Challenging Traditional Assumptions of High School Science through the PET Curriculum

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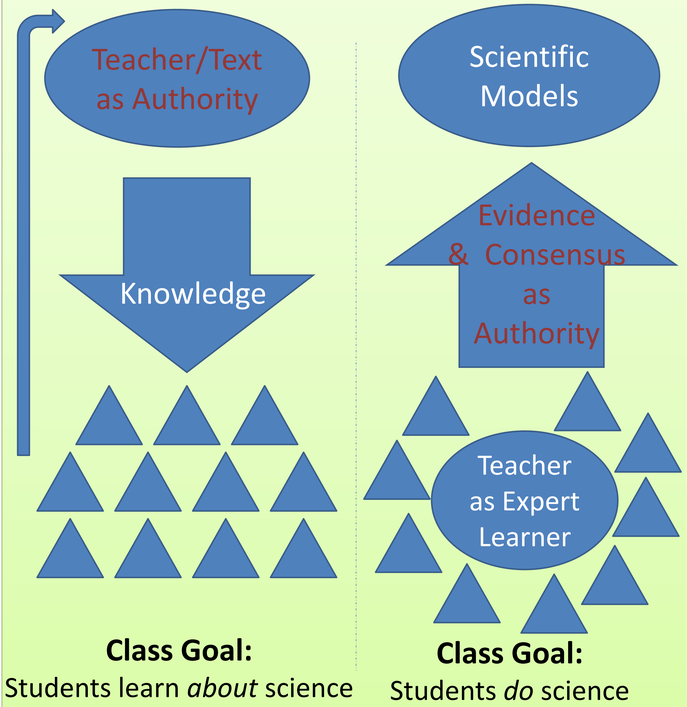
Streamline to Mastery

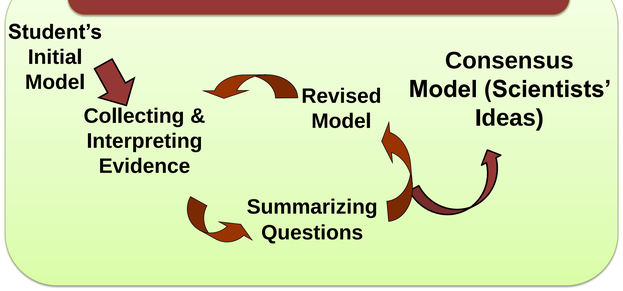
The Problem

Certain racial and ethnic groups remain largely alienated from physics and other STEM fields.

Two Models of Instruction



Physics and Everyday Thinking™ Learning Cycle:



Research Questions

1. In what ways do the structures and enacted practices of the PET curriculum encourage students from historically underperforming groups toward greater participation in physics classroom activities?

2. In what ways do students' participation in scientific practices via PET and students' scientific identities mediate one another?

Conceptual Framework

- A model of learning in which identity and community are mutually constructed; each is meaningless without the other.
- Authentic participation is only possible when one feels a sense of validation and belonging to activities of a group.

Data

- 30 hours of class video
- 12 individual interviews
- 2 focus group interviews
- Student work (lab books)
- In-class assessments
- PET conceptual test

Findings

"I think it's really a part of physics. I have been wrong a lot in this class and it's not necessarily a bad thing because you learn from your mistakes."

"Even if you hadn't thought about it before, it gets you to do that and start thinking about it and get interested.."

1. Students became comfortable expressing their ideas and came to value having their ideas challenged

"I think Initial Ideas are good because it gives—we get to see all the ideas that come to the table."

"Because, Initial Ideas it's better if you're wrong. Because if you're right from the beginning it's boring. You don't argue. You don't have a discussion."

"Yeah, I think so because you may say that background knowledge it kind of helps other students like get a –if they don't have an idea of like initial idea of what's going on in there and actually background knowledge will kind of help them create a starting point into the lab."

"Because we all have like different background knowledge that are applicable that adds to our initial ideas."

2. Students expressed a metacognitive awareness of the role that their own ideas play in the learning process

"Science or physics is just different. Like you have your own thought and we always have to tweak our own thoughts, and it's different from any other class. Like history, you know what you are going to be learning about. Physics is you think of something and you have to tweak it."

"It's just like the building blocks. It's like starting with at least something. I mean starting with nothing is really hard to build up an idea. But if you have at least a minimal building block and somebody, even if it's not correct, it helps to build your idea."

"Like, what's your evidence? Your evidence then, like, "Well, I saw this"…like just telling them straight up "Prove it. Prove that you know."… I was like "Oh, how so?" you know like I just kept asking questions."

"And he brought one in, or he brought one in the circle and we did the experiment in front of everybody, and then you know it helped us. We were like "oh".

3. Students were essential contributors to the creation of a learning context of critical scientific inquiry

"And you wouldn't like to like argue with them because you would think they would take it wrong. So we just grew with each other and realized it was right to argue with each other because we were all doing it to help each other, not just to make you look bad in the circle and stuff."

"We used to be gullible before this class. We just took the information from the teacher and we were like, 'OK, you're right, I guess.'"

Implications for the Development of Critical Science Curricula

Essential Elements	Enacted Through
Student dignity is maintained	*Authority* is replaced with *evidence and consensus*. Students' developing ideas are leveraged to move toward scientifically accurate models.
Student's social and cultural repertoires are leveraged to enhance learning	Everyday experiences and language are encouraged to coexist with formalisms and conventions
Students engage in and come to value scientific practices	Creating ongoing opportunities for engagement in and processing of epistemologically transparent scientific practices