

Sense of Belonging of Undergraduate Students in the College of Science: Does Confidence in Mathematical Ability matter?

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Sense of Belonging or Belongingness

- A personal belief that one is an accepted member of an academic community whose presence and contributions are valued.
- Belongingness is associated with progression, motivation, achievement, persistence, retention and student well being.
- Belongingness has been shown to vary with gender, race, nationality, LGBTQIA+, socio-economic status, religion, disability, and other factors.

Sense of Belonging Survey

- Conducted with ethical approval from UCD Human Research Ethics committee.
- Undergraduate students from seven Schools (faculties) in the College of Science.
- Survey questions are adapted from the “Math Sense of Belonging Scale” [1]
 - 18 positively framed and 12 negatively framed questions.
 - Participants rated their agreement on an 8-point scales.
 - 1:Strongly Disagree to 8: Strongly Agree.
- Responses gathered via a Google form.
- Advertised on Brightspace (VLE), student social media groups, student societies and clubs, etc.

[1] “Math Sense of Belonging Scale”, Good, C., Rattan, A., & Dweck, C. S. (2012).

As a student in the UCD College of Science

1: strongly disagree; 8: strongly agree

18 positively framed questions:

- I feel valued.
- I feel accepted.
- I feel respected.
- I enjoy being an active participant.
- I trust the testing materials to be unbiased.
- I have trust that I do not have to constantly prove myself.
- trust my instructors to be committed to helping me learn.
- Even when I do poorly, I trust my instructors to have faith in my potential.
- ...

12 negatively framed questions:

- I feel excluded.
- I feel neglected.
- I feel disregarded.
- I feel like an outsider.
- I wish I could fade into the background and not be noticed.
- I try to say as little as possible.
- I wish I were invisible.
- ...

Other questions include

- What is your gender?
- How do you define your race/ethnicity?
- Do you identify as part of a minority in the College of Science?
- If so, what minority do you identify with?

Other questions include

- How much do you enjoy problem solving?
- How confident were you in your maths abilities before joining UCD Science?
- How confident are you in your maths abilities now?
- How much do you interact socially with other students in your school?
- Are you a member of any UCD clubs or student societies, for example, Women@STEM, Women@CompSci, UCD Biological Society, International Students Society, LGBTQ+ Society?

Two additional open ended questions

- Is there anything that has positively or negatively impacted your Sense of Belonging to your School and/or the College of Science?
- Are there ways that you think that Sense of Belonging might be improved in your School and/or the College of Science?

UCD School of Computer Science – Pre-pandemic

- Lower Sense of Belonging in minoritised women.
- Non-minoritised women had a Sense of Belonging comparable to non-minoritised men.
- Women involved in networking, outreach, and mentoring activities had a higher Sense of Belonging.

Catherine Mooney, Anna Antoniadis, Ioannis Karvelas, Lána Salmon, and Brett A. Becker. 2020. Exploring Sense of Belonging in Computer Science Students. In Proceedings of the 2020 ACM Conference on Innovation and Technology in Computer Science Education (ITiCSE '20).

Catherine Mooney and Brett A. Becker. 2020. Sense of Belonging: The Intersectionality of Self-Identified Minority Status and Gender in Undergraduate Computer Science Students. In United Kingdom & Ireland Computing Education Research conference. (UKICER '20).

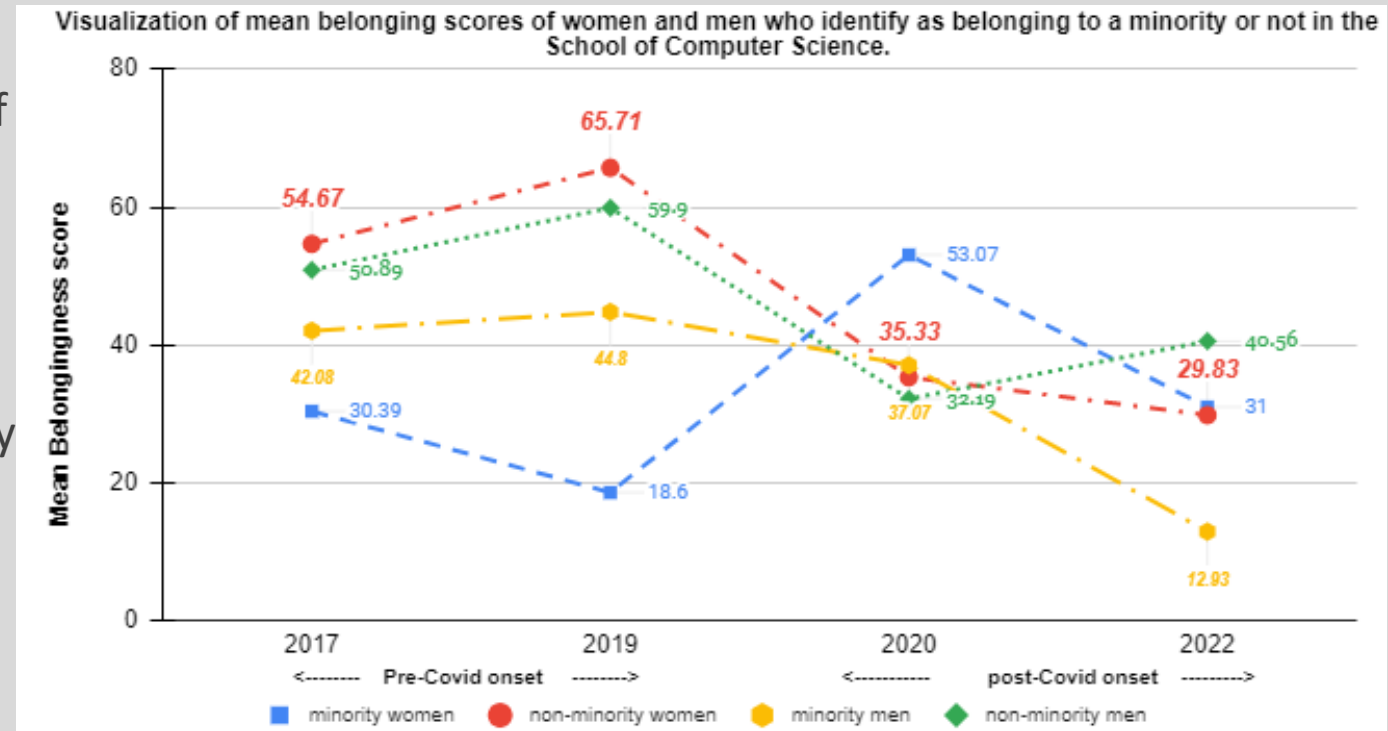
UCD School of Computer Science – Post-pandemic onset

- Investigated the impact of the pandemic on Computer Science students Sense of Belonging (August 2020).
- Provided evidence that the shift from in-person to remote learning dramatically affected the Sense of Belonging of CS students.
- This effect varied between genders and whether students self identified as being minoritised.

Catherine Mooney and Brett A. Becker. 2021. Investigating the Impact of the COVID-19 Pandemic on Computing Students' Sense of Belonging. In Proceedings of the 52nd ACM Technical Symposium on Computer Science Education (SIGCSE '21)

Changes in belongingness from 2017-2022

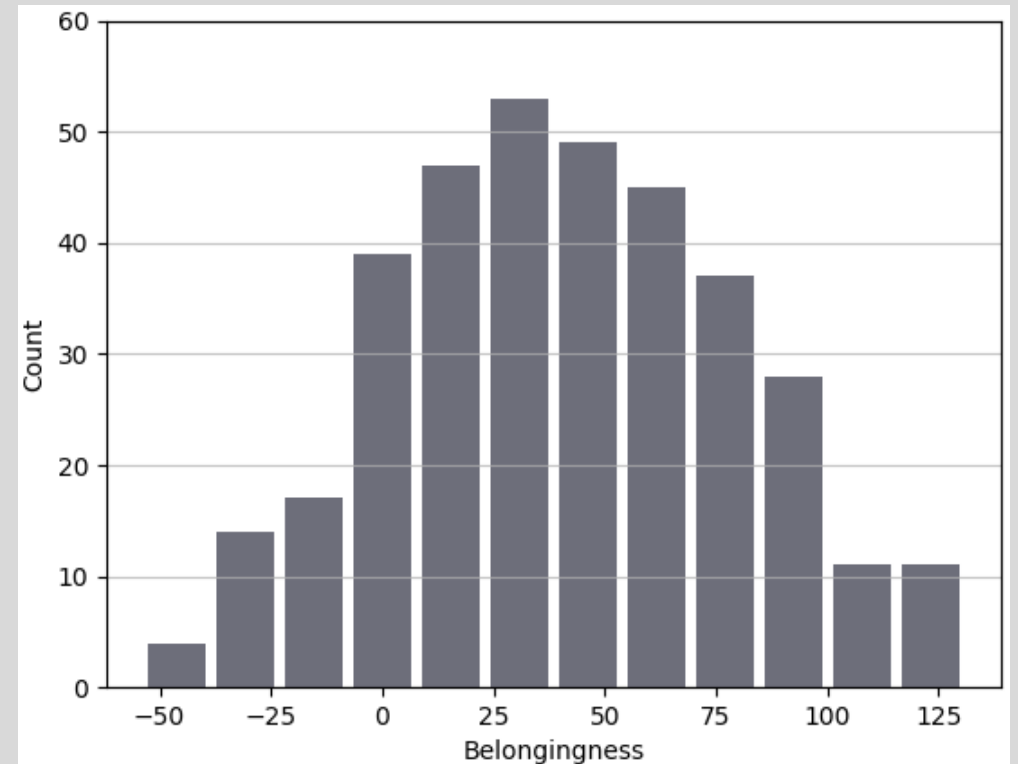
- Pre-COVID, women identifying as being minoritised had the lowest belongingness of all students, this increased when teaching moved online, and dropped again after returning to campus.
- Non-minoritised women had a very similar belongingness to non-minoritised men, although they have slightly diverged recently
- Most recently, a dramatic and statistically significant decrease in the belongingness of minoritised men.

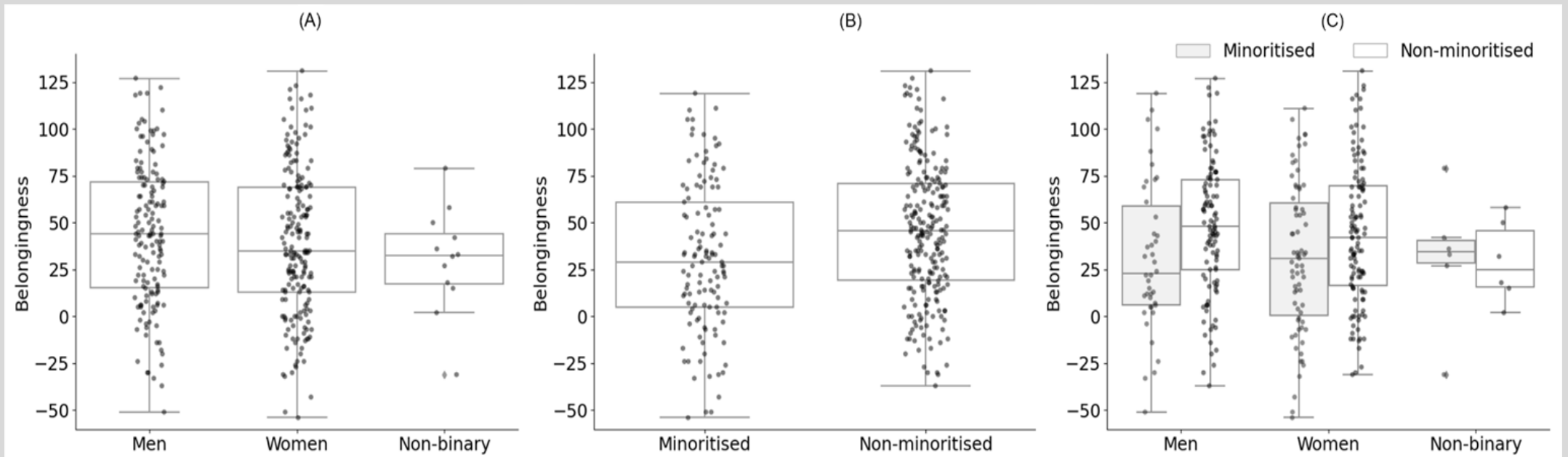


Shamima Nasrin Runa, Brett A. Becker, and Catherine Mooney. 2022. Variations in Sense of Belonging in Undergraduate Computing Students Through the COVID-19 Pandemic. In Proceedings of the 2022 Conference on United Kingdom & Ireland Computing Education Research (UKICER '22).

UCD College of Science – January 2022

- 378 students completed the survey; 355 valid responses. Population ~2,000; response rate ~19%
- 54% identified as women (W), 43% as men (M), 3% as non-binary (NB) and ~1% preferred to not disclose (ND).
- 34% of students identified as minoritised and 64% as non-minoritised
- Belongingness scores can range from -78 to 132, with a midpoint of 27. The mean for all students is 40.9.





- There is no statistically significant difference in the sense of belonging between students who self-identify as men, women, or non-binary (one-way ANOVA $F(2,350) = 1.036$, $p = 0.356$).
- Minoritised students have a statistically significantly lower belongingness ($t(227.05) = -3.22$, $p < 0.001$).
- Minoritised men and women have a statistically significantly lower mean belonging compared to non-minoritised men and women ($t(68.113) = -2.334$, $p = 0.022$ and $t(140.44) = -2.186$, $p = 0.030$, respectively).
- Non-minoritised women have a very similar mean belongingness to non-minoritised men.

(A)

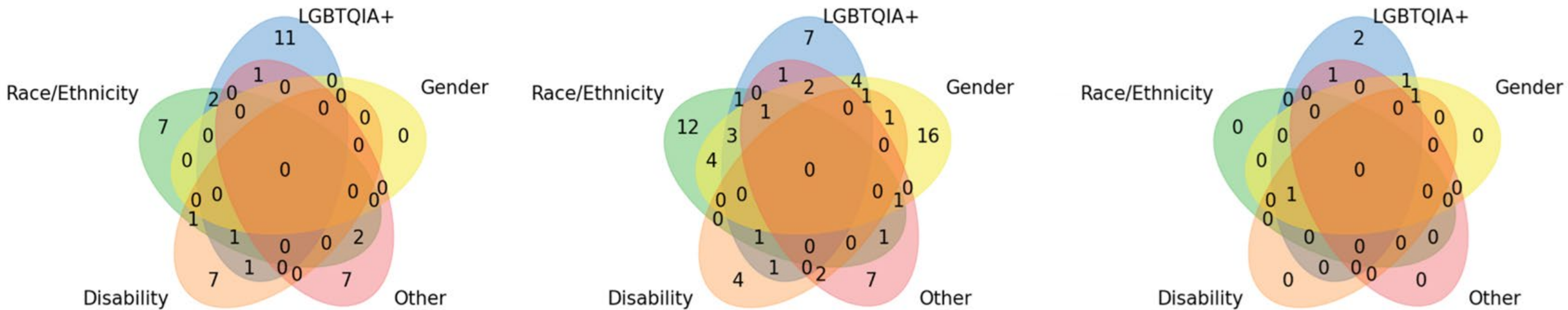
Men

(B)

Women

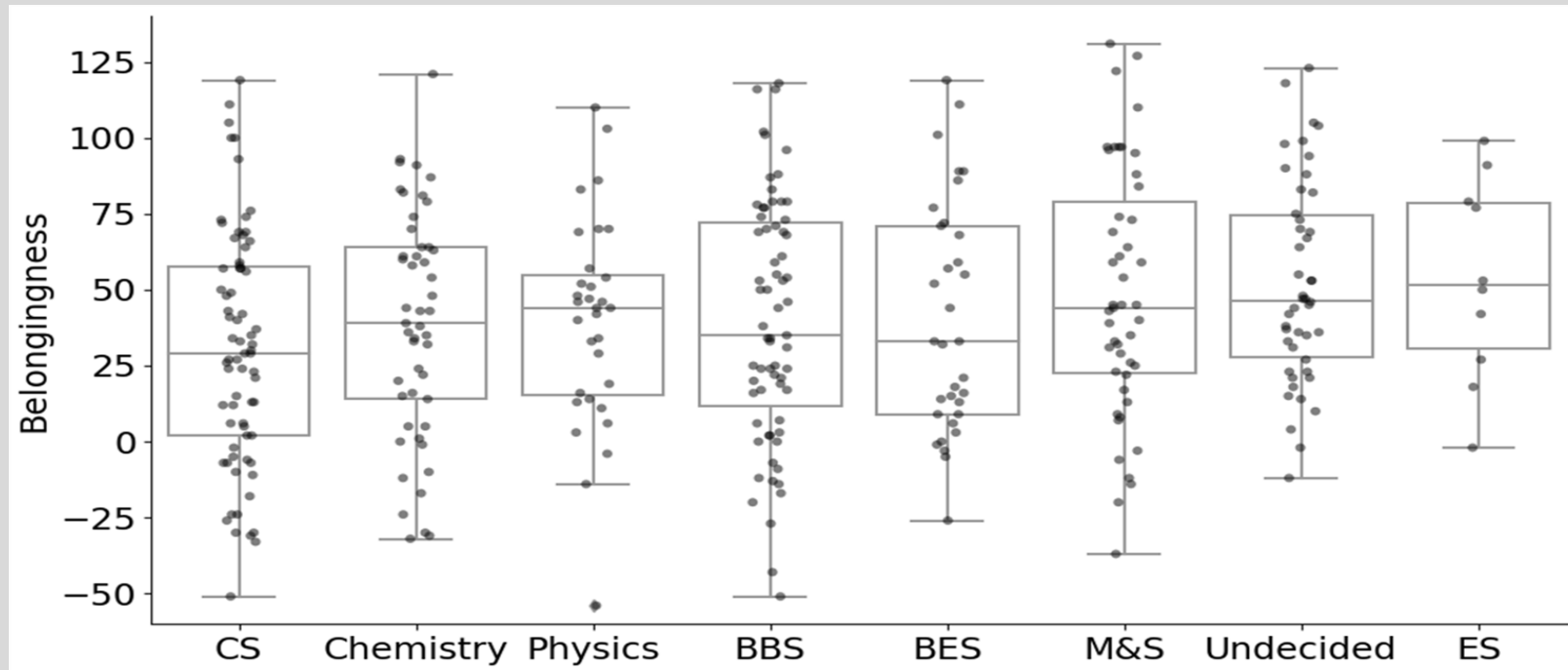
(C)

Non-binary



- Men: 29% identified as minoritised, none due to their gender.
- Women: 37% identified as minoritised.
- 46% identified as minoritised due to their gender and 23% stated that the only reason they were minoritised was their gender.
- ‘Other’ reasons included being a mature students, being religious and socio-economic background.

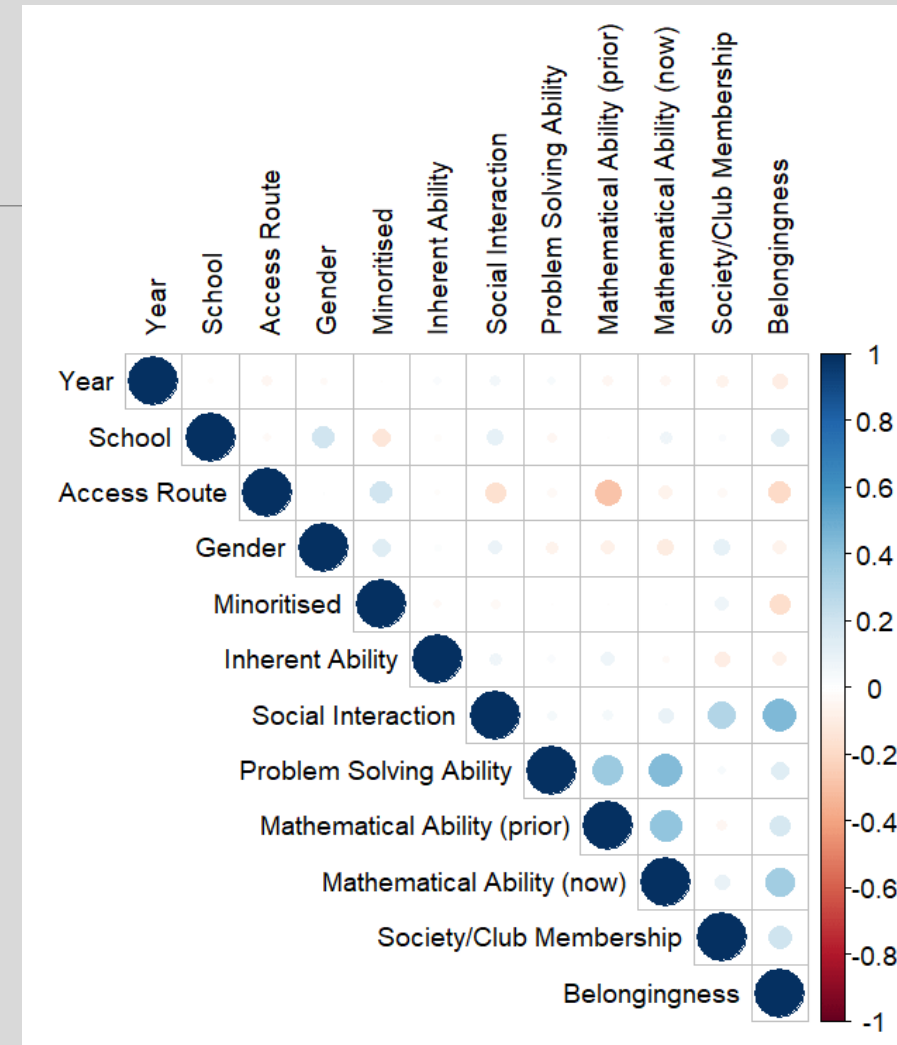
SoB Across Schools



- A one-way ANOVA revealed that there was not a statistically significant difference in belongingness between students in the seven schools or undecided students ($F(7, 347) = 1.759, p = 0.094$).

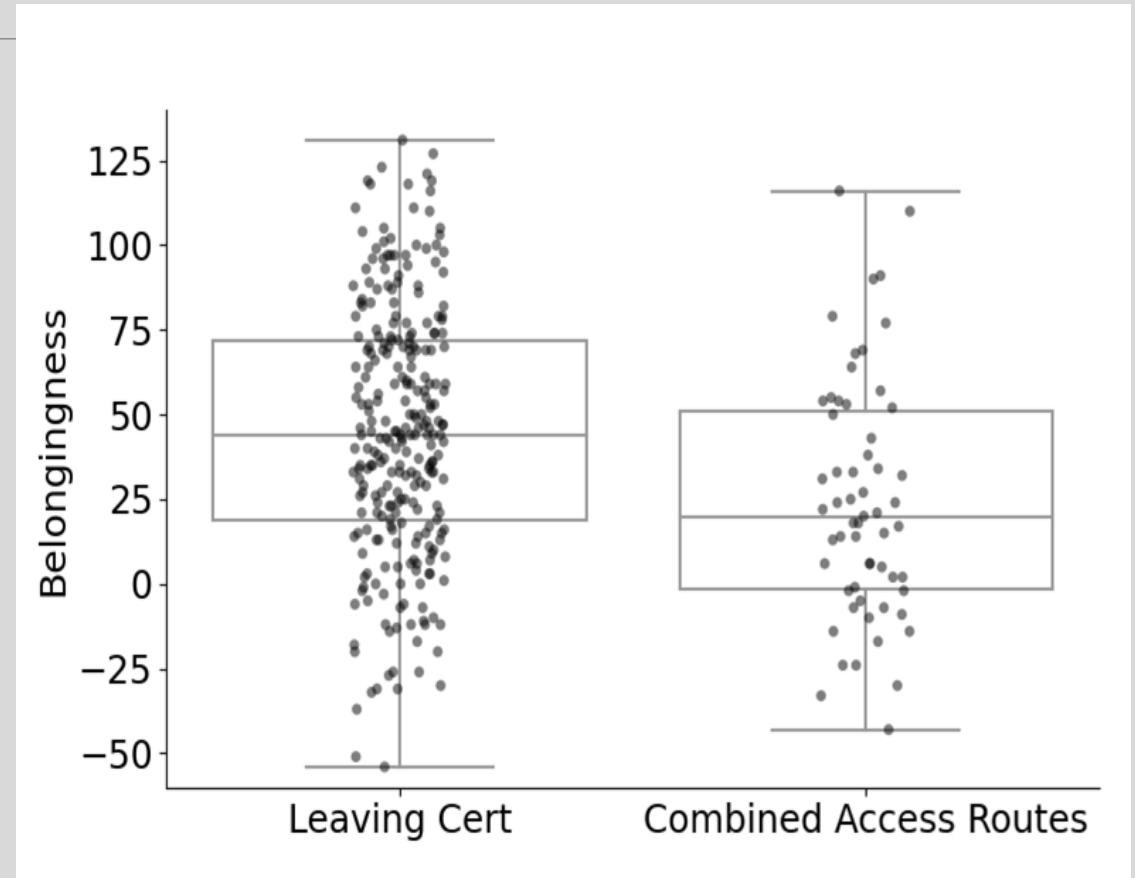
Factors correlated with SoB

- Most positively correlated with belongingness: social interaction, mathematical ability (now), society/club membership, mathematical ability (prior).
- Most **negatively** correlated with belongingness: **access route**, minoritisation

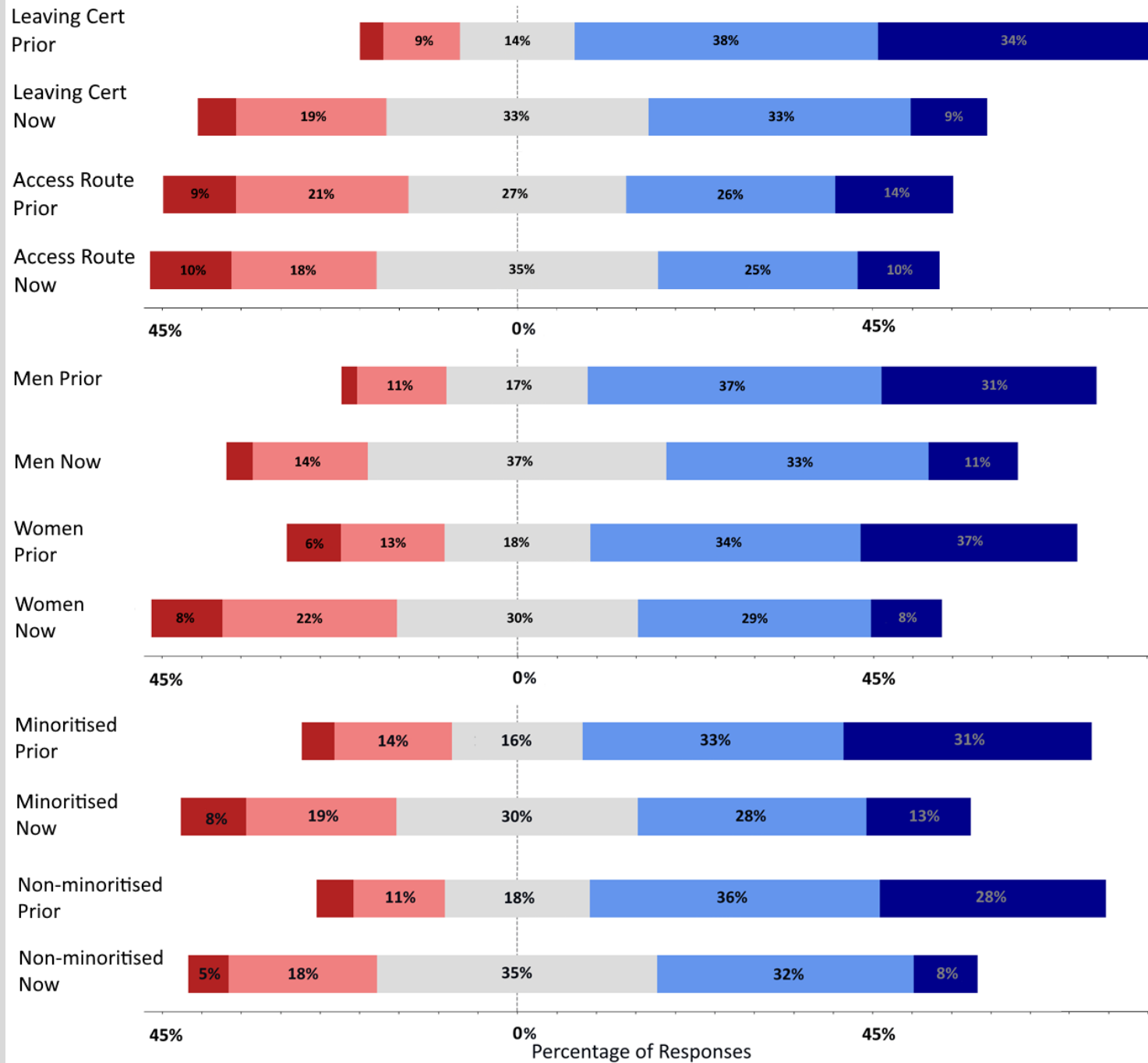


Entry pathways

- Students who entered the College via the Leaving Certificate (N=268, M=45.1) have a statistically significantly higher ($p < 0.0001$) belongingness compared to students who entered via Access Routes (N=59, M=24.4)
- UCD access routes:
 - QQI-FET
 - Mature Applicant
 - Higher Education Access Route (HEAR)
 - Disability Access Route to Education (DARE)
 - UCD University Access Courses
 - UCD Open Learning Certificate



Students' Reported Confidence in Maths Ability



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Thanks! Questions?

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