

Thanks!