Why don’t we have a textbook in Modeling Physics?

On 21 Aug 2014, Joe Morin, an experienced modeler in Minnesota, posted this to the physics modeling listserv:

It's time for me to answer the "why don't we have a textbook" question for our students (and then the parents). Please offer your suggestions. If we can put together a good list we'll have a standard answer. Here are a few bullet points to start with:

- We are learning how to **do** science, not just learn **about** science.
- We begin each area of study by posing questions, and then doing experiments to answer the questions.
- We don't want to just use a textbook to give us a lot of mindless facts and formulas.
- We learn much more by doing than by reading or by listening or watching.
- We want to learn together and articulate our ideas and sharpen our understanding through group discourse.

In August 2017, Joe added this:

- Modeling is a well-tested pedagogy shown to be superior to other approaches by physics education research.
- Modeling is supported with a wealth of teacher notes, student worksheets, and other materials for each unit.
- Teachers across the country (and abroad) share with one another and continue to refine their approaches.
- Teachers can pick and choose among rich resources to "customize" their content for different level classes.

All of my tests and quizzes were "open notes". This encouraged students to make the material their own, and reinforced the need for them to truly understand the material. It also comes in handy when/if a parent questions why their student did so poorly on the last assessment: "Well, it was an open notebook test."

In 2017, Joe contributed his LETTER TO PARENTS:

Textbook:

Since conventional textbooks are not the best way of imparting strategic knowledge, the instructor guides the students through the topics for this course. Content is selected from sources available from Massachusetts Institute of Technology and Arizona State University (Pritchard, Hestenes). The textbook: *Physics, Principles and Problems*, by Paul Zitzewitz, 2002 is a reference available to students either online or in hard copy format.

Course Objectives:

To equip students with an understanding of the processes of science.
To enable students to master selected concepts of physics.
To develop students’ thinking and problem solving skills.
To help students in the development of their faith.
To provide students a foundation for college.

Instructional Objectives:
To teach students how to think like scientists, and to study and understand physical phenomena using a scientific process.
To engage students in gaining a deep understanding of the physical world by constructing and using scientific models to describe, to explain, to predict and to control physical phenomena.
To provide students with basic conceptual tools for modeling physical objects and processes, especially mathematical, graphical, and diagrammatic representations.
To familiarize students with a small set of basic models as the content core of physics.
To develop insight into the structure of scientific knowledge by examining how models fit into scientific laws and theories.
To teach students to approach problems using fundamental principles of physics.
To show how scientific knowledge is validated by engaging students in evaluating scientific models through comparison with empirical data.
To have students engage in scientific discourse: formulating scientific claims, evaluating them, presenting them, and soliciting peer input during oral discourse.
To teach students to be proficient and critical consumers of educational technology and prepare them for entering a technology-infused work place.
To develop in students a love of learning for understanding.

Prerequisite:
Algebra I is the only prerequisite. Students need to use mathematical reasoning – arithmetic, algebraic, and trigonometric – in solving physics problems. Students are expected to have learned these disciplines in earlier math courses, but it is recognized by the instructor that students will need to be retaught these disciplines as they are applied in physics.

Teaching Methodology:
Building upon Robert Karplus' foundational work on the learning cycle, MIT and ASU each developed a Modeling process to improve student achievement in physics. The modeling cycle developed by Malcolm Wells at ASU has two major components, model development and model deployment. A third component has been added by the author called model breaking (Noschese).

Web references:
http://modeling.asu.edu/modeling/mod_cycle.html
http://relate.mit.edu/current-projects/maps-pedagogy/

Addendum: textbook-like resources (suggested by Jane Jackson in Sept. 2017):
1) A modeling-friendly free downloadable "textbook" is SPIRALPhysics. It has goal-less problems, ranking tasks, and multiple representations. Dwain Desbien, an outstanding modeler, uses SPIRALPhysics in college physics. Dwain wrote in 2015, "I use parts of it in all my classes. I particularly use it in University Physics 2 and 3. It is a great resource for activities."
Download many FREE modules for calculus-based or trigonometry-based physics at:
http://www.dropbox.com/sh/oulpsaytsjxvhzh/AADt7uvQWqNgOXOz5B-YrQXba?dl=0
(A permanent weblink is on the ASU modeling legacy website, at Weblinks for Modelers:

modeling.asu.edu/modeling/weblinks.html in the section called <Model-based instructional methods by others>.)

2) In 2017, the AMTA published an affordable bound Mechanics Course-book. The Course-book supports Modeling Instruction by combining worksheets and the student's lab notebook into a single resource. As a familiar, textbook-like resource for students, the Course-book can increase comfort among parents, administrators, and faculty. Order at http://sites.google.com/socraticbrain.org/new Click on <CourseBook>. (AMTA members have a special discount that is unpublished.)