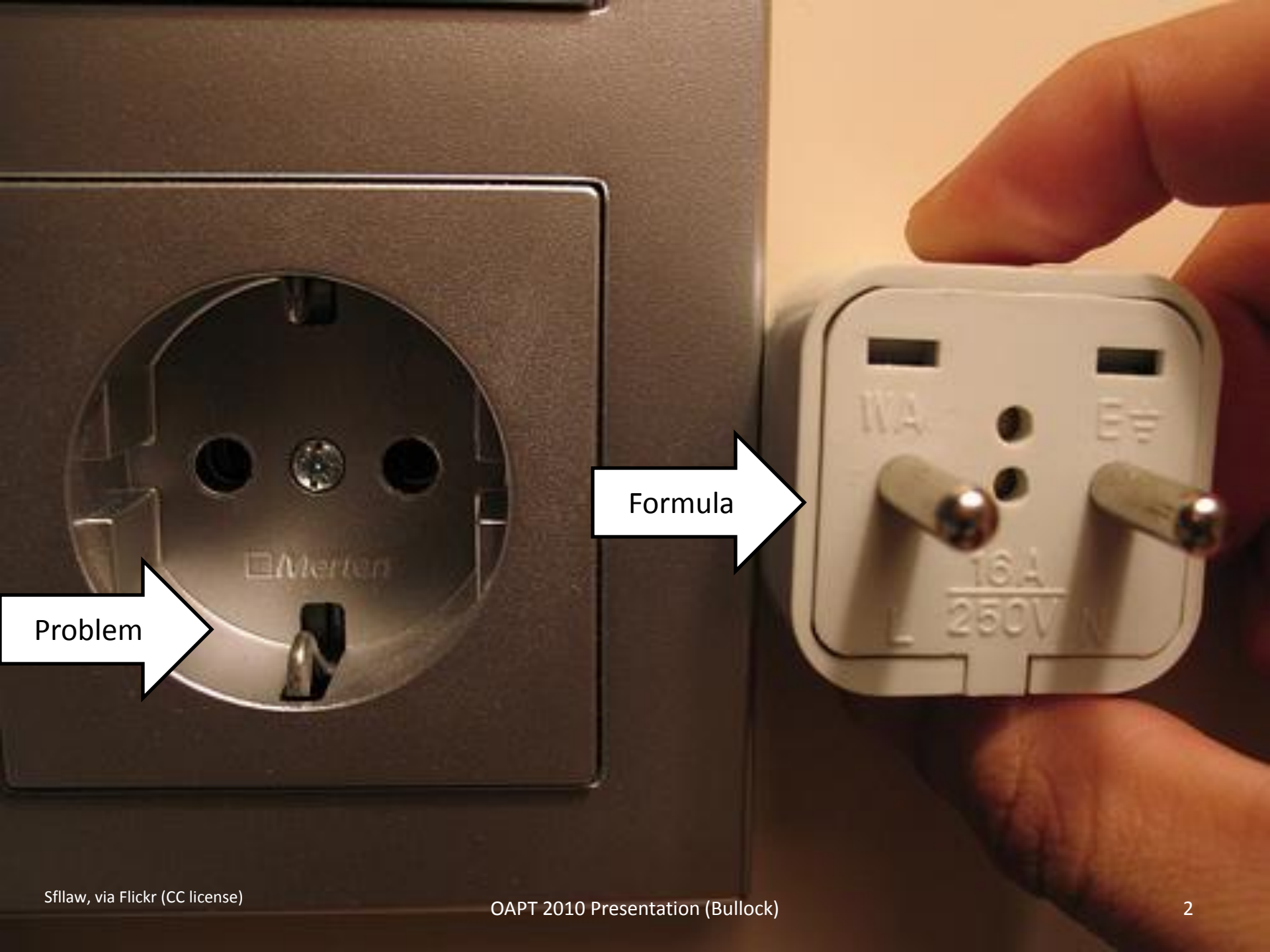


# Problem Solving in the Physics Classroom

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Problem

Formula

# What is a Problem?

- A question is a situation where the route between what *is* and what *is desired* is readily apparent.
- A problem is a situation where the route between what *is* and what *is desired* is not readily apparent.

# What is a Problem?

$$P = \left( \frac{S_D - S_C}{K + R} \right) \text{Role}$$

(Desjardins & van Oostveen, 2008)

$S_D$ : Desired Situation

$S_C$ : Current Situation

$K$ : Relevant Knowledge of the Problem Solver

$R$ : Resources Available to the Problem Solver

Role: Contextual factors related to the Problem Solver

# Problem Solving: Beyond Formulae

A few ideas from Hestenes (1987, p. 449):

- “Problem solving is traditionally taught by providing examples for students to emulate.”
- “Experts do not solve problems the way they say they do.”
- “Experts tacitly employ a *model-centred strategy* for solving physics problems.”

# 1. Multiple Representations of Knowledge

- Knight (2004) argues that students should feel comfortable representing problems in a variety of ways.
- Knight's key idea: Separate the pictorial representation (including a sketch, a coordinate system, and labels for given information) from a physical representation (motion diagrams, free-body diagrams) and a mathematical representation.

## 2. Problem Sorting & Classification

- Students have been conditioned by years of doing textbook problems to expect that the easier problems will precede the harder problems, so they should begin at the beginning.
- PEEL Procedure E5 challenges students to group problems into a number of different problem sets, based on similarities and differences.

### 3. Where and Why Is It Wrong?

- It is often difficult for students to consider their own solutions critically because of the personal effort and emotion they have invested in a particular problem.
- PEEL Procedure E1 challenges students to examine a problem set and sample solutions, with a view to correcting the solutions *as well as* providing an explanation of the thinking that led to the incorrect solution.

# The Road Ahead

Knight (2004, p. 44) reminds us of the dangers of formula hunting:

“Although such a simple strategy fails when facing the increasingly complex problems of college courses, students have no other alternative strategy at their disposal. Exhortations to “just remember a few principles” are meaningless because they don’t know — unless they’re taught — how to reason this way.”

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