Guide

Tasks Inspired by Physics Education Research

Indicates a research-demonstrated benefit

Overview

Short activities that help students apply concepts and address known difficulties; designed so that they cannot be solved using plug and chug.

Type of Method	Curriculum supplement
Level	**Designed for:** Intro College Calculus-based, Intro College Algebra-based **Can be adapted for:** Teacher Prep Course, Teacher Professional Development, High School, Intro College Conceptual
Setting	**Designed for:** Lecture - Large (30+ students), Lecture - Small (<30 students) **Can be adapted for:** Recitation/Discussion Session, Homework, Studio
Coverage	Many topics with less depth
Topics	Electricity / Magnetism
Instructor Effort	Low
Resource Needs	Cost for students
Skills	**Designed for:** Conceptual understanding
Research Validation	**Based on research into:** theories of how students learn , student ideas about specific topics
Compatible Methods	Peer Instruction, PhET, UW Tutorials, JiTT, Ranking Tasks, ILDs, CGPS, Physlets, Context-Rich Problems, RealTime Physics, ABP Tutorials, SCALE-UP, OSP, SDI Labs, OST Tutorials, Thinking Problems, Workbook for Introductory Physics, LA Program, CAE TPS, MBL, CPU, SCL, TEFA, Tools for Scientific Thinking, M&I, Tutorials, Clickers, Responsive Teaching
Similar Methods	Ranking Tasks, Thinking Problems, Astro Ranking Tasks
Developer(s)	Curtis Hieggelke, David Maloney, Stephen Kanim, Thomas O'Kuma

Website	http://tycphysics.org/tipers.htm
Intro Article	10377
Intro Article	nTIPERs: Tasks to Help Students “Unpack” Aspects of Newtonian Mechanics

What does it look like?

TIPERs are short activities that help students apply concepts and address known difficulties. They come in ten formats, listed below. Each activity fits on one page and can be completed in 5-15 minutes. Activities are designed so that they cannot be solved using "plug-and-chug." Because the tasks are short and independent of one another, they are easy to try out without making significant alterations to your course. They are constructed to be the right “step size” so that students feel comfortable responding to them using their natural ideas rather than memorized physics. They can be used for in-class group discussions, homework assignments, quizzes, or test items. They are constructed based on research into student ideas.

Activity outline

Ten TIPER formats (more detailed descriptions):

Bar Chart Tasks — these require student to draw histograms for specified quantities of a situation.

Changing Representation Tasks — given one representation, e.g., a free-body diagram, students generate an alternative representation, e.g., the Newton’s second law equation.

Comparison Tasks — these ask the student to determine which of two situations has a greater value for a quantity, or if the two situations have the same value for quantity.

Conflicting Contentions Tasks — these tasks present two or three (usually natural language) statements about a situation and the goal is to decide which, if any, of the statements is correct.

Linked Multiple-Choice Tasks — in these the same question, with the same set of answer possibilities, is asked about a sequence of variations for a situation.

Qualitative Reasoning Tasks — these tasks ask about how a qualitative variation of a situation affects the behavior of the system.

Ranking Tasks — ask students to rank a set of physical situations based on the magnitude of a single characteristic.

Troubleshooting Tasks — these require the identification of the acknowledged error(s) in a contention, representation or analysis.

What, if Anything, is Wrong Tasks — these are similar to troubleshooting tasks except that there may not be anything wrong.

Working Backwards Tasks — these usually have one or more equations as the starting point with the goal being a description or drawing of a physical situation.

Where did it come from?

TIPERs were developed by the Two-Year College Physics Workshop project leaders, Curtis Hieggelke, Steve Kanim, David Maloney, and Thomas O'Kuma. They were inspired by Alan Van Huevelen's ALPS manual, which introduced bar charts tasks, changing representation tasks, and working backwards tasks, and by the University of Washington Physics Education Group, which introduced conflicting contentions tasks and provided ideas for issues in electricity and magnetism.

Teaching materials

TIPERs books (you can download the instructor's guide from the resources tab in each of the links below):

- TIPERs: Sensemaking Tasks for Introductory Physics
- E&M TIPERs: Electricity and Magnetism Tasks
- Newtonian Tasks Inspired by Physics Education Research: nTIPERs
- Ranking Task Exercises in Physics

Magnetism TIPERs online

Resources, training, & community

Using Ranking Tasks in the AP Physics Classroom

For suggestions about how to develop your own TIPERs, see Maloney, "Developing Conceptual Exercises", Winter 1994/ 95 CaFD Newsletter.