How effective is safety training in undergraduate teaching labs?

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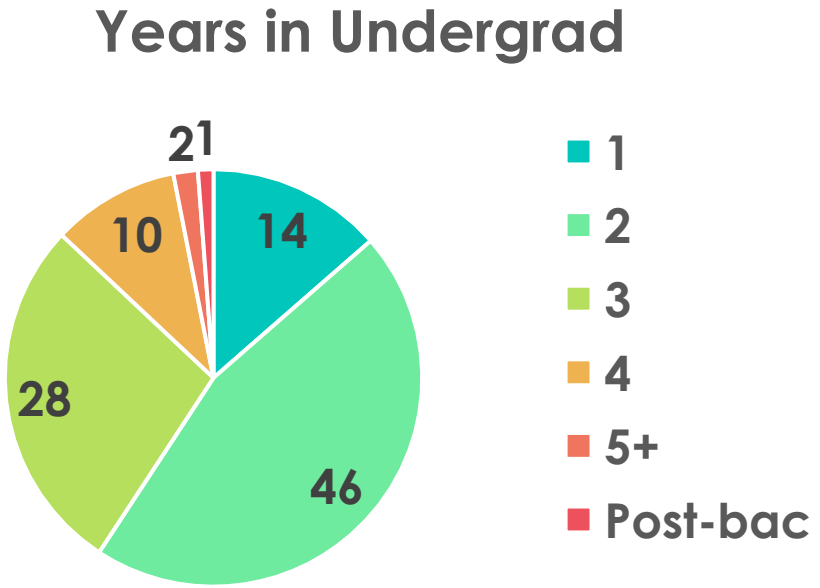
Questions to ask as safety professionals

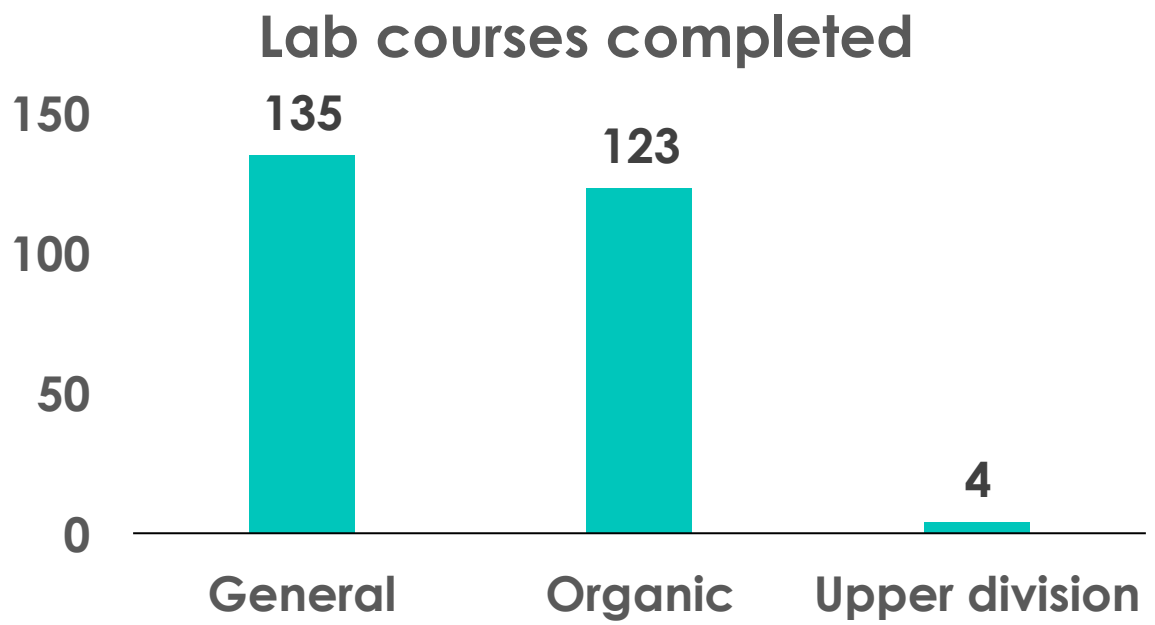
- Are students receiving the basic safety communication we expect?
- Are students learning to take this information and apply it?
- How are TAs supporting the safety culture in their lab classes?

Survey sent to students and TA

Survey Breakdown- Student Responses

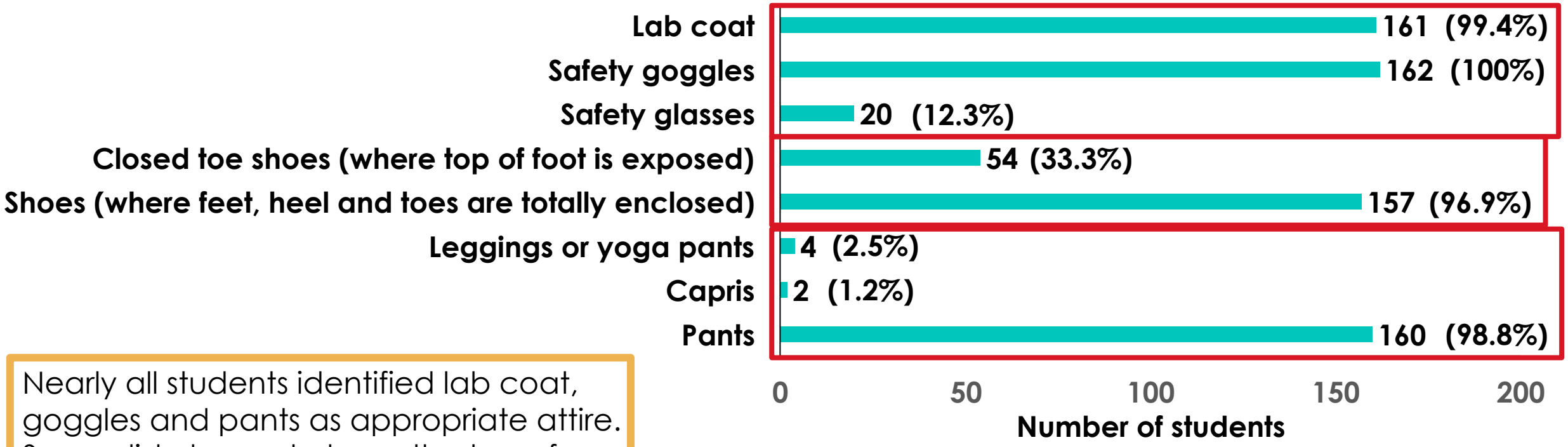
- Approximately 5000 undergraduate students enrolled in chemistry lab courses per quarter
- Forwarded link by TA
- Responses: 162





What is the appropriate attire to wear in a chemistry lab course?

Students were asked to check all that apply



Total students = 162

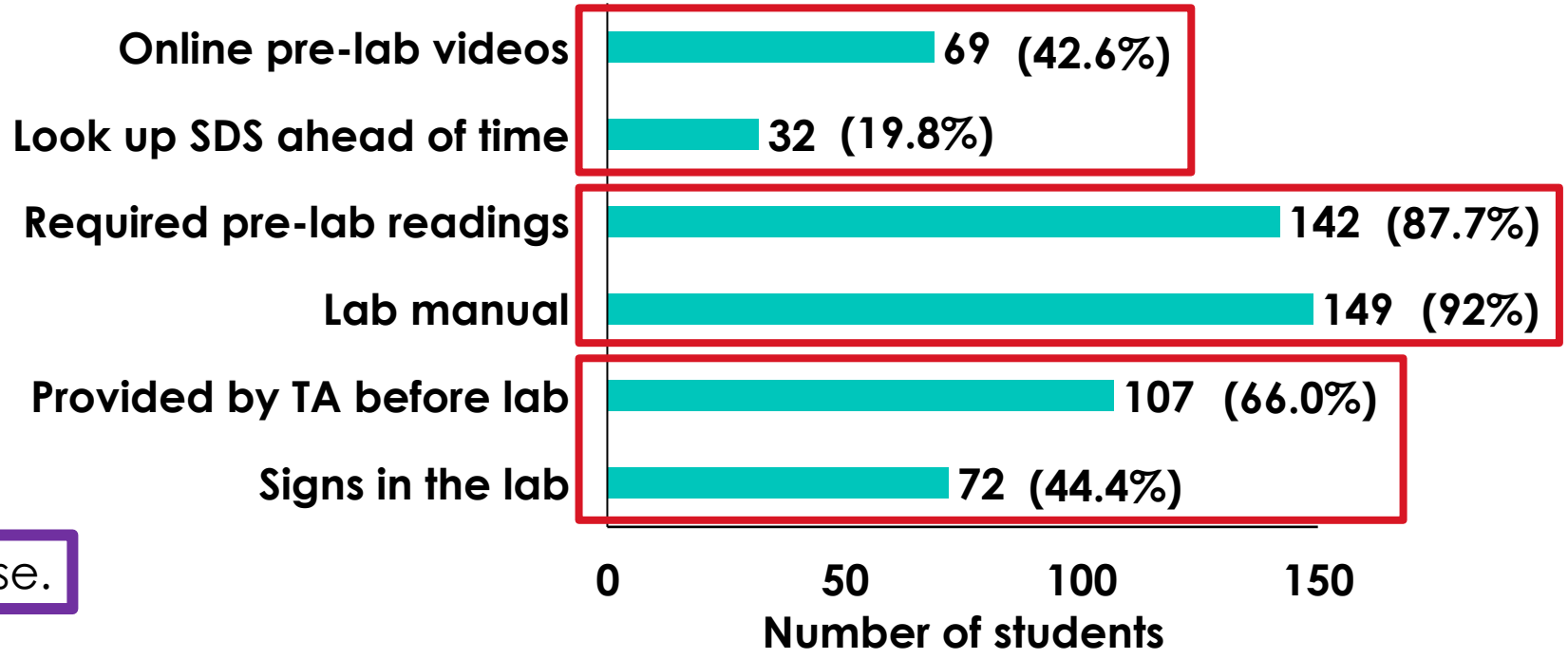
Nearly all students identified lab coat, goggles and pants as appropriate attire. Some did choose to have the top of their foot exposed.

How do students receive safety information regarding their lab experiments?

Majority of students receive safety information from lab manual and their TA. Experience varies by TA.

- Take advantage of lab manual use.

"We don't and then they ask about them on the quiz…"



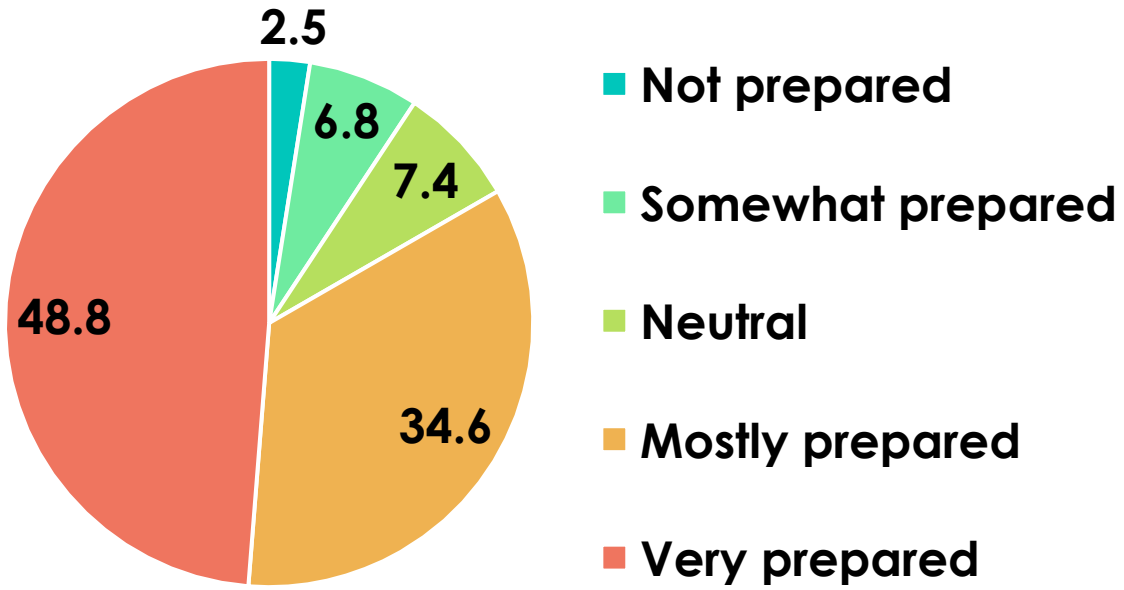
Total students = 162

Students were asked to check all that apply

Based on this safety information, how prepared do students feel to carry out their experiments safely?

Majority (83.4%) of students feel mostly or very prepared for lab.

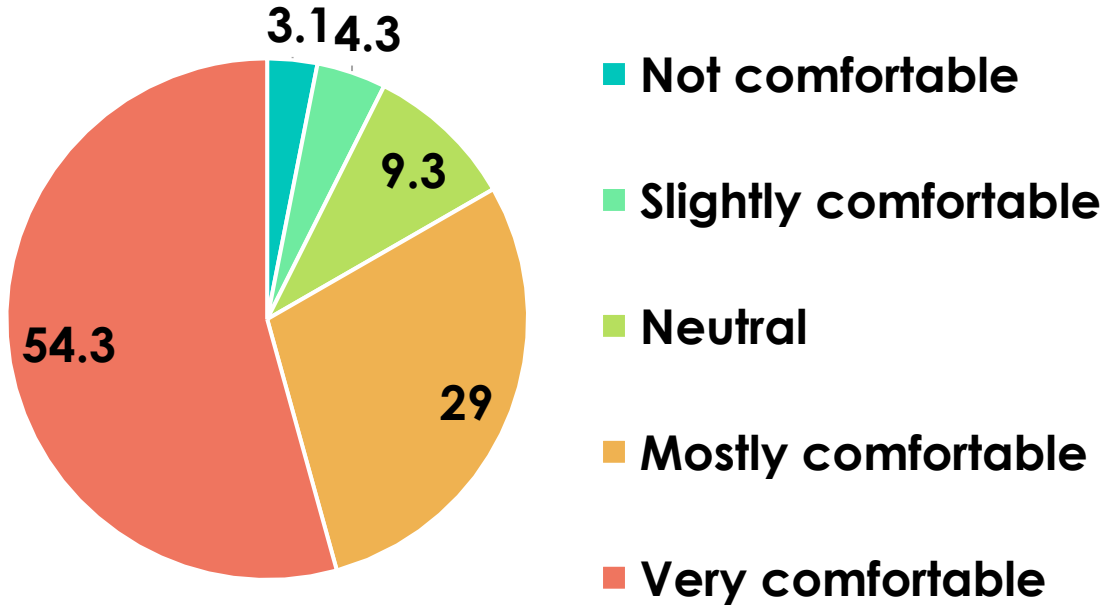
16.7% of students feel neutral or not thoroughly prepared. Roughly 835 students per quarter.



How comfortable do they feel telling their TA about a safety issue?

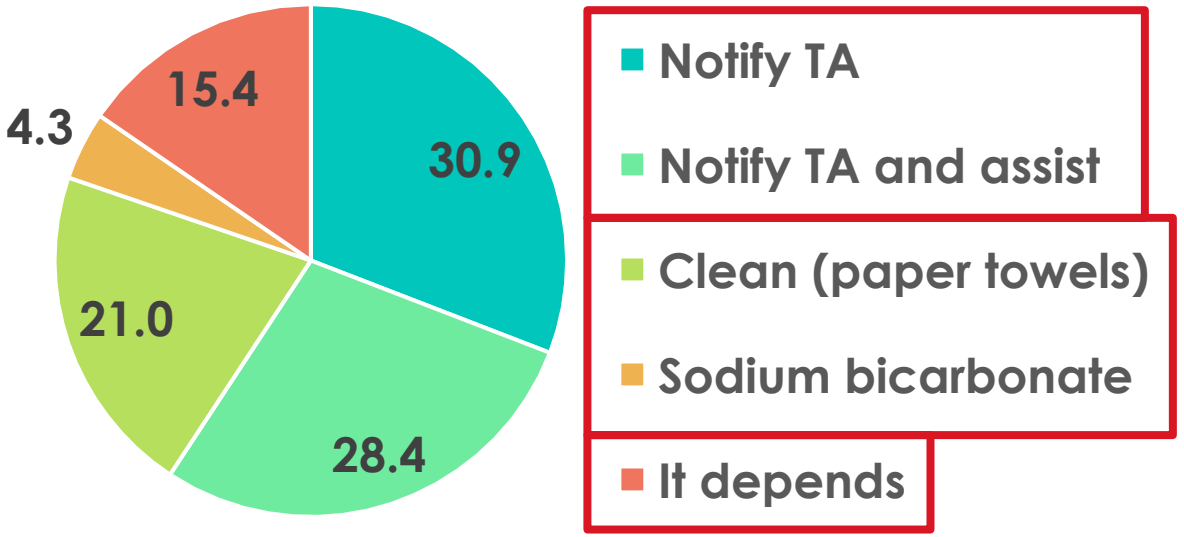
- Similar percentages of students feel comfortable or not.
- Does not appear to be correlation between those that are less prepared.

- Incorporate how to discuss and teach safety into TA trainings.



Please describe how to respond to a small volume spill.

- Good start! Possibly leaving hazardous material unattended.
- What are students gaining from experience?
- Students mention only cleaning with paper towels if this is safe or non-hazardous
- Great answer for acid spills
- Outline response for variety of spills



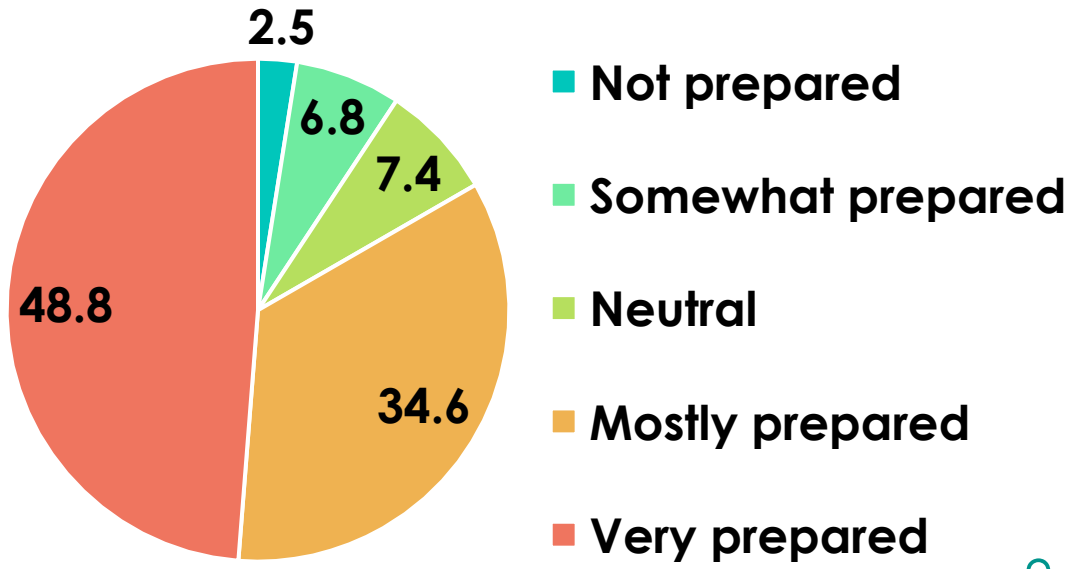
- Incorporate mock spill response.
- Include disposal instructions.

Assume they know what the spill is and provide no real acknowledgement of unknown spills

Students are mostly prepared but is that enough?

- Students are receiving the basic information
- 9.1% feel only somewhat or not prepared (455 students per quarter)
- Bicarb and paper towels are the answer to everything!

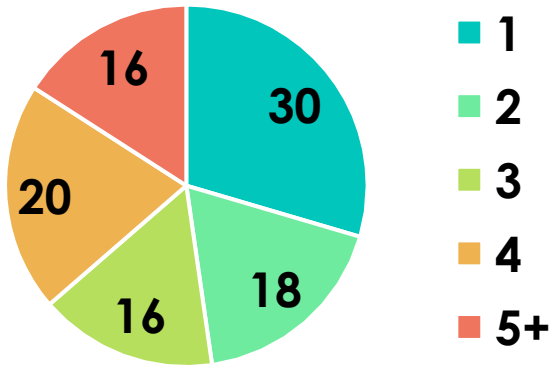
"I think the TA lectures before the lab and lab manual are probably the best ways to inform students about safety hazards…"



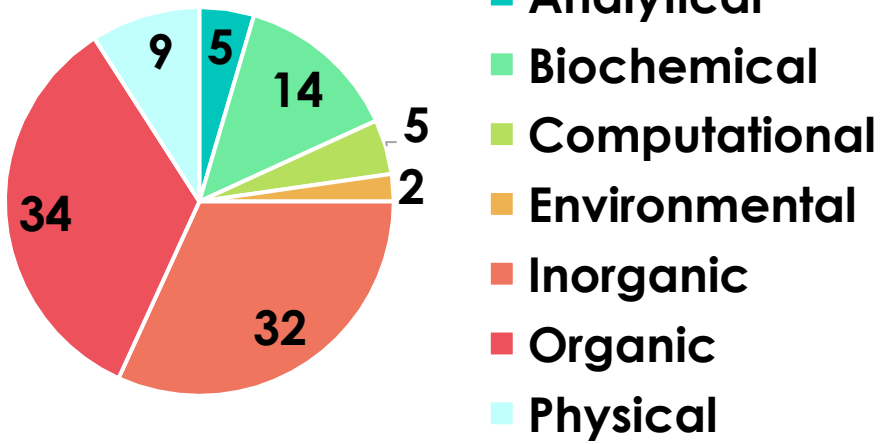
Survey Breakdown- TA Responses

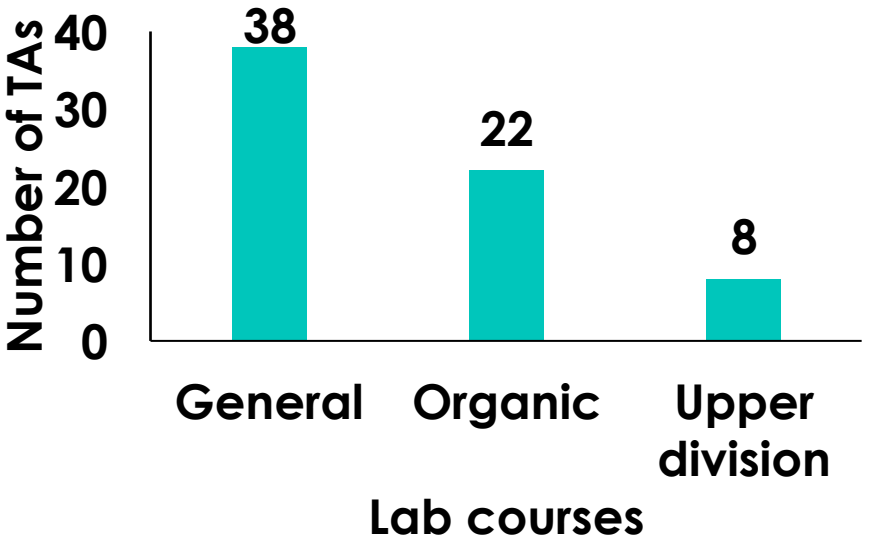
- Received email with link via listserv
- Responses: 44 (19%)

Years in Grad School



Research Discipline





TAs receive adequate initial training

- 1-2 days of general safety information
  - Mock discussions
  - Read and sign SOPs
  - UC Lab Safety Fundamentals
  - Live demos
  - Focused on general chemistry

"Lengthy and thorough"

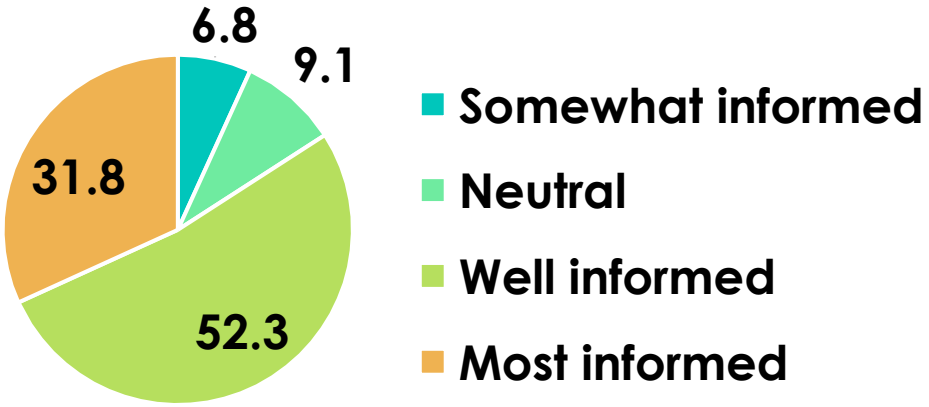
"A classroom setting filled with redundant occasionally useful information. There was a mock discussion and lab which were very helpful in understanding procedural dealings."

Initial training has evolved in recent years. Less applicable to organic labs.

- Focus on more than the "rules".
- Create organic specific initial training. Highlight differences between general chemistry courses.

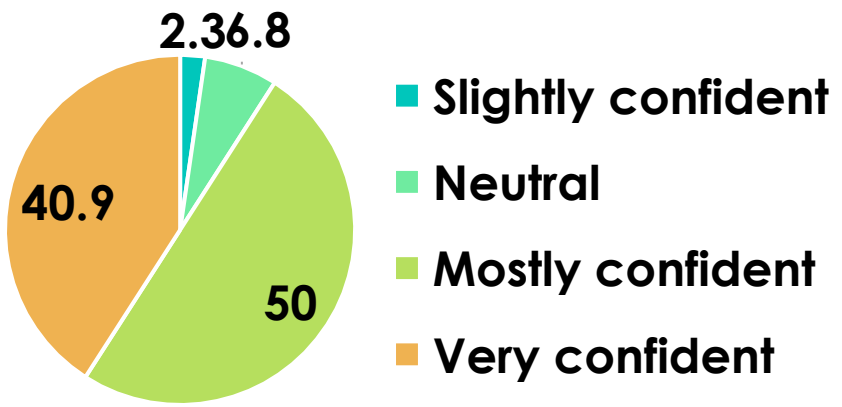
TAs relationship with safety information

How informed do TAs feel on safety issues before teaching lab?



15.9% of TAs are neutral or only somewhat informed regarding safety issues.

How confident do TAs feel in relaying safety information?



8.9% of TAs are neutral or only slightly confident relaying safety information.

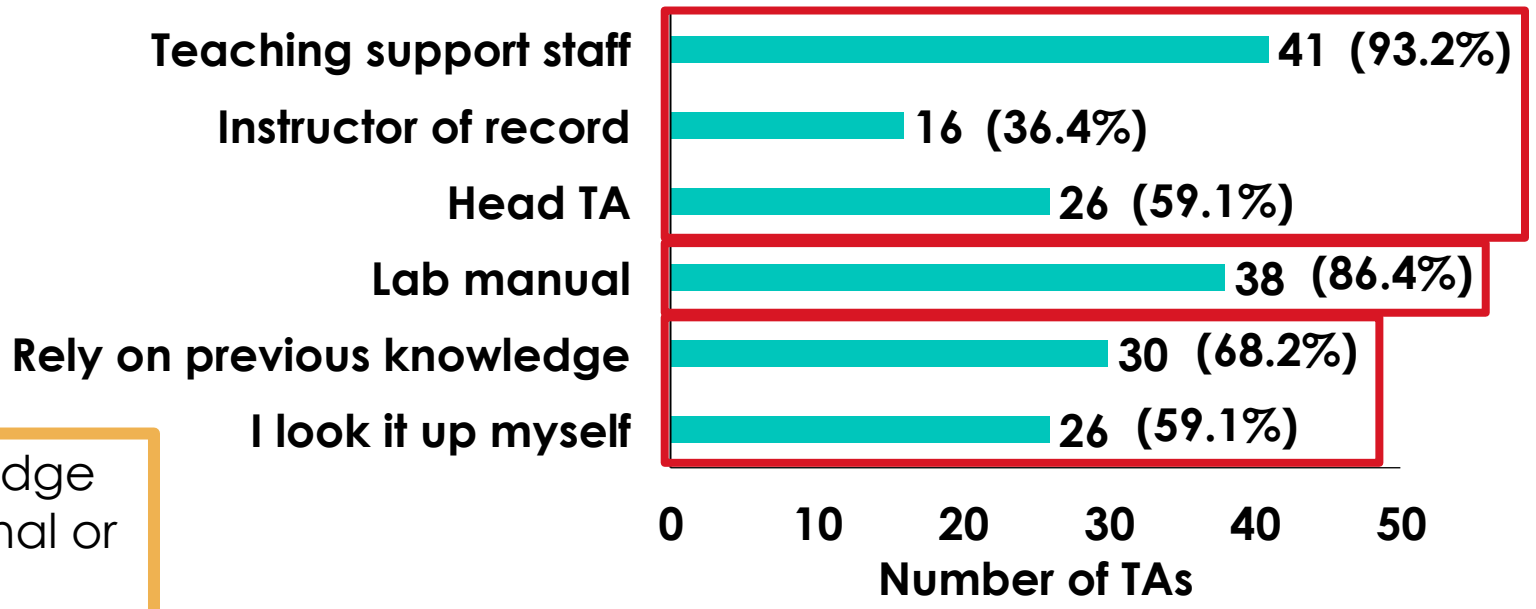
- Focus on training TAs to effectively discuss safety with students.

How do you receive information regarding safety in the teaching labs?

Staff highly responsible for information TAs receive. The lab manual is heavily used.

Nearly 60-70% rely on previous knowledge or look it up themselves. Is this additional or are they not receiving enough?

- Take advantage of lab manual use.
- Capture previous knowledge to help inform change.

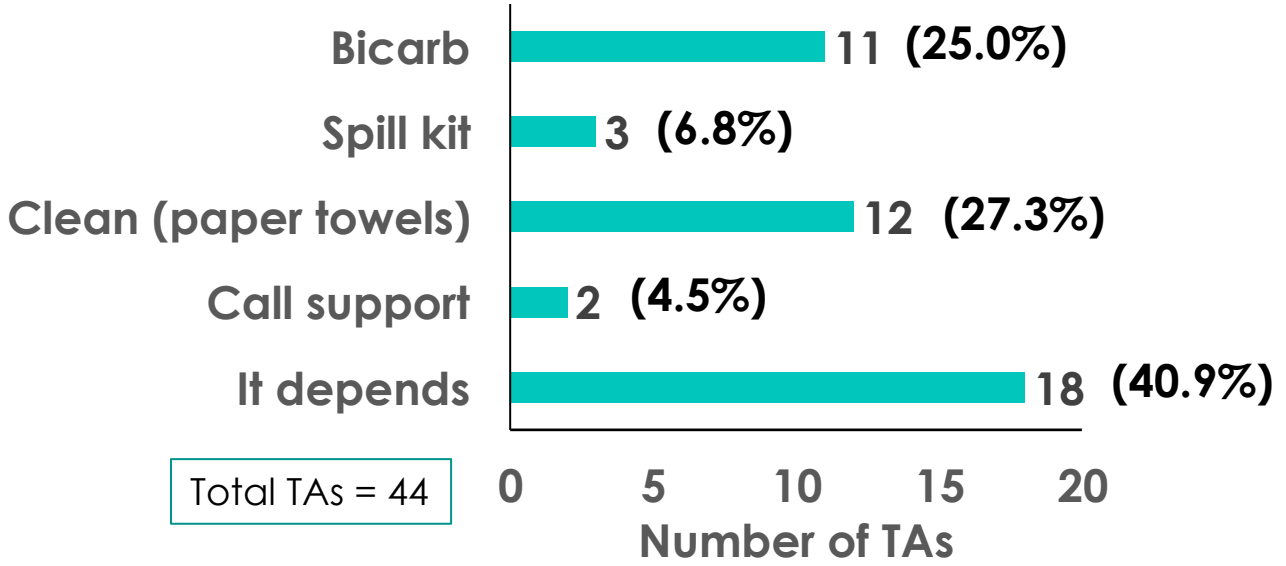


Total TAs = 44

TAs were asked to check all that apply

How TAs respond to a small volume spill

- Acid most common spill in general chemistry
- Clean it varies
  - Does not always include disposal
- 5 TAs mention assisting students



- Include mock spill response.

"Ask students if they were splashed and determine proper aid if this is the case. Ask what happened to cause spill, retrieve whatever spill kit is needed and clean up spill for students. Talk to students about how this can be avoided in the future. Complete incident form."

Describe how TAs support a good safety culture

- Walking around the lab is important
- Be supportive when accidents happen
- Demonstrate proper techniques
- Write safety notes on the board

"By enforcing the rules"

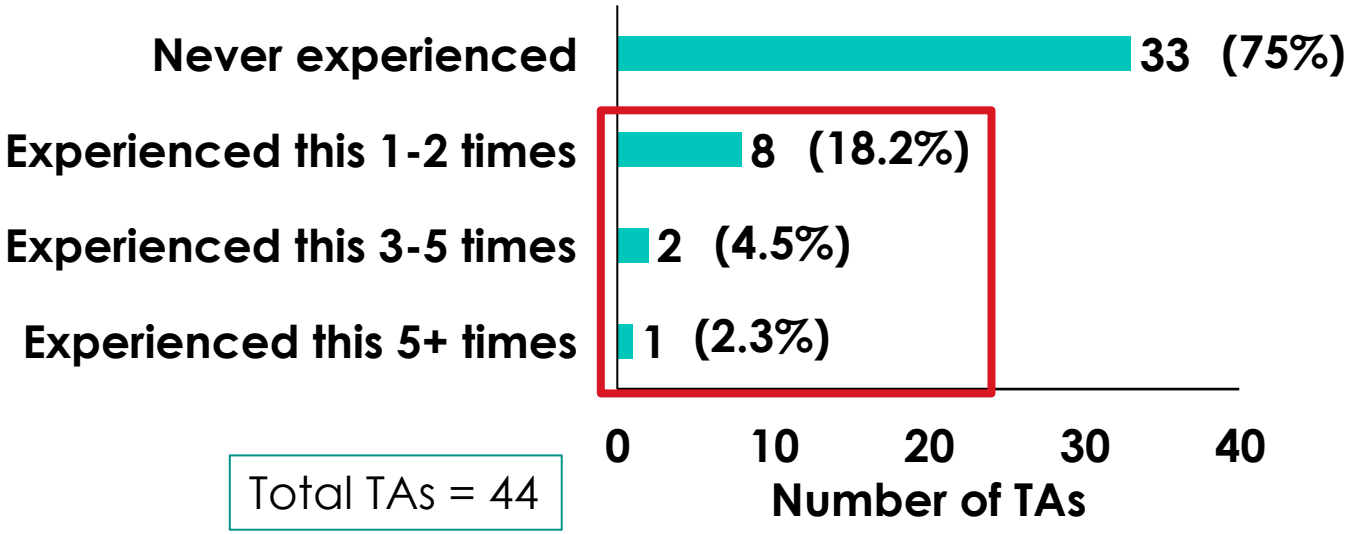
"Go over safety, and let everyone know that mistakes happen every now and then"

- Great habits! Work on ways to translate teaching these to less confident TAs.

TAs experience minor lack of support

Examples provided by TAs

- Inaccessible drench hose.
- Expected to transfer overflow waste to new bottle.
- Lack of promptness in supplying new waste containers.
- Miscommunications



Total TAs = 44

25% of TAs have experienced a lack of safety support. Anecdotes highlight minor issues.

- Streamline communication for organic TAs.
- Initiate anonymous feedback form.

Strive towards larger goals

- Change focus to safety as a skill set
- Prepare students for graduate school or industry
- Improve safety culture through open discussions

Moving towards a skills based safety attitude

- Provide context for students
- Develop materials specific to organic labs
- Create safety teaching moments for TAs
  - Focus on safety as a skill set
  - Possible to incorporate into lecture curriculum
- Online resource
  - Video tutorials
  - Ask pre or post lab questions
  - Provide archive of lessons learned
  - Interactive risk assessment tool

- SDS → how to read and what's important?
- Mock spill response
- Toxicity → chronic vs. acute
- Hierarchy of controls
- Near misses and lessons learned
- Risk assessments

- Repeat survey with more intentional questions based on this information gathered

Acknowledgements

- Debbie Decker
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- Franz Group Members

FRANZ GROUP

UC Davis Graduate Student Association

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"Definitely need more clarity on safety. It smelled like almonds in our lab and lecture mentioned that could be signs of a lethal amount of acid in the air. I think maleic acid so yeah do something not trying to get cancer."

Please describe how to respond to a small volume spill. – Student quotes

"Clean it. Neutralize. Sterilize."

"Notify TA. Neutralize it if it were acid or base."

"I don't know"

"Alert the TA, then use absorbent material to soak up the spill. Depending on how hazardous the substance is, ask if the absorbent material can go into regular trash or needs special waste disposal. Wash the area with appropriate washing media..."

"Depends on what it is… if it's an acid or base, I'd call over the TA so they can neutralize it… if if it's anything else I'd honestly use paper towels or wait for it to evaporate."

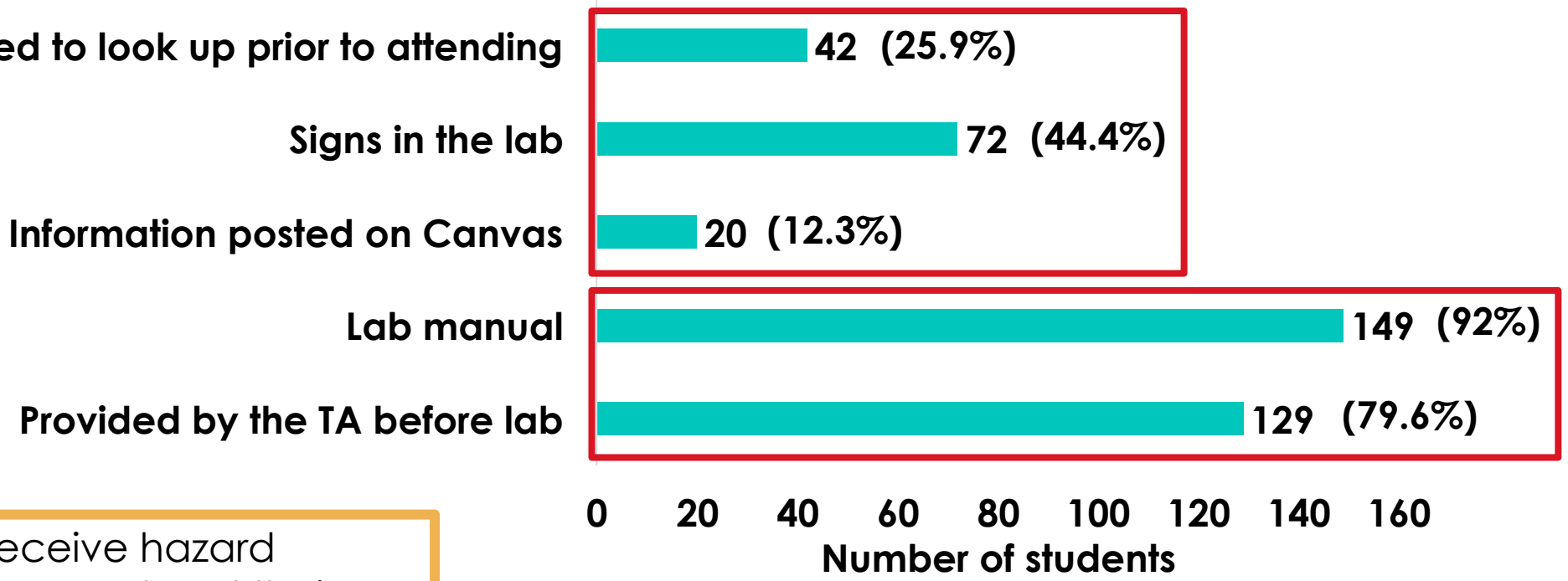
Anecdotes about responding to incidents

- Most cite broken glassware, minor hot plate burns or small spill (of acid)
- "Stayed calm and took care of the mess…It's important not to make the student feel as if they are in trouble/did something wrong."

"I had a student generate a toxic gas outside of the fumehood and I had did not feel prepared by the TA meetings on how to handle it. I called the dispensary and they came and helped me disperse the gas through the fumehood and evacuated the room."

"A student poured chromic acid into the red safety carrier instead of the waste bottle. I knew to neutralize the chromic acid… but I didn't have the proper waste segregation for the hazardous waste that I had created… Unfortunately it sat in the fume hood for the rest of the lab, which meant that I had to make sure no one used the safety carrier."

How do students receive hazard information for chemicals they are using?



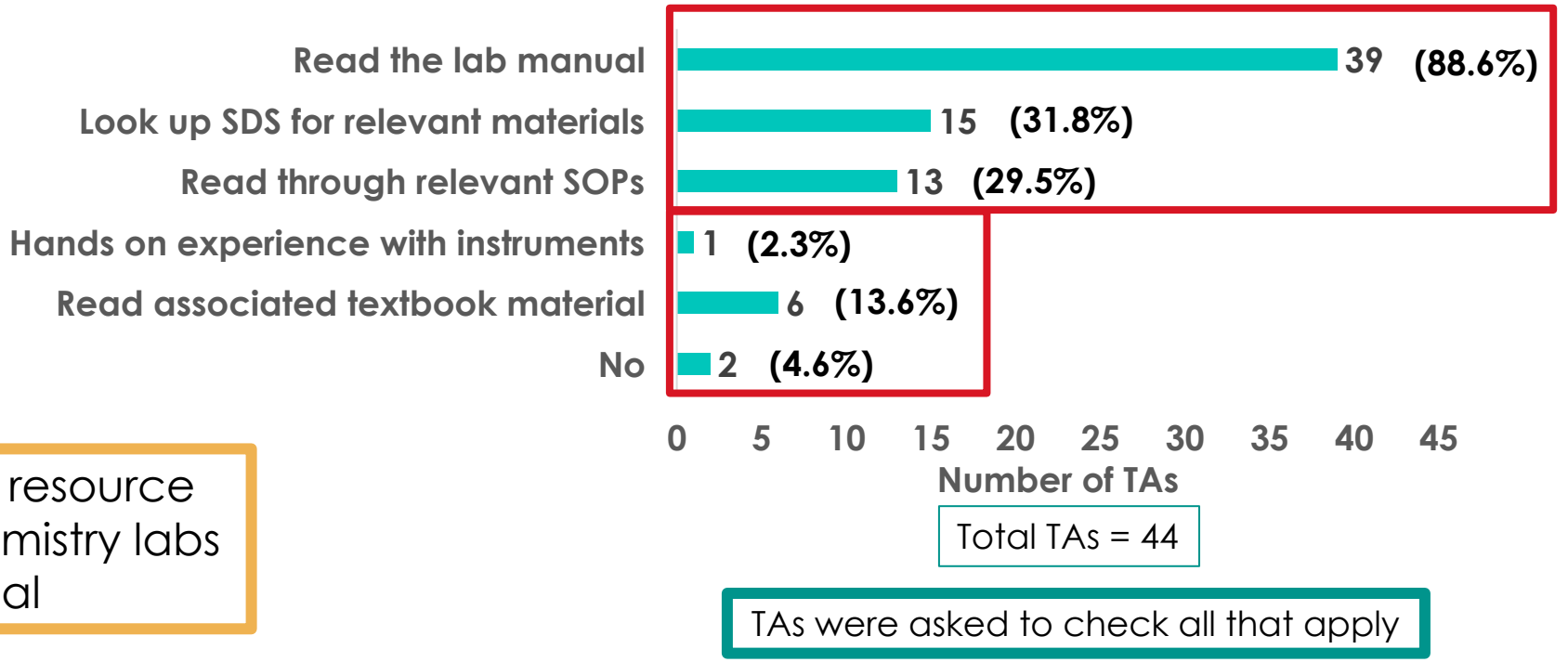
Majority of students receive hazard information from lab manual and their TA.

Only 44.4% of students cited signs in the lab. Are they truly lacking or less obvious to students?

Total students = 162

Students were asked to check all that apply

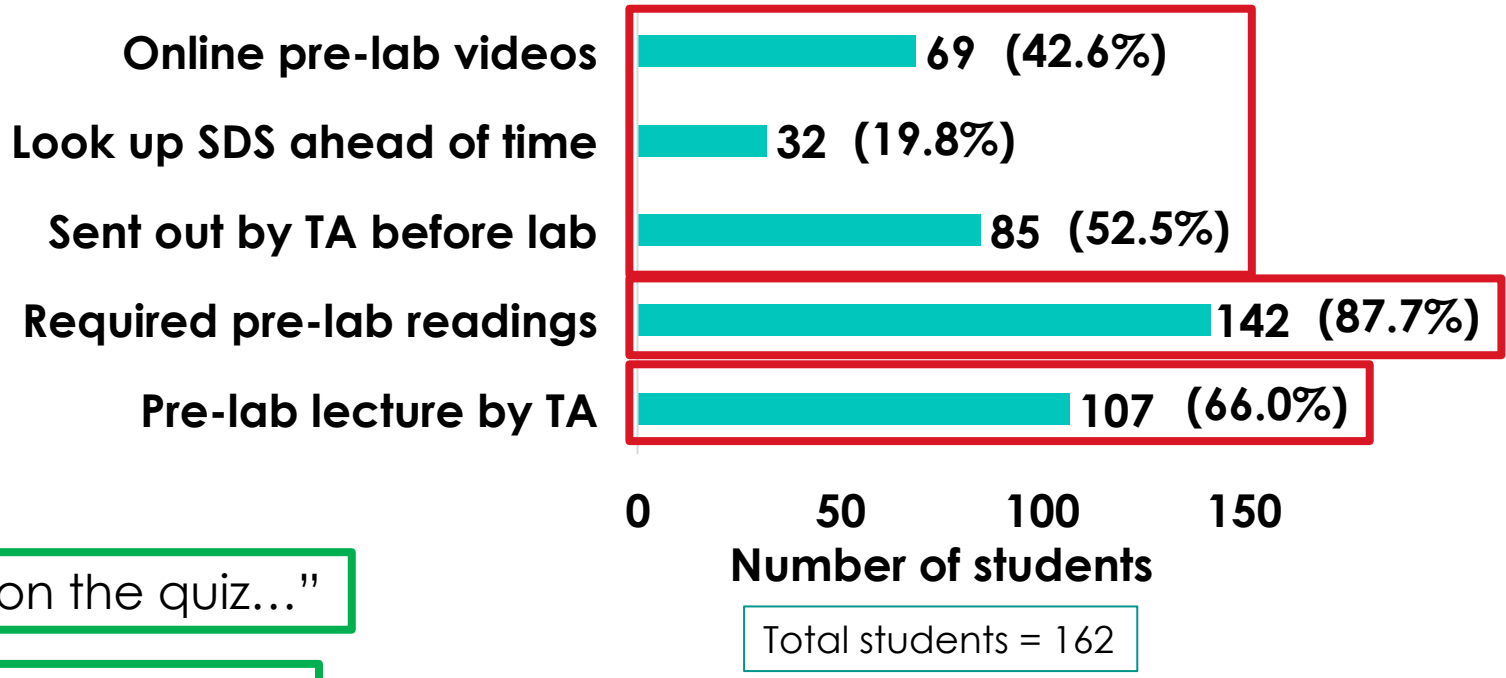
Prep TAs perform outside of scheduled meetings



Lab manual is most used resource but only the general chemistry labs have a TA specific manual

How do students receive safety information regarding their lab experiments?

Students were asked to check all that apply



Total students = 162

Generally, students receive most information from pre-lab readings and pre-lab lectures provided by the TAs.

Experience and information provided by the TA tends to vary.

"We don't and then they ask about them on the quiz…"

"I was told by my general chemistry TA but not my organic chemistry one"

Challenges to consider moving forward

- Limited time in lab
  - 3 hours with only short time for pre-lab lecture
- Trickle down effect of information
- Control of information → expand on topics as students advance
- Lack of effort by students and TAs

Experiences vary greatly. Need to identify ways to manage that for both TAs and students.

Suggestions for immediate improvements

- Develop shadowing program for first time TAs
- Update the lab manuals
  - Develop organic specific TA lab manual
- Provide context for students!
- Create initial training geared towards organic labs