



Emma McKay is a physicist, an activist, and a humanities scholar. They are interested in justice and quality of life in this time of ecological crisis and believe that scientists can contribute to these goals in unique ways through addressing the ethical consequences of their work. Emma was interviewed by the APS in 2022, asking the question, “Should We Build Quantum Computers At All?” They co-founded FemPhys, a community aimed at making physics better for marginalized folks, at the University of Waterloo in 2014, and have since been growing as a queer anxious nonbinary white settler person. They love plants, bugs, drawing, and learning about what folks are doing in physics, science, and equity. (Speaker at WIPC 2019)



FROM WELCOME TO BELONGING: BUILDING PHYSICS IDENTITIES

Laura.Stiles-Clarke@smu.ca

(she/her/hers)

CAP Division of Gender Equity in Physics

June 21, 2023



Approximately when did you start to feel that you belonged in physics?

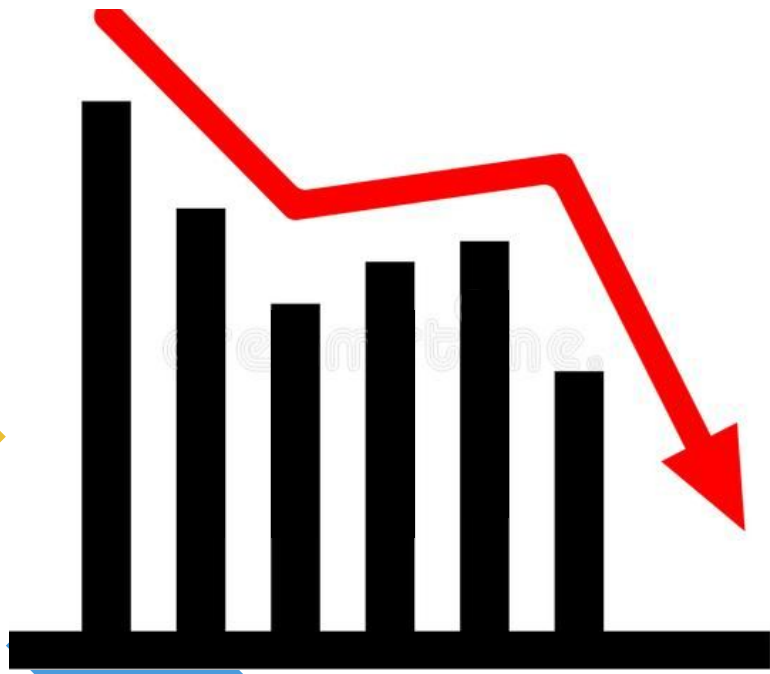
- A. In secondary/high school
- B. First year of undergraduate study
- C. Second year of undergraduate study
- D. Upper year of undergraduate study
- E. After graduating from undergrad
- F. When I got a job related to physics
- G. I'll let you know when it happens



Students choose an option

WHAT'S HAPPENING IN PHYSICS?

Enrollments



Culture



WHAT'S NEEDED IN PHYSICS?

Individual and group professional development



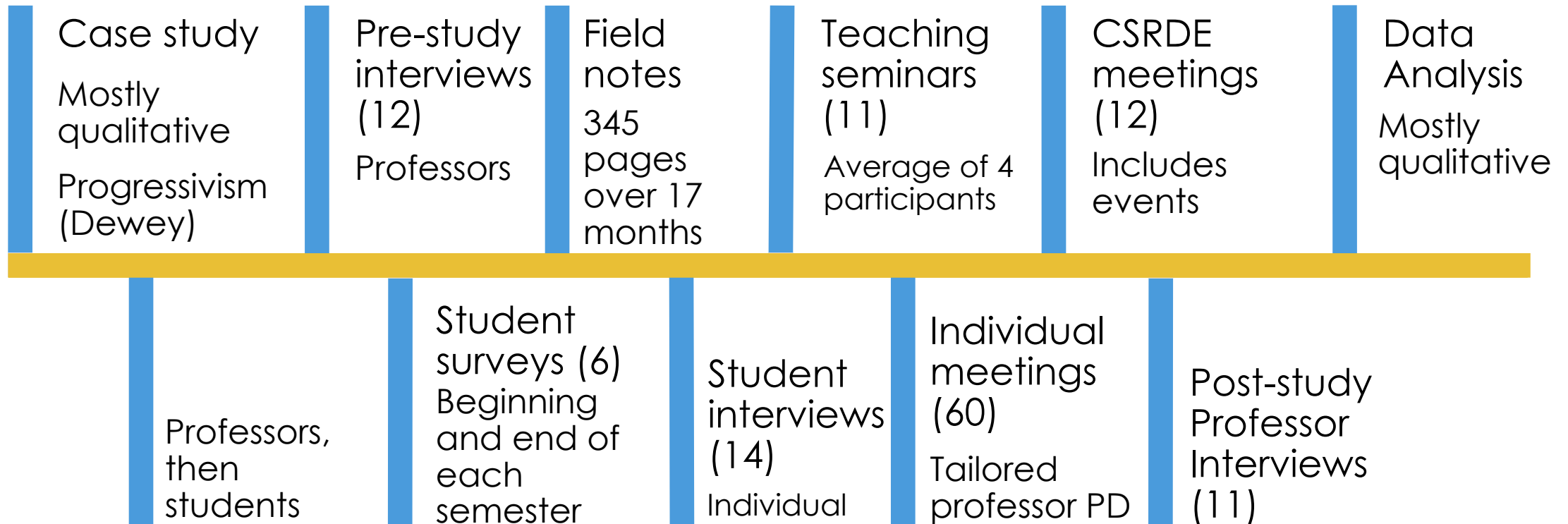
RESEARCH QUESTIONS

1. What stages are involved in the process when a group of physics faculty (the CSRDE) commits to increasing student retention, diversity, and engagement?

2. How does participating in this process affect participants' perspectives on teaching and learning?

3. What effects does this process have on student feelings of belonging in the department?

METHODOLOGY AND METHODS



September
2018



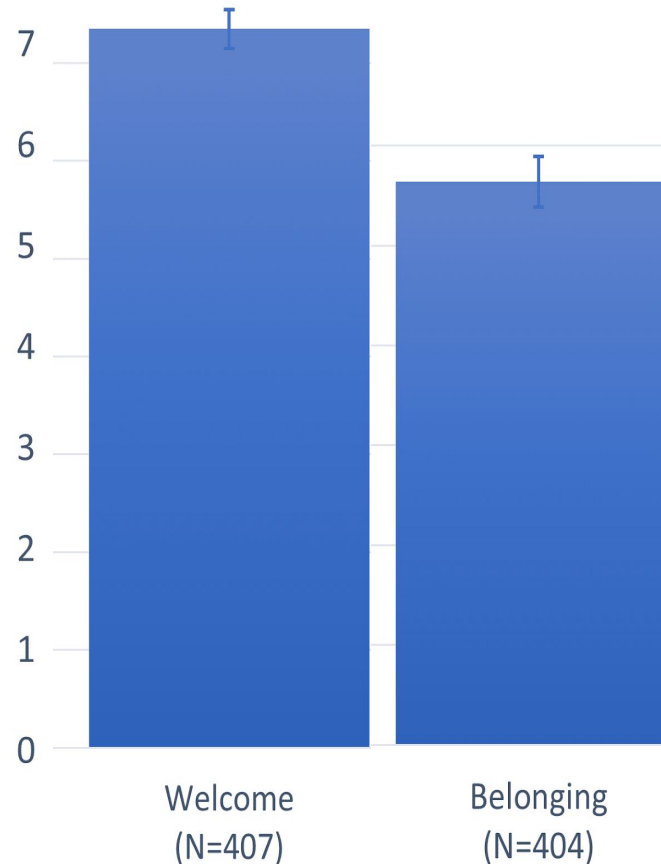
December
2019

STUDENT RESULTS: HIGHLIGHTS

Second tier

Students with B grades were just as likely to be interested in physics as A students despite feeling less welcome, belonging, and success

Welcome vs. belonging



Gender differences

Statistically significant differences ($p < 0.001$) between male and female student respondents on eight of ten questions.

More favourable for males.

Most of us don't have any teaching background. ... Some of us are good at teaching, some of us aren't. But it's kind of luck; none of us have learned how to teach. We've learned on the job. (Charley)

[When I started teaching here, I felt like I was] thrown to the lions. That was pretty rough. It was a little rough the first year, and it took me a couple of years to find my feet. ... It took me some time. (Robin)

A lot of us are not trained... It was sort of like learning on the fly all the time, and maybe that's not the best. ... We just do it. I don't know if it's any good. (Jamie)

I received absolutely no guidance whatsoever. ... And so, the first year, the students suffered, for sure. I did, and they did. Everybody suffered through. ... It was a mess. (Sydney)

MISSING PEDAGOGICAL KNOWLEDGE

Building Skills and Changing Mindsets

Tips & Tricks

Confidence

Focus on Individuals

Empowerment

From Teacher-Centered to Student-Centered

Relevance

Demos

Active Learning

Problem Solving

Building Community

Welcome

vs.

Belonging

Curriculum Map

Student experience

Second Year

First Year

Mentoring

Recruitment

Research Experiences

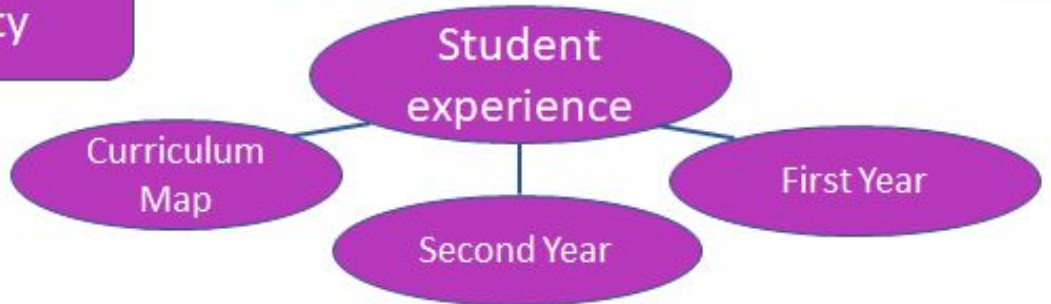
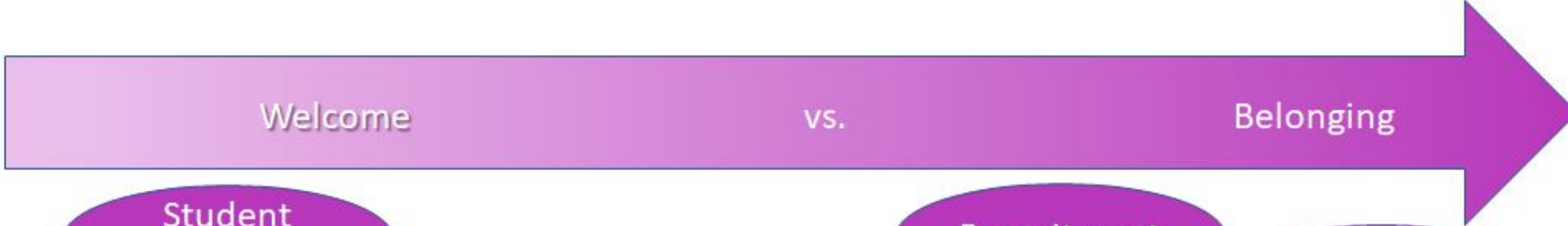
Face to Face Interactions

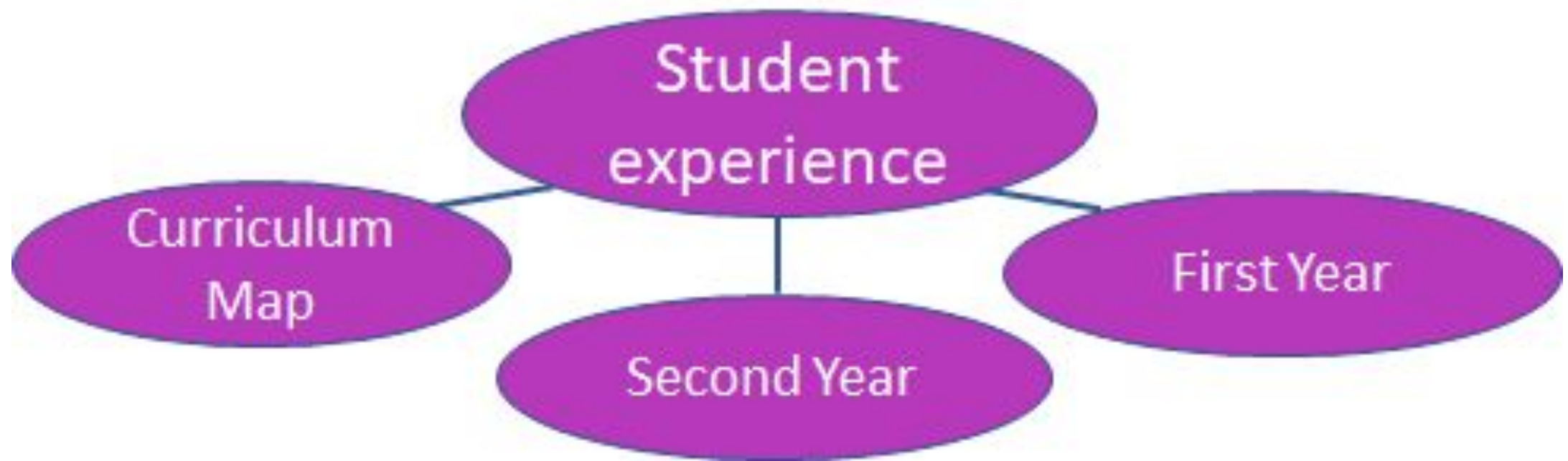
Second Tier

Culture Change



**Building
Community**







Do you think first year students be considered part of the physics community?

- A) Yes**
- B) No**
- C) Sometimes**



Students choose an option





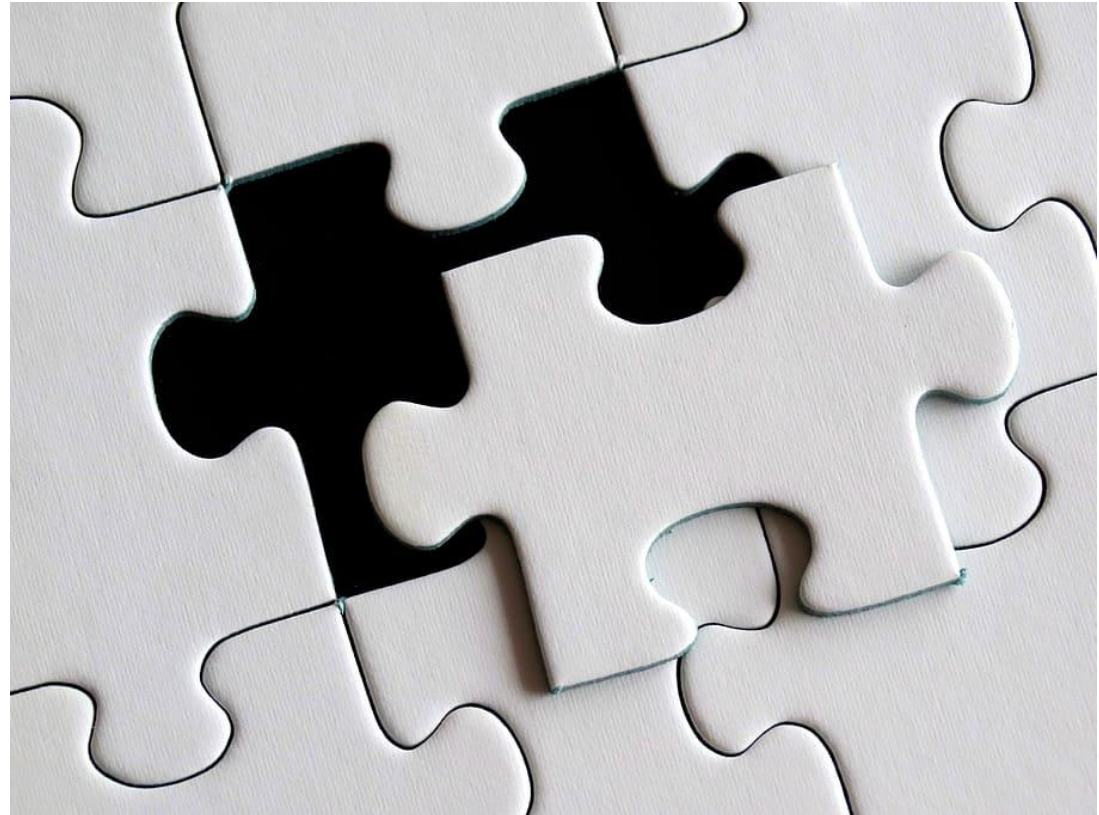
Question: Do you have concerns about any of these strategies? What would you be comfortable (or uncomfortable) trying in your department?

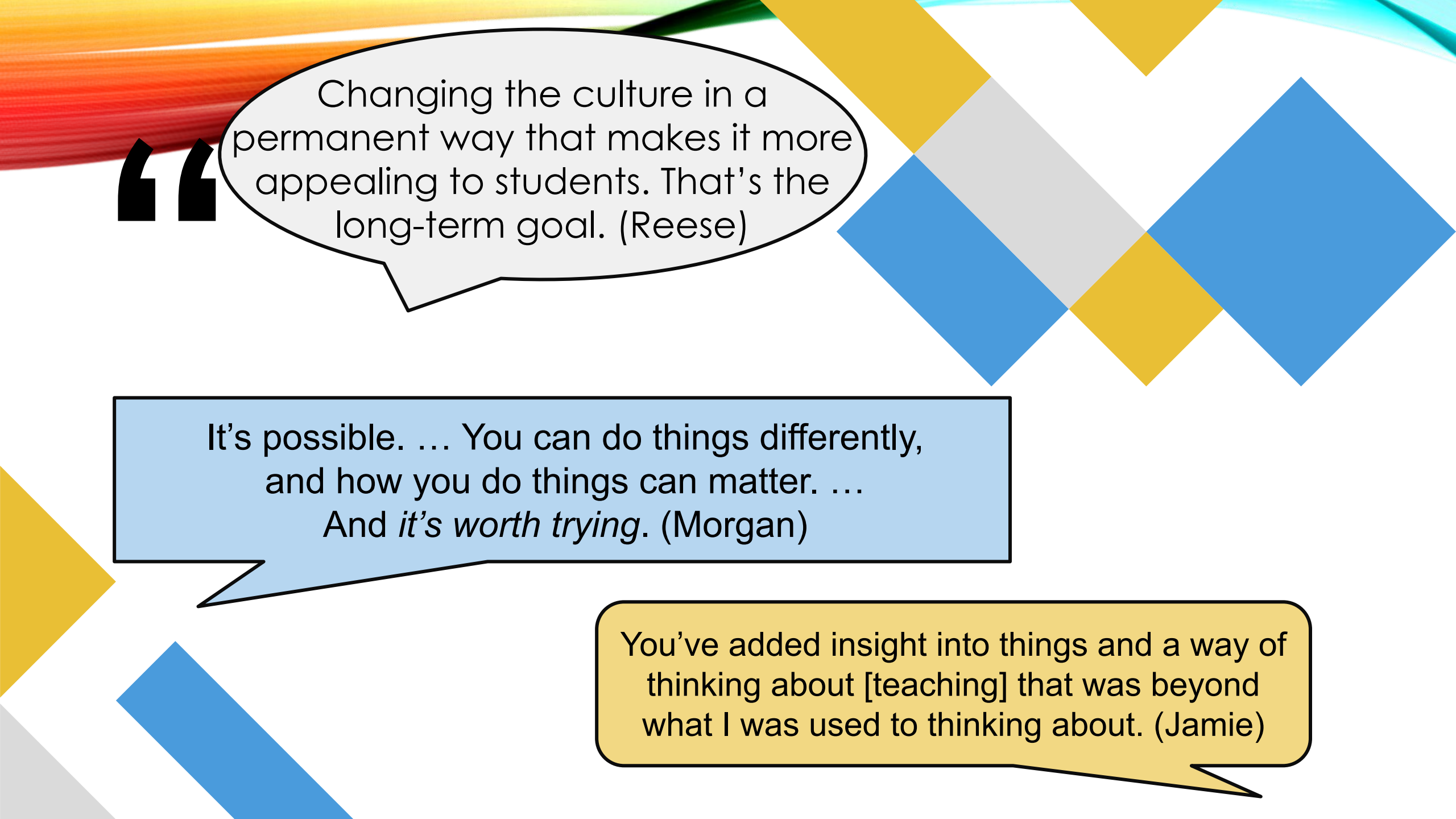


Students, write your response!

Physics identity (Hazari et al., 2010; 2020)

- Competence
- Performance
- Interest
- **RECOGNITION**





“ “ Changing the culture in a permanent way that makes it more appealing to students. That’s the long-term goal. (Reese)

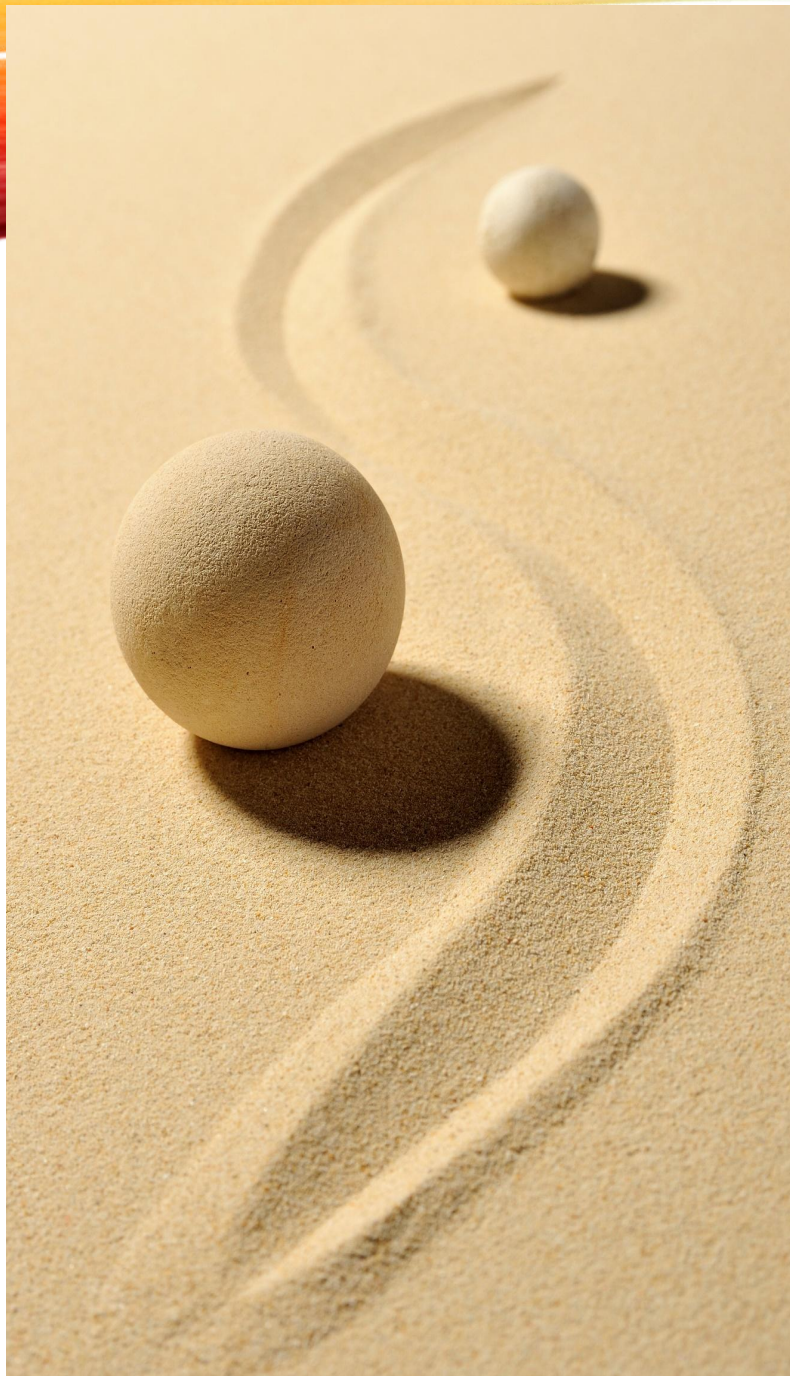
It’s possible. ... You can do things differently, and how you do things can matter. ...
And it’s worth trying. (Morgan)

You’ve added insight into things and a way of thinking about [teaching] that was beyond what I was used to thinking about. (Jamie)



Cultural change in physics is ...

- ▶ Necessary
- ▶ Possible
- ▶ Complex
- ▶ Long-term
- ▶ Easier with expert support



Limitations and future research

-
- Students
 - Professors
 - Host site
 - Timing
-

Sudbury · Audio

Nobel Prize winner says Laurentian's physics program cut means losing great minds, research funds



Sudbury school's profs played big role in Nobel work at underground science facility SNOLAB, Art McDonald says

CBC News · Posted: Apr 23, 2021 4:00 AM ET | Last Updated: April 23, 2021



THANK YOU

- To the professors and students who participated in this research.
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THANK YOU AND DISCUSSION

Laura.Stiles-Clarke@smu.ca

STUDENT DATA – GENDER DIFFERENCES IN EXPERIENCE (MALE VS. FEMALE RESPONDENTS)

	Question	p value
1	How welcome do you feel in the physics department?	8×10^{-5}
2	To what degree do you feel you belong in the physics department?	4×10^{-12}
3	Overall, how comfortable do you feel with your classmates in your current physics course(s)?	5×10^{-6}
4	Overall, how comfortable do you feel in your relationships with professors that you know in the physics department?	1×10^{-3}
5	Overall, how comfortable do you feel in your relationships with other physics department staff that you know?	3×10^{-8}
8	To what degree do you feel that your current physics classmates would like you to continue in physics after this course?	2×10^{-6}
9	To what degree do you feel that your current physics professor(s) would like you to continue in physics after this course?	1×10^{-4}