How Do We Make Our Teaching Labs More Inclusive?

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Layout of Presentation

Challenges in the Chemistry Lab

Physiological

- Hunger
- Thirst
- Exhaustion

Sensory Inputs

- Smells
- Noise
- Touch

Communication

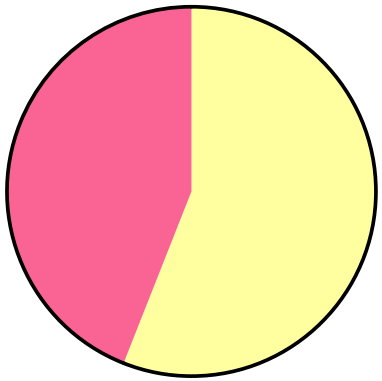
- Instruction Comprehension
- Students' capacity to take breaks

Anxiety

- Assessment Anxiety
- Anxiety regarding Chemicals
- Social Anxiety

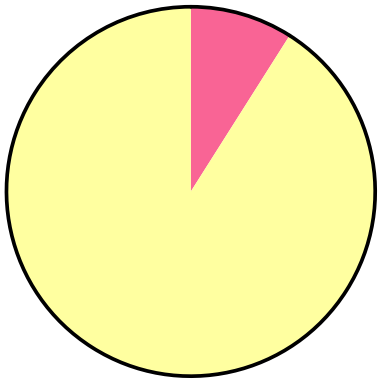
The ‘Leaky Pipeline’

Undergraduate Students



Male
Female

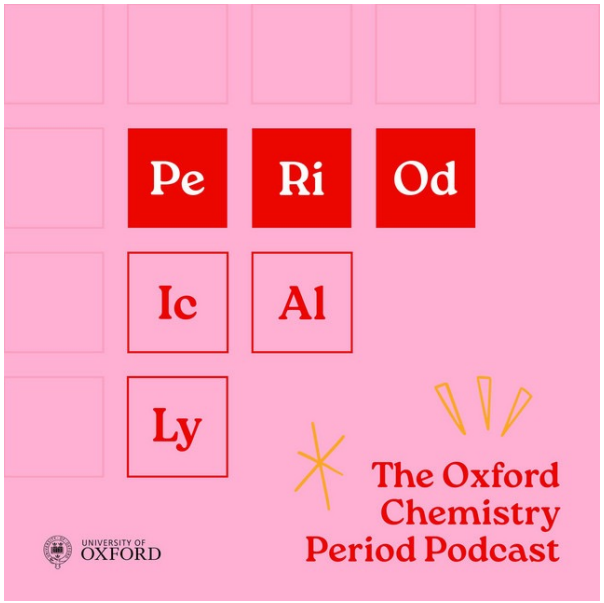
Professors



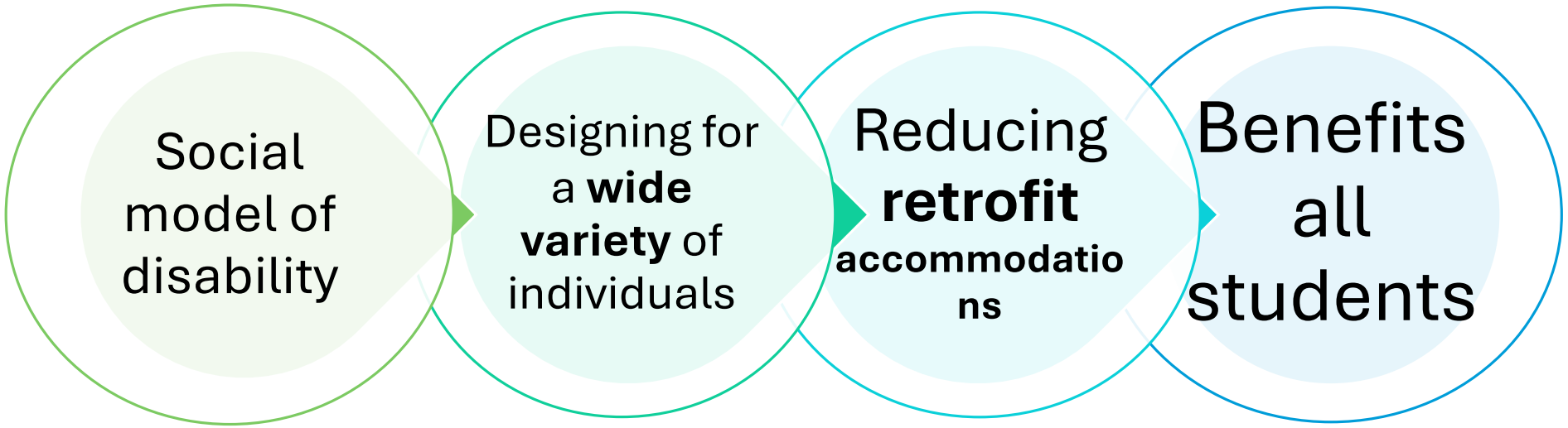
Female
Male

Present for other minorities too, including disabled scientists.

*Data from ‘Breaking The Barriers’ RSC Report



Inclusive Design



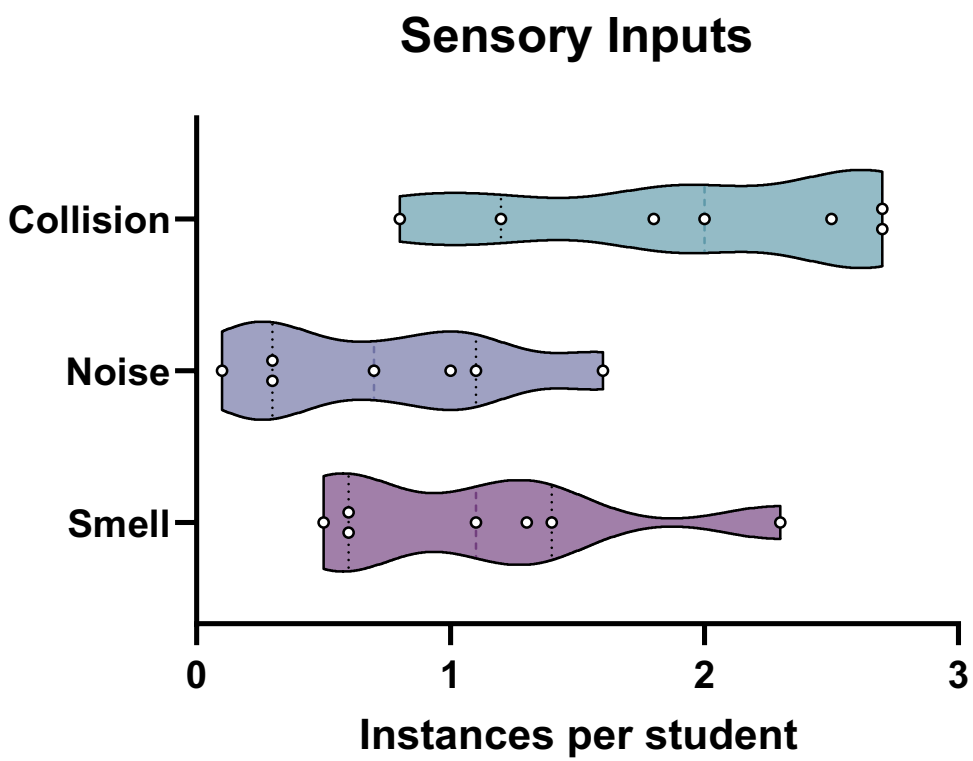
T. Siebers, Disability Theory, University of Michigan Press, 2008
M. O. Ojezele et al. , Ethiop J Health Sci, 2022, **32**, 681–688.

Research Overview

Part 1: Shadowing in the Laboratory

Part 2: Survey

- **Self- efficacy**
- Frequency of **Physical Hindrances**
- Effects of **Menstruation**
- **Disability** and its disclosure



- **Each dot represents one day.** This means one group of students completing one practical
- Instances of all sensory input **varied** dependent on the practical.
- But every day some students were working in **busy, noisy, smelly environments.**

Sound	Smell	Touch
Fume hoods	TEMED	Students with needles
Closing Cupboards	Solvents	Polystyrene
Glassware clinking/smashing	Sharpie Pens	Heat guns
Polystyrene box	Coconut Oil	Hand in water when using bomb calorimeter
Filling N_2 balloons /using N_2 taps	Flame of Bunsen burner	Gloves
Heat guns		Heat from Bunsen burner
Hissing from depressurising bomb calorimeter		

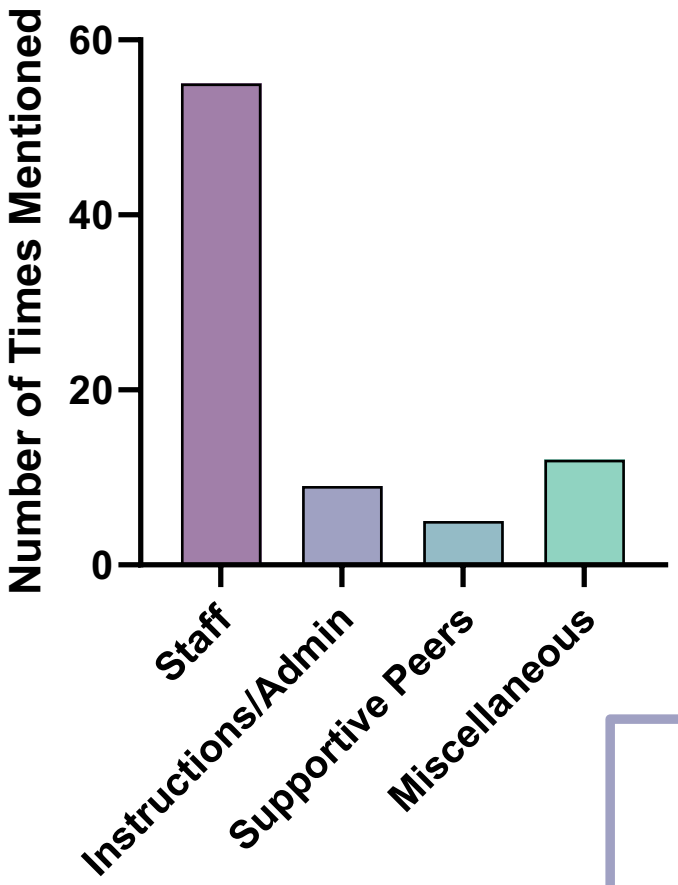
Survey (105 respondents)

*Rounded to 2 sig fig.

	Identify as having a 'disability'	Identify as 'Neurodivergent'	Period in last 12 months
Number	21	25	47
Percentage (%) *	20	24	45

- **~15%** of the total student body
- Respondents could have particularly **strong views**

"In what ways do you feel supported in the lab currently?"

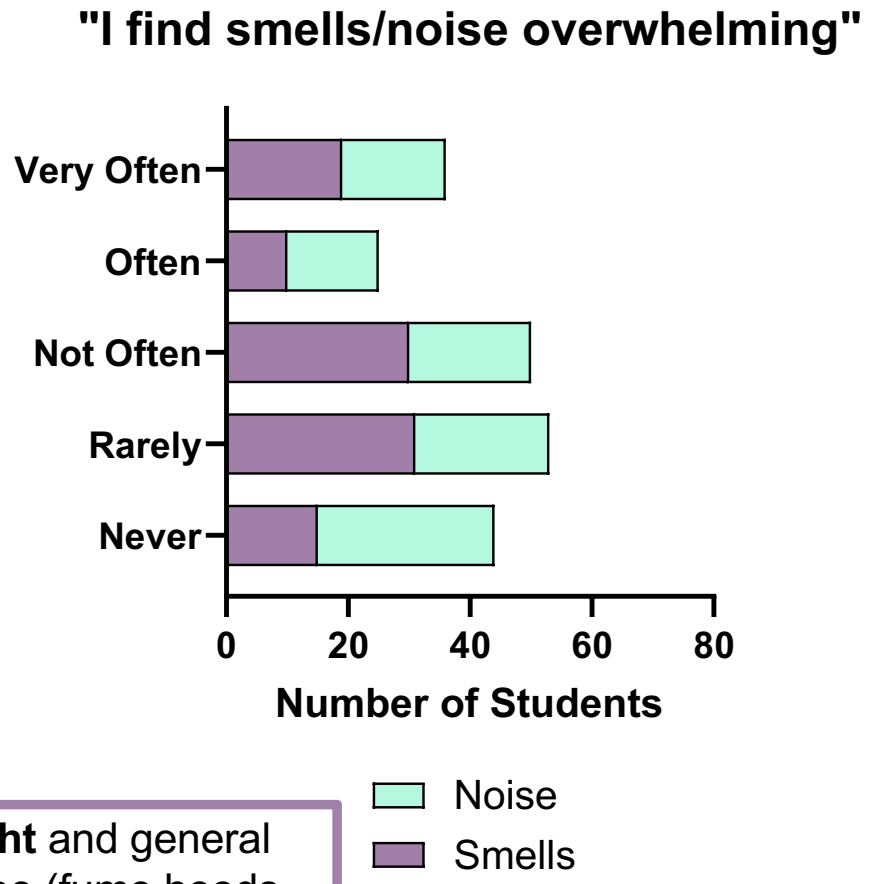


- A good rapport between students and tutors contributes to a **positive learning experience** and can be important in **motivating students.**
- **Clear and concise instructions** can particularly help neurodivergent students navigate their work

"**Some amazing members of staff** in 2nd and 3rd year labs …who are very **supportive**"

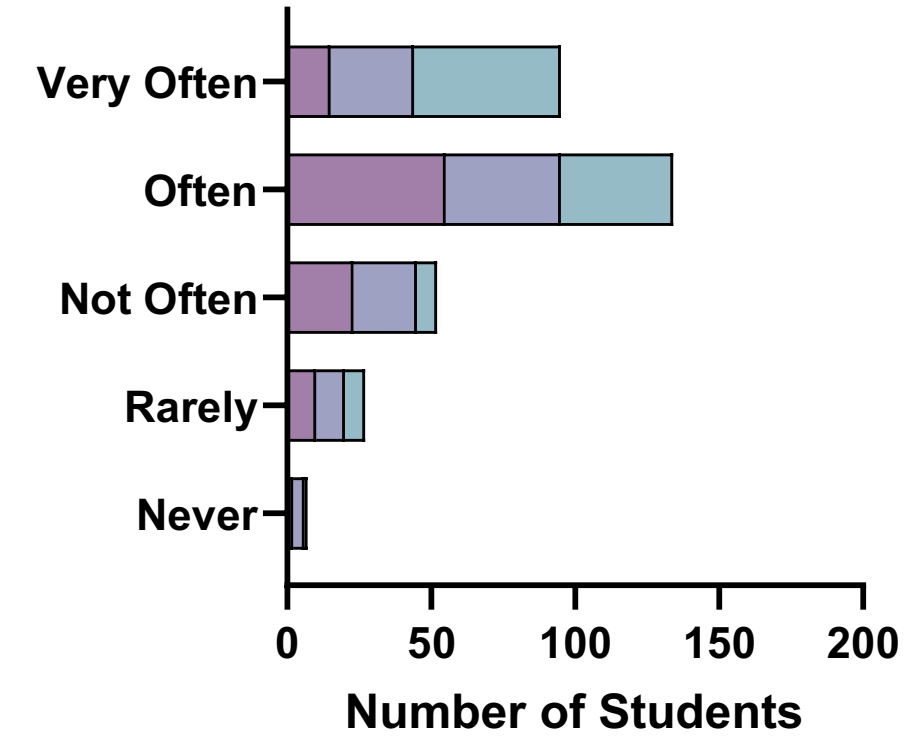
- All individuals can experience **objective sensory overload** e.g. in a hectic environment due to **fatigue, stress**

- **Subjective sensory overload** is individual centred and prominent in disorders such as **ADHD** and **Autism**



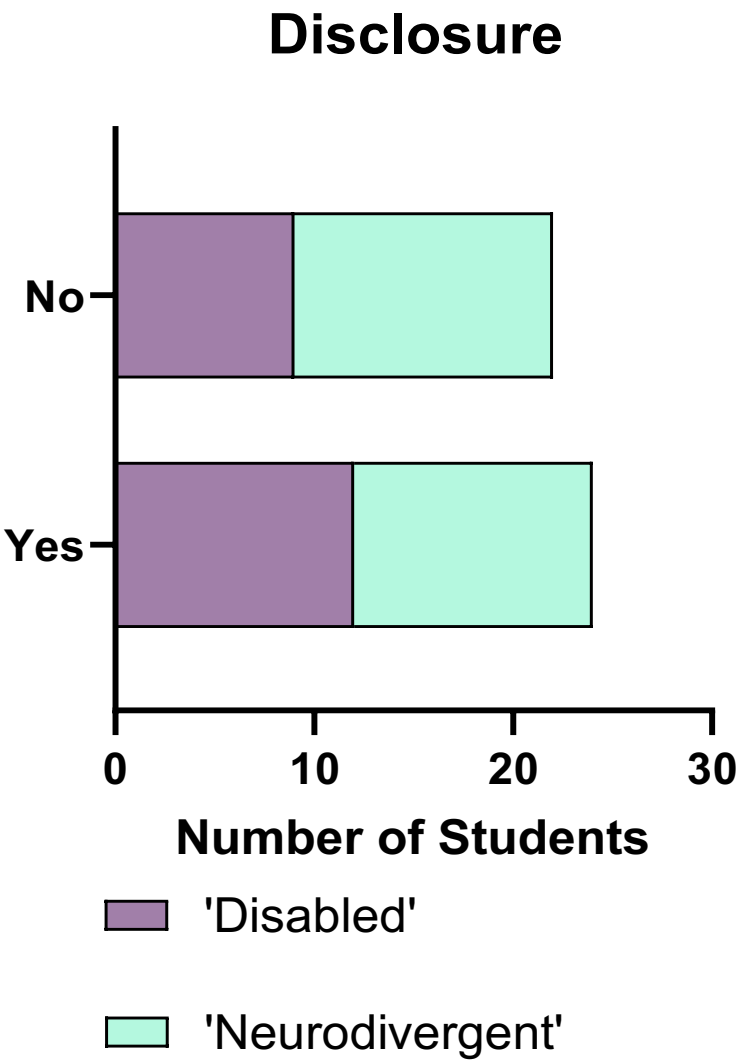
"The **solvent smell**, **bright light** and general high level **of background noise** (fume hoods, other people, other equipment) means I almost always leave the labs with a **headache**."

Physiological Needs



"Sometimes no time for lunch and then concentration dips as 6 hours is too long without any form of break"

Maslow's hierarchy of needs says requirement for **food , water and rest** need to be satisfied for humans to pursue higher level needs such as **knowledge and understanding**.



"I feel as though I can't tell people without having an official diagnosis."

- **48% of responses** to this question said they had **not disclosed** their disability or neurodivergence to the teaching labs.

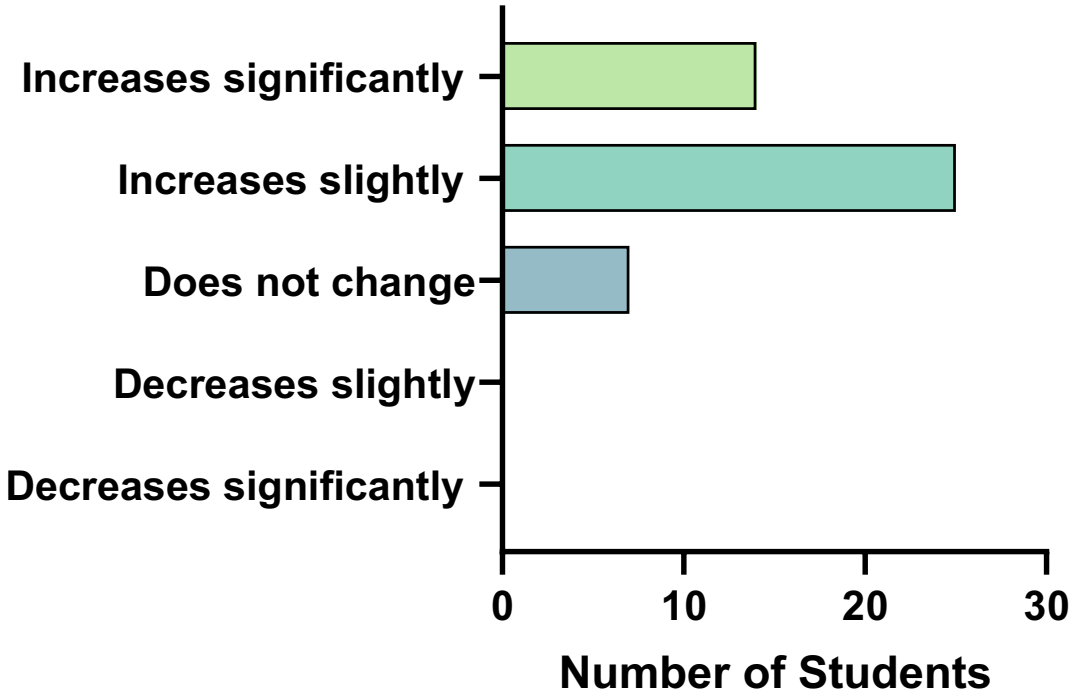
Note: not 48% of students as some identified as 'neurodivergent' and 'disabled'

- Students expressed they didn't know what could be put in place to support them

- The example difficulties that were shown below were experiences such as pain, hunger, thirst, anxiety etc.

"Having to stand up for hours at a time without a seat is extremely tiring and obviously painful."

"During your period how does the extent to which you experience the difficulties (shown below) change?"

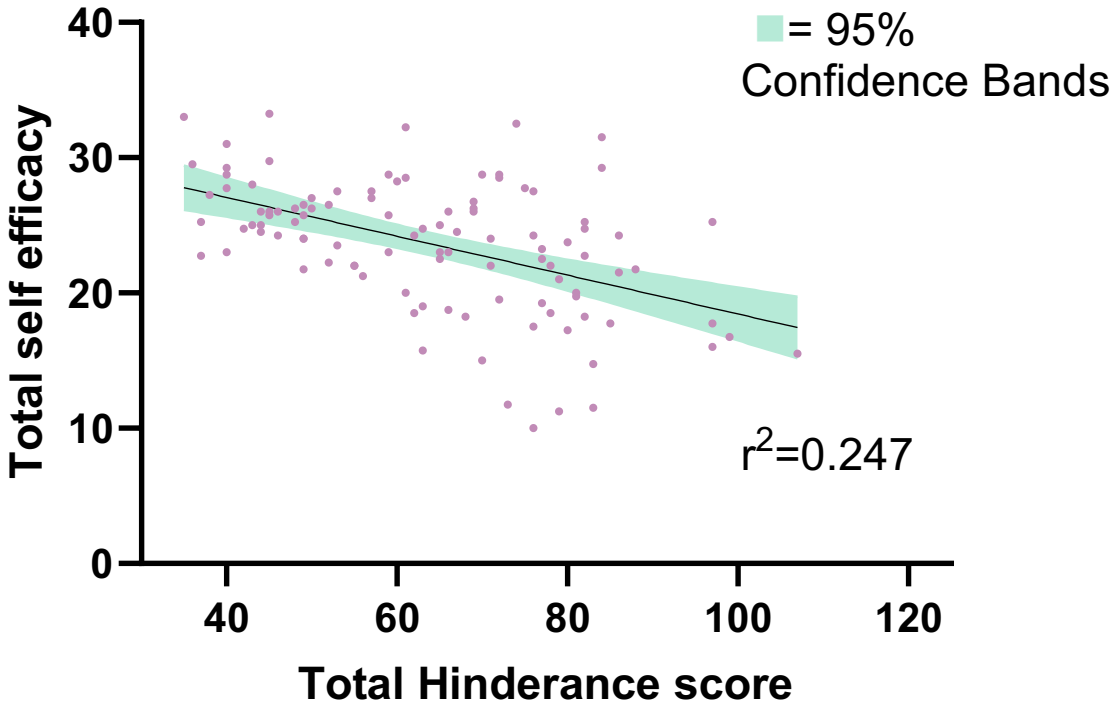


“I might be in pain and **want to leave** but it might be during a part of the lab where **I have to be stood** for a couple of hours. Sometimes [I] get **hot flushes** where I feel **dizzy** but **I can’t sit down** and the tasks become **overwhelming**. [I] Feel **uncomfortable with raising this** as I feel I should just continue but can lead to the labs being unpleasant. The **noise** and the **smells** seem to become more **overwhelming**. Feel worse when I see others getting on where **I am struggling to even think straight.”**

“How does your experience of the Teaching Labs change during your period?”

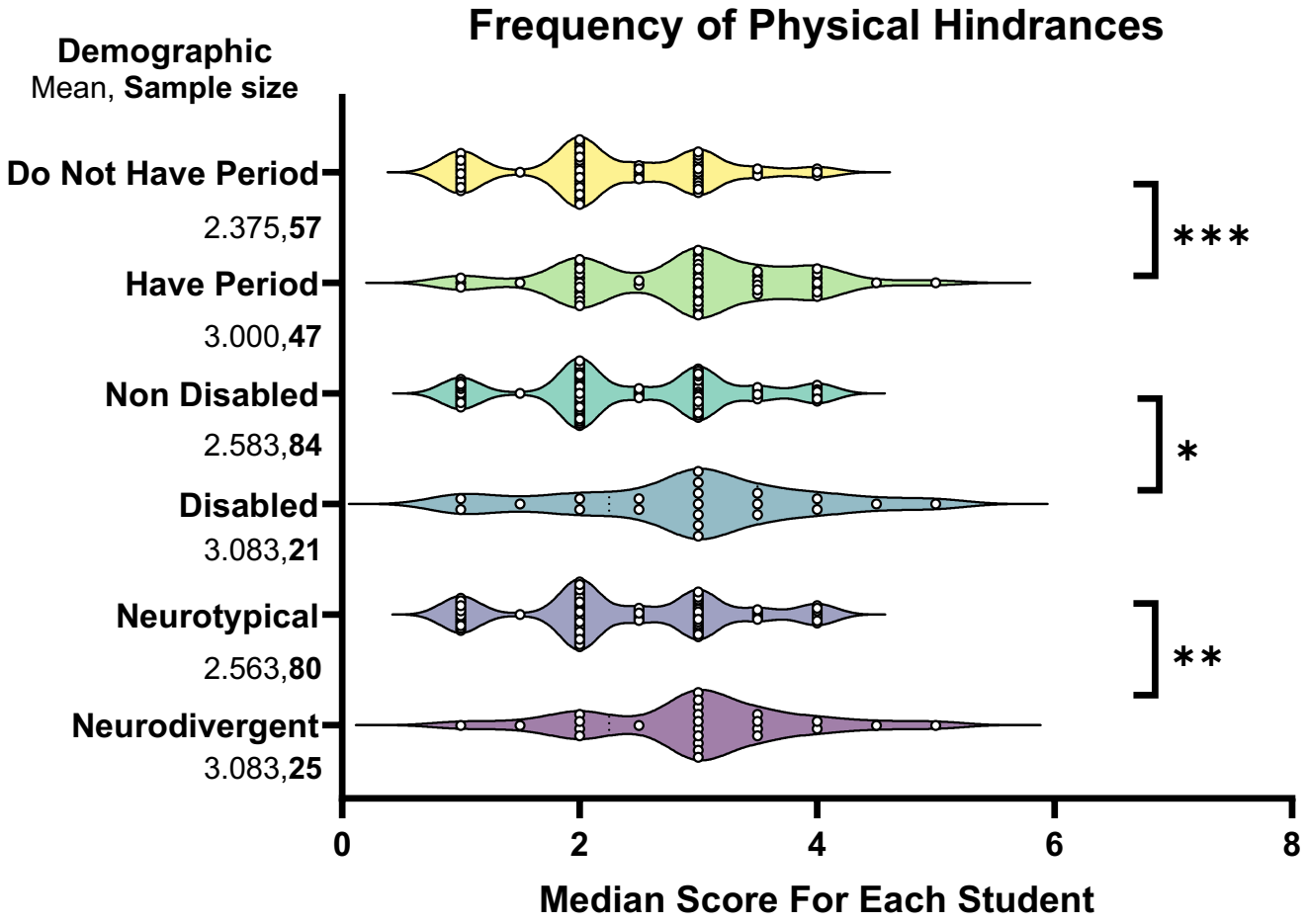
- Pain
- Frequently going to bathroom
- More hunger and thirst
- More fatigue
- Feeling slower
- Less optimism
- More overwhelm
- Nausea
- Exhaustion
- Hot flushes
- Dizziness
- Concentration difficulties
- Feel clumsier
- Increased anxiety
- Social overwhelm
- Need more breaks
- Worry about getting ‘behind’
- More sensitive to light/sound

Hinderance Frequency vs Self Efficacy



Spearman's Correlation Statistics	
r value	-0.4897
P (two tailed)	<0.0001
Sample Size	105

- Students with **high self efficacy** can have an improved academic performance
- It has also been suggested that higher **self efficacy improves persistence in long term academic goals** (e.g. professorship)
- Tentatively, this data suggests there could be a link between **students finding the lab more difficult** and them having **lower self efficacy.**



Mann Whitney U test was used to compare the data sets.
*ns=p>0,05, *=P≤0.05, **=P≤0.01, ***=P≤0.001*

- **No significance** found between the Self-Efficacy of different demographic groups
- But according to this survey, **students with periods** and **neurodivergent/ disabled students** are experiencing statistically **more frequent hinderances in the laboratory**.

Where Next?

- **Dignify** the time and energy designing an delivering practical course by ensuring students are comfortable enough to learn
- A difficult lab experience could be impacting **students' retention** within science
- Could menstruation be a neglected variable in understanding '**Leaky Pipeline**' for women within STEM?