Real-World Contexts: Challenges in Curriculum Development

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Why Real-World Contexts?

Real-world contexts …

- motivate$^2$ students to learn physics.
- promote inductive reasoning - principles developed from observations.
- provide situations for design-based$^3$ problem solving.


Which Real-World Contexts?

Contexts chosen based on following criteria...

- Have all students experienced it in some way?
- Is it amenable to hands-on exploration?
- Are underlying principles in clear view?
- Are principles transferable to other contexts?

In spite of these criteria...

Most students have ...

- Seldom given prior thought to how real-world devices work, although they have used them.
- Do not have well formed ideas about the working of these devices.
- Make up their thoughts on the spot, when asked how the devices work.

Example: Interview on Optic Fibers


From what I understand, it’s a, it’s almost a series of reflections. … I’m pretty sure it’s reflected light all the way through. …
From what I understand, it’s a, it’s almost a series of reflections. … I’m pretty sure it’s reflected light all the way through. … I think just by a series of a-, of angled, um, I don’t want to say mirrors, but it’s got to be mirror-like, a mirror-like substance. … I guess if, if you did just enclose light in, uh, it can’t be glass ‘cause it’s flexible. …. I don’t know how you would do it. …

I’ve seen, it almost looks like … it’s a plastic substance, I know, cause they use it for now, uh, that, that cable for computers and things, … but I don’t … know what they use; and it’s gotta be reflecting somehow. I don’t know.
Implications for Physics Education Research

- Stability of knowledge is questionable.
- Framework: p-prim-resource rather than coherent mental model.
- Difficult to probe student knowledge without affecting it.
- Focus on dynamics of knowledge transfer & construction rather than state of knowledge.


Implications for Curriculum Design

Typical Methodology

- Clinical Interviews
- Curriculum Design & Development
- Pilot- & Field-Testing

- Determine students' prior knowledge
- Design interventions to change knowledge

What is a Teaching Interview?

- ‘Mock’ instruction:
  - Attempts to change student knowledge.
  - Rich setting for students to express themselves.
  - Variety of instructional strategies.
  - Involve groups of up to three students.
- Researcher’s Role:
  - Observer.
  - Instructor.

* Steffe (1983); Steffe & Thompson (2000)

Benefits of Teaching Interviews

- Provide insights about ...
  - Dynamics of knowledge construction & transfer.
  - Effectiveness of materials & strategies.
  - Student interactions with...
    - instructional materials,
    - peers, and
    - instructor.
- Teaching Interviews are a bridge between research and curriculum development.

Summary

- Real-world devices ...
  - provide useful contexts for learning.
  - raise important issues in PER.
  - pose challenges to teaching & instructional development.
- Teaching Interviews can help address these challenges.