Physics Learning Identity of a Successful Student: *A Plot Twist*

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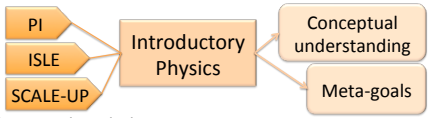
Introduction

At Oregon State, we have implemented reform in our introductory physics courses (large-enrollment, calculus-based) aimed at supporting conceptual understanding and curricular meta-goals.



These goals include:

- Ability in (and valuing) problem solving and reasoning like a physicist
- Self-efficacy in physics knowledge building and justification
- Explicit reflection on epistemological beliefs

Growth related to these meta goals can contribute to physics learning identity development.

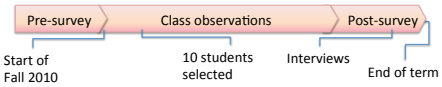
Identity: Community of practice (Wenger, 1998)

- Belief that practices are valuable for achieving common goals
- Perception of belonging and value as a member of the community
- Agency to affect meaningful change

Problem statement

A student was successful in the course as measured by course grade; however, his physics learning identity did not appear to become more sophisticated. A possible reason is that reform efforts are lacking structural alignment between course meta-goals and assessments so that meta-goals did not need to be achieved in order to get a high grade in the course.

Methodology



- PH211 (1st term of a year-long, intro physics sequence)
- Pre/post validated survey for measuring physics learning identity
- Selected 10 students with extreme high/low survey scores for in-class observations & individual interview
  - Semi-structured protocol assisted by a personal meaning map (Falk, 1998)

E. Wenger, Communities of Practice: Learning, Meaning, and Identity, Cambridge University Press, 1998.
J. H. Falk, T. Moussouri, and D. Coulson, Curator 41, 107–120 (1998).

Interview findings

Solving physics problems =
1) recognizing the patterns
2) finding the right equation
3) solve to achieve the goal of finding a number

"I can help somebody figure out what they need to do to get through the problem, but as far as understanding the why's behind it, it doesn't… I don't find it interesting. I don't care why it happens the way it does. I know it does and I can solve it. So I don't… when I'm helping someone else, I don't emphasize, "you use this equation because it makes sense ***because*** of this." You just use it because you do because that's what you're supposed to."

Assessment: Homework
Completes HW alone
Views as practice
Goal = get answers

Assessment: Tests/Grades
Knows equations
Recognizes patterns
Gets answers
Course grade = A

Survey summary (Unfavorable = 1, Favorable = 5)	Pre-survey	Std dev from average
Self-efficacy for…		
Communicating physics	4.43	1.43
Problem solving	4.17	1.13
Academic success	5.00	1.64
Social expectations about…		
Learning in a team	4.33	-0.17
Student responsibility for learning	4.40	0.15
Value of group work	3.25	-0.96

Erik as a learner

Class observations

- Erik **did not choose to engage** more deeply even when confronted with an open-ended question involving assumption making and choosing a model
- Erik **was willing to to engage** when a peer initiated the process but did not choose to start the process
- Erik **persisted in sense making** even when prompted to do what he was "supposed to" do

Assessment: In Class
Participates
Sits @ front
Attends regularly

Activity: Students asked to work with neighbors and use energy bar charts to represent a cat falling off the roof, then interpret into mathematical representations.

S3: [turns to Erik who turns to face S3] Would the system be the… I know it's the cat and Earth at least, but would the… roof be part of the system or…
E: It wouldn't need to be.
S3: Yeah…
E: Cause the only thing interacting is the cat with the ground, with the Earth due to gravity.
S3: Yeah.
E: That's our only interaction. We're going…

S3: It's pretty much just the position and place. [pause] Doesn't add or take anything away from it, except just gives it a position for the cat to be on.
E: It is what gives the cat the initial potential energy.
S3: Yeah.
E: Cause the cat got up there. That's what it amounts to. If you get up there you've expended energy, you have to gain that back to get back down.
S2: [E looks at S2's notebook] We didn't really write a mathematical representation, did we?
S3: [E turns to S3] Yeah. But technically though, if you expend the energy to go up and go back down, you technically… physically, in physics you gain… it's equal but when… biological sense, you don't get it back.

Constraints to changes in learning identity:

- Prior learning experiences and attitudes
- Structural mismatch between assessments and meta-goals
  - Students can do well on exams (assessments for assigning grades) without achieving learning goals
  - Students may not see compelling reasons to change
  - Student changes are not reflected in assessment results

Implications for research and instruction

- ✓ Need to take into account prior experiences and attitudes that hinder identity change because students do not see the benefit of changing what appears to work for them
- ✓ Exams do ask for models chosen and assumptions made; however, these non-standard assessments still may be inadequate
- ✓ Need to incorporate assessments for meta-goals that impact grades and other results that students value