Canadian Consortium of Science Equity Scholars

Enhancing Equity in Science Education

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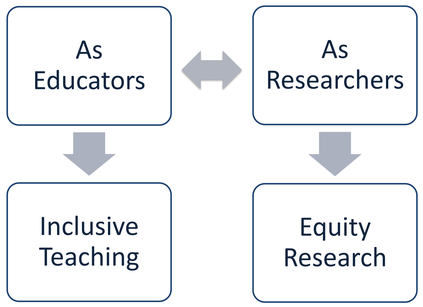
Project Goals

Improve equity in university-level science courses to better support all students, especially those who are historically or current underrepresented.

A National Consortium to Improve Equity in University Science Courses

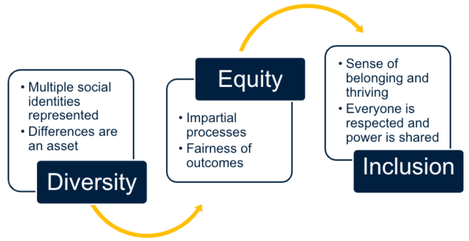


By working together, we can:

- Cultivate a national community of science equity scholars and facilitate continued research and innovation
- Obtain a large set of data to identify how an inclusive course climate – or the lack thereof – impacts students' sense of belonging across science courses, institutions, and sociodemographic groups
- Disentangle institutional, disciplinary, and instructional effects
- Publish validated instruments to measure perceptions of inclusive classroom climate, sense of belonging (social and disciplinary), and equitable teaching practices

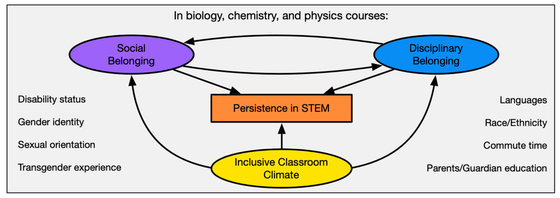
Together we can thoroughly understand drivers of post-secondary STEM course equity in Canada and address inequities.

Framing: Critical Theories



Educational inequities are often referred to as "achievement gaps", which promotes a deficit model.[1] Critical approaches reframe "gaps" as "societal debts".[2] Key to this approach is grounding the research in the lived experiences of students and their relationship with the system.

Sense of Belonging, Classroom Climate & Student Persistence

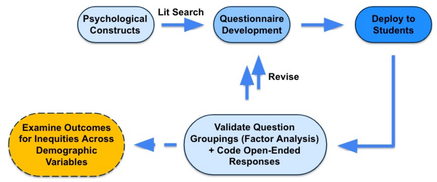


Research has shown that persistence in a field is related to both social[3] and disciplinary[4] belonging. Studies also indicate the importance of attention to the classroom environment in supporting sense of belonging for students.[5-10]

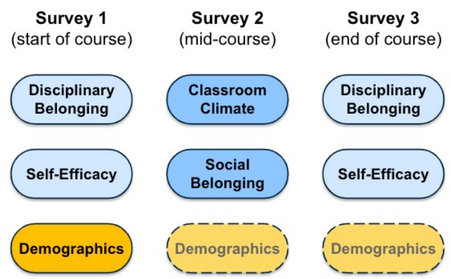
Classroom climate plays an important role in how students experience science courses and offers a strong potential lever for change.

Measurement Tools

Research Instrument Development[11]



Survey Deployment



Disciplinary Belonging[4]

Perceiving oneself as a valued, accepted, and legitimate member of an academic domain

Social Belonging[12]

Relating to peers in the course, the extent to which an individual feels:

- Secure, accepted, included, valued and respected by the group
- Connected with or integral to the group
- That professional/personal values align with those of the group

Classroom Climate

Measures inclusive classroom climate including:

- Instructor's high regard for students
- Support for diverse learning needs
- Barriers to connecting with peers/instructor

Self Efficacy[13]

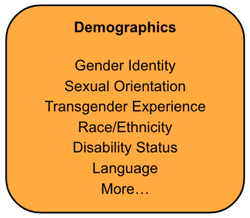
The belief in one's capability to complete a particular task:

- Influences choices and effort related to learning
- Directs engagement, which influences learning

Sociodemographic variables

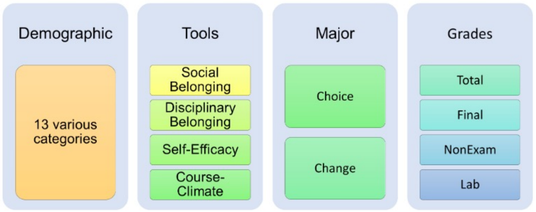
Categories are social constructs, not indicators of "innate differences" / "biological differences."

There is a great deal of variability within groups.



Fall 2022 Data

- 4 schools: UBC, UCalgary, UofT, YorkU
- 7241 students participated: UBC (n=2666), UCalgary (107), UofT (3121), YorkU (1527)
- 3 disciplines: Chemistry, Biology/Ecology, and Physics
- 3 surveys: pre, mid, post



Ongoing Activities

- Answering research questions about course climate and sense of belonging
- Creating detailed instructor reports
- Facilitating reflection on the instructor reports to enact inclusive teaching

References

1. Traxler, A. L., Cid, X. C., Blue, J., & Barthelemy, R. (2016). Enriching gender in physics education research: A binary past and a complex future. Physical Review Physics Education Research, 12(2), 1–15.
2. Ladson-Billings, G. (2006). From the Achievement Gap to the Education Debt: Understanding Achievement in U.S. Schools. *Educational Researcher*, 35(7), 3–12.
3. Banchefsky, S., Lewis, K. L., & Ito, T. A. (2019). The role of social and ability belonging in men's and women's pSTEM persistence. Frontiers in Psychology, 10, 2386.
4. Lewis, K. L., Stout, J. G., Finkelstein, N. D., Pollock, S. J., Miyake, A., Cohen, G. L., & Ito, T. A. (2017). Fitting in to move forward: Belonging, gender, and persistence in the physical sciences, technology, engineering, and mathematics (pSTEM). Psychology of Women Quarterly, 41 (4), 420-436.
5. Killpack, T. L., & Melón, L. C. (2016). Toward inclusive STEM classrooms: what personal role do faculty play?. CBE—Life Sciences Education, 15 (3), es3.
6. Tanner, K. D. (2013). Structure matters: twenty-one teaching strategies to promote student engagement and cultivate classroom equity. CBE—Life Sciences Education, 12 (3), 322-331.
7. Ovid, D., Rice, M. M., Luna, J. V., Tabayoyong, K., Lajevardi, P., & Tanner, K. D. (2021). Investigating Student Perceptions of Instructor Talk: Alignment with Researchers' Categorizations and Analysis of Remembered Language. CBE—Life Sciences Education, 20(4).
8. Kalender, Z. Y., Marshman, E., Schunn, C. D., Nokes-Malach, T. J., & Singh, C. (2019). Gendered patterns in the construction of physics identity from motivational factors. Physical Review Physics Education Research, 15 (2), 020119.
9. Walton, G. M., & Cohen, G. L. (2007). A question of belonging: race, social fit, and achievement. Journal of Personality and Social Psychology, 92 (1), 82.
10. Walton, G. M., & Cohen, G. L. (2011). A brief social-belonging intervention improves academic and health outcomes of minority students. Science, 331 (6023), 1447-1451.
11. Carpenter, S. (2018). Ten Steps in Scale Development and Reporting: A Guide for Researchers. *Communication Methods and Measures*, *12*(12), 25–44. http://doi.org/10.1080/19312458.2017.1396583
12. Lewett-Jones, T., & Lathlean, J. (2008). *Nurse education in practice*, 8(2), 103-111
13. Pintrich, P. R. (1991). A manual for the use of the Motivated Strategies for Learning Questionnaire (MSLQ).

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