Motivating Students to Learn Physics

Robert E. Thorne
Physics 2207: Introduction to Mechanics
  Calculus-based. 1st of 2 semester sequence.

*Clientelle:* Biological and life sciences, Chemistry, Earth and Atmospheric Sciences, Human Ecology, English, Government, Economics, . . . *pre-med and pre-vet*

Physics 2214: Oscillations, Waves and Quantum Physics
  3rd of 3 semester sequence.

*Clientelle:* Engineering, CIS, Physics, Earth and Atmospheric Science, other science
What was your primary reason for signing up for Physics 2207?

To fulfill a requirement: 96%
Interested in physics: 3%
Course had great reputation: 1%
What was your attitude towards Physics 2207 when you signed up for it? (Select all that apply.)

Sheer terror 18%
Anxious 44%
Afraid it will kill my chance of getting into professional/graduate school 20%
Comfortable: a good chance to develop some useful skills 26%
Motivating Students

Relevance

A clear path to mastery

Transparent evaluation
From Physics 2207:

“Why I am forced to take this course?"

“What use is this stuff to my major?”

From Physics 2214:

**WHY** is it important to study the things we are studying?

I would be so, so, so happy if you could spent 30 seconds addressing this at the beginning of each lecture.
Illustrate the concepts with **applications from many disciplines**, to show relevance to student interests.

**Emphasize the interconnectedness of science**, to show how our understanding in distinct areas is interleaved into a complex, self-consistent tapestry.

**Resources:**

- Pre-course student surveys
- Texts from other courses
- The Web!
Two identical glasses are filled to the same level with water. One of the two glasses has ice cubes floating in it.

When the ice cubes melt, in which glass is the level of the water higher?

1. the glass without ice cubes
2. the glass with ice cubes
3. same level in both
Examples of Oscillations
Motivating Students

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The **only** way to develop mastery in Physics and related subjects is **by solving lots and lots of problems.**

Provide a wide range of problems to allow a natural progression to mastery: "clicker questions", numerical problems, symbolic problems, derivations, context rich applications.

Minimize student time spent reading.

Provide study skills support.
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Demotivation Bombs:

Disconnected, poorly executed exams

Needlessly punitive grading schemes
Homework: graded on effort only

Quizzes: slight variants of homework problems

Exam questions: Test what you've taught!

“Absolute” grading, i.e., no curve.
  85-100% = A, 70-85% = B, 55-70% = C.

Want:

- Symmetric grade distribution (no long tails)
- Scores track for students with different preparations
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What role does thermal expansion play in forming the Taugannock amphitheatre?