

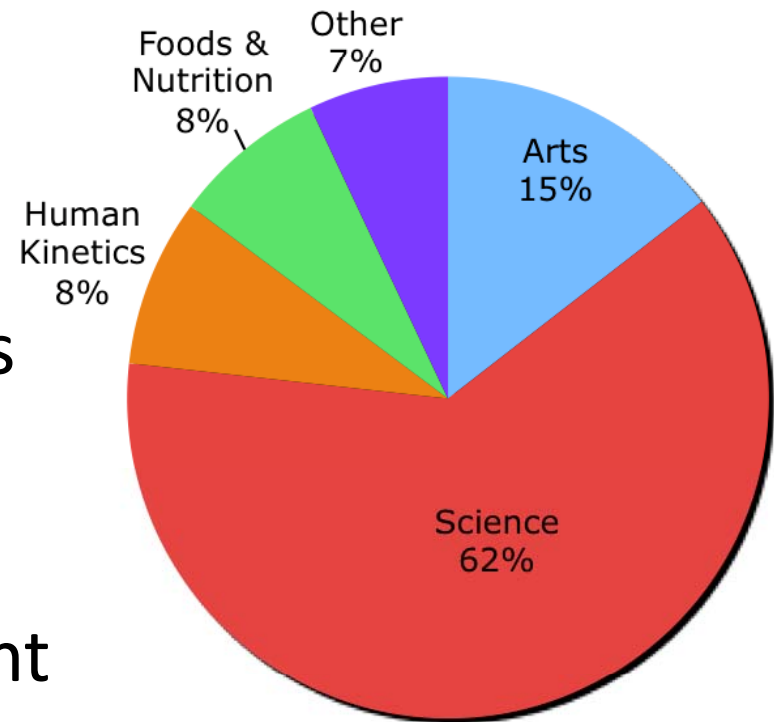
Development of a Course-Specific Skills and Content Survey

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Physics 100

- Introductory course for students who did not take Physics 12 in high school
- ~850 students in 3 sections
- Presents physics in real-world context with connections to environment whenever possible




Why a special survey?

- Pre/post surveys are excellent tools for examining student learning, and comparing from year to year.
- However, existing surveys are suitable for testing Phys 100's particular content and course goals:
 - Solving real-world problems need additional skills such as making assumptions
 - Some of Phys 100 content such as thermal physics is not on traditional surveys

Development of the Phys 100 Problem-Solving Survey

1. Identify target problem-solving skills
2. Develop questions to target those skills
3. Validate questions with student interviews to ensure they are working as designed
4. Deliver survey to class
5. Analyze results



Repeat as Necessary

Surveyed Problem-Solving Skills

Course-specific survey enables testing very physics-specific skills.

- Math: constructing equations, unit conversions, algebraic calculation
- Choosing relevant physics
- Making assumptions and estimates
- Visualizing sequential processes
- Interpreting charts and diagrams

Example Question #1

For the following sentence, choose the *algebraic equation* that most closely matches the meaning of that sentence.

"There are eight students for every teacher"

- a. $S * T = 8$
- b. $S = 8 * T$
- c. $8 * S = T$
- d. $S = 8$
- e. $T = 8$
- f. None of the above

Example Question #2

You are conducting an energy analysis of a house to figure out where to install additional heaters. **Which of the following could you reasonably *ignore* when evaluating the temperature of each room?** Choose all that apply.

- a. Heat loss by conduction through the walls
- b. Heat loss by conduction through double-paned windows
- c. Heat loss by conduction through single-paned windows
- d. Heat loss by radiation through the windows
- e. Heat gain by radiation from the outside
- f. Heat gain from appliances in the rooms
- g. Heat gain from neighboring rooms
- h. None of the above

Filtering Survey Results

- To ensure we only consider authentic responses, surveys are filtered using three criteria:
 - Students complete both pre and post survey
 - Students answer a trick question properly (see next page)
 - Students report consistent effort to answer survey questions correctly. (see next page)

Filtering Survey Results

Two questions are used to filter the survey results:

You're participating in a contest to design a container that will keep an egg intact when you drop it off a six storey apartment building. You want to figure out how tall the building is to help with the design of your container.

To make an estimate, you drop a golf ball off the top of the roof and time how long it takes to fall to the ground. **This question is to test and see who is actually reading the test. If you are reading this question, select choice g in the answers below.*** You run three trials of the experiment, timing the fall of the golf ball at 2.1, 2.3, and 2.3 seconds respectively.

Approximately how tall is the building?

- a. 18 m
- b. 20 m
- c. 22 m
- d. 24 m
- e. 26 m
- f. None of the above answers is correct
- g. That cannot be determined from the given information

To help us interpret your results, please read the following statement and indicate whether you agree with it. Please answer honestly; remember the survey is graded for participation only.

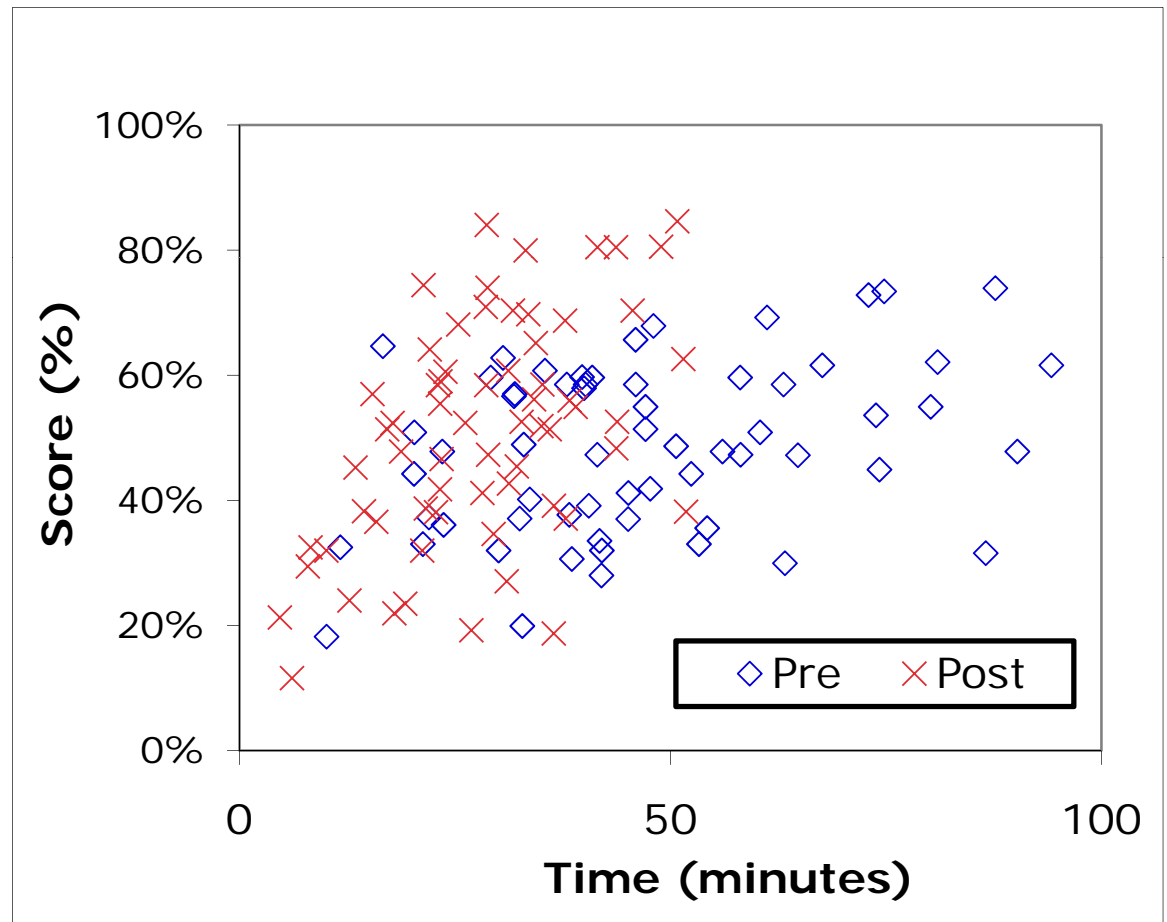
"On this survey I made a dedicated and consistent effort to answer each question correctly."

- a. strongly agree
- b. agree
- c. neutral
- d. disagree
- e. strongly disagree

***emphasis added (so you can see the trick)**

Problems with Student Motivation

- Despite offering participation marks for completing the survey, the 2008 survey showed identical overall marks for pre and post scores
- Student interviews and analysis of time spent on the survey showed students were rushing the post survey.



Improving Student Motivation

- The 2009 survey included several changes to improve motivation on the post survey:
 - The survey questions are clearly drawn from course content
 - Students are told the survey is a good way to practice for the exam
 - Students are given immediate feedback on their score

Results of 2009 Survey

- Analysis of 2009 results showed higher self-reported engagement
- Skills that are NOT explicitly taught in the course showed no improvement (as expected).
 - This is an improvement over the 2008 results that show a decrease in score. (see results for example q'n 1)
- Results show major improvement in student motivation

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	Pre	Post	Shift
2008	43%	36%	-8%
2009	43%	42%	-1%

Benefits for Instructors

- Specific feedback on what students are learning in the course
- Survey tailored to course content and learning goals
- Consistent survey enables year-to-year comparisons.