

Beyond Misconceptions Research: Students as Resources, and Attitudes and Beliefs

Teaching and Learning Physics, Fall 2015

Postmodern Philosophy

There is no absolute truth, we can not act independently of culture, values, power structures, etc.

Every thing you do (or don't do) is embedded in and sends messages about culture and power.

Even science.

- Why did the apple fall from a tree on a white European guy of upper socioeconomic class in the 1600's?

It is not possible to teach “objectively”, to remain neutral around values, beliefs, culture or power.

Historical Perspective

Identifying student difficulties, design curriculum to address.

Focus on students' affect (attitudes, beliefs, emotional response, etc.)

Key research movement was from University of Maryland PER group
(Hammer, Elby, Redish)

Two commonly used surveys: C-LASS (Colorado) and MPEX (Maryland)

Sample items from the CLASS and MPEX. Statements that experts agree with are indicated in bold.

CLASS

I study physics to learn knowledge that will be useful in my life outside of school.

A significant problem in learning physics is being able to memorize all the information I need to know.

Knowledge in physics consists of many pieces of information each of which applies primarily to a specific situation.

If I get stuck on a physics problem on my first try, I usually try to figure out a different way that works.

MPEX

• Learning physics helps me understand situations in my everyday life.

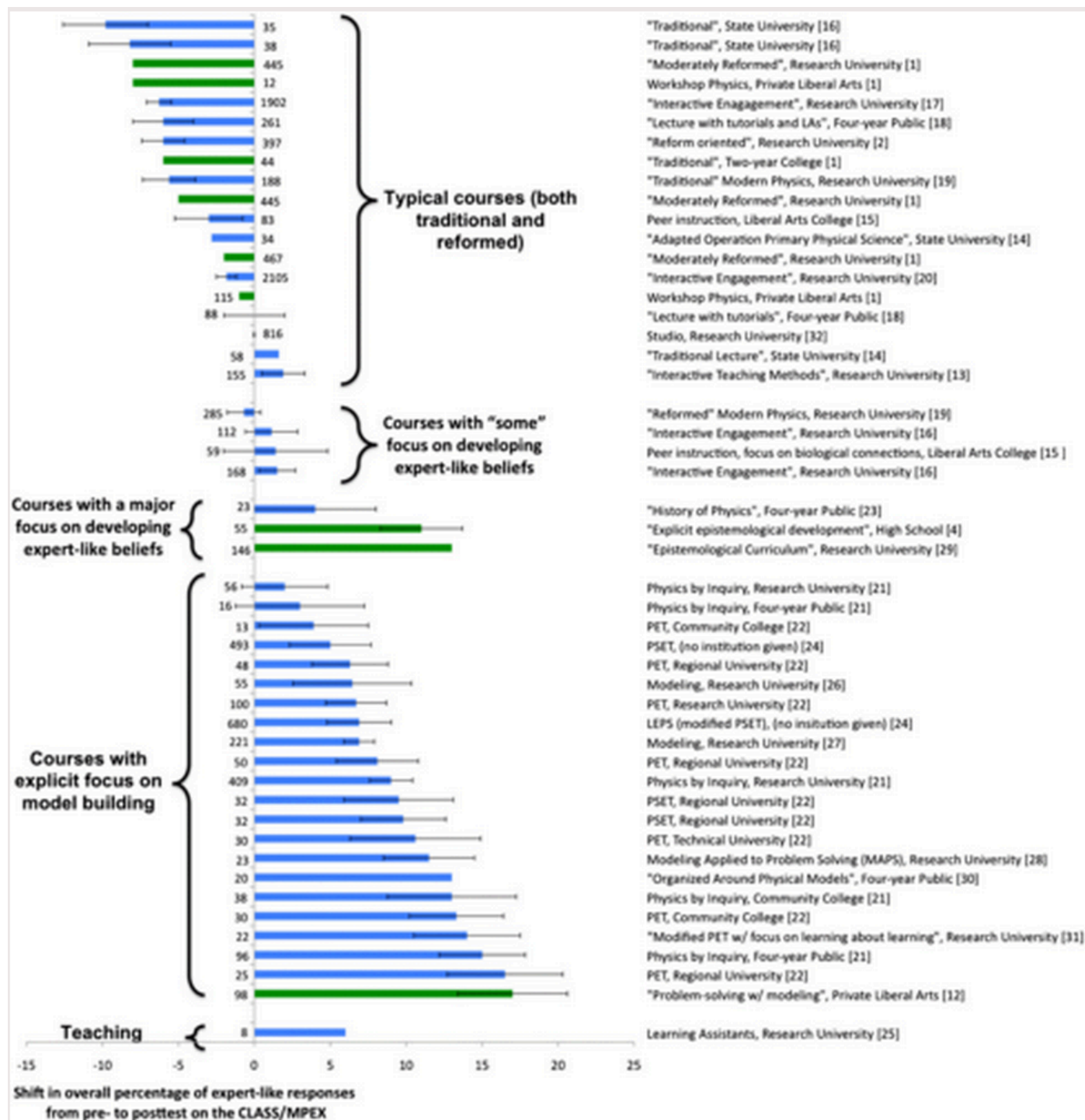
• A significant problem in this course is being able to memorize all the information I need to know.

• Knowledge in physics consists of many disconnected topics.

• In doing a physics problem, if my calculation gives a result that differs significantly from what I expect, I'd have to trust the calculation.

physics instruction impacts students' beliefs about learning physics: A meta-analysis of 24 studies, Adrian Madsen, Sarah B. McKagan, and Eleanor E. Beaman, *Phys. Rev. ST Phys. Educ. Res.* **11**, 010115 – Published 2 June 2015

24 studies published in *Physical Review Special Topics–Physics Education Research*, *American Journal of Physics*, and the *Physics Education Research Conference Proceedings* that reported CLASS or MPEX results for undergraduate physics classes in the United States and Canada



Physics courses are selecting students with expert like beliefs, rather than developing them.

Scores of eventual majors start higher than the general population or intended majors.

Of 10 students reporting learning gains and attitude scores reported relations between learning and positive attitudes

When you ask them to explain the flight path of a baseball, they pretty much get it, but then when you go back to the physics problem it is as though you are talking about something absolutely and completely unrelated. I don't know if we've got at a clear answer WHY this happens...anyone?

CLASS statements

What do you believe a favorable response would be?

How important is it that students respond favorably to this statement?

In what ways do traditional educational approaches encourage favorable or unfavorable views on the CLASS statement.

How might instruction be changed to encourage a more favorable view?

CLASS statements

I am not satisfied until I understand why something works the way it does.

There is usually only one correct approach to solving a physics problem.

Nearly everyone is capable of understanding physics if they work at it.

To understand physics I discuss it with friends and other students.

I enjoy solving physics problems.

It is important for the government to approve new scientific ideas before they can be widely accepted.

When studying physics, I relate the important information to what I already know rather than just memorizing it the way it is presented.

What topics would you like to see discussed that are not on the schedule, or that are on the schedule but you would like to go further?