

**Enhancing
Psychological
Safety,
Reducing
Stress, and
Fostering
Inclusive
Teaching in
Chemistry**



**ROYAL SOCIETY
OF CHEMISTRY**

Dr Frane Vusio

Hello, my name is Frane.

- I completed my PhD in Health Sciences with WMS in 2021.
- I am an applied psychologist and clinical associate working for NHS Scotland.
- I also work as a Low-Intensity Therapist.
- Besides my clinical roles, I am also actively engaged in research and teaching with Doctoral College at the University of Warwick.



Dr Ehsan Ghadim

Hello, my name is Ehsan.

- I have completed PhD in the chemistry department at the University of Warwick.
- Currently, I am an honorary postdoctoral researcher at the School of Engineering at the University of Warwick.
- Member of RSC



Aims for today:

01

Understand how anxiety and stress can affect lab safety.

02

Learn practical strategies for maintaining safety focus under pressure.

03

Explore inclusive practices to support diverse learners and researchers.

04

Gain tools to implement continuous safety improvements, based on well-being.

Previously we covered in session one:

- Definition of the main constructs (Stress, Anxiety, importance of laboratories in chemistry education, chemistry and lab anxiety).
- Common sources of stress and anxiety in chemistry and laboratory environments.
- Strategies to deal with stress and anxiety using the CBT approach.
- Importance of gradual exposure to overcome chemistry or lab anxiety.

What is psychological safety?

- Psychological safety is defined as: “A shared belief that the team is safe for interpersonal risk-taking.” (Edmondson, 1999)
- A psychologically safe environment encourages individuals to speak up, admit mistakes without fear of punishment, offer ideas, challenge assumptions and seek help when needed (Kamentzky, 2021)



Challenging

(I can speak out)



Contributing

(I can make the difference)



Learning

(I can ask questions without having all the answers)



Included

(I belong here, and I feel welcomed)

Why does safety culture and mental health in labs matter?

1. Stress and Anxiety Impair Safety Performance (Arnetz et al., 2011)
 2. Poor Safety Culture can Worsen Mental Health and Wellbeing (Keller et al., 2020)
 3. Inclusive, Supportive Lab practices Promote both Safety and Wellbeing (RSC, 2021)
- Data show that safety = fewer incidents +lower stress
 - Near-miss reporting systems help create a learning culture, which is psychologically safer than a blame culture
 - A strong safety culture not only prevents accidents but also reduces anxiety and helps everyone thrive in the lab.

The Need to Go Beyond Compliance: Improving Safety Culture

- High Incidences of injuries, explosions and chemical exposures in academia and industry
- UCLA Laboratory Fire (2008)
- Texas Tech Explosion (2010)
- Regulatory frameworks OSHA's Laboratory Standard and Chemical Hygiene Plans (CHP)
- Need for a safety culture that involves attitudes, beliefs and behaviours.

Enhancing Lab Safety Culture



The Link Between Stress/Anxiety and Safety Lapses

High Stress and Anxiety

↓
Impair
Attention
and focus

↓
Reduce
working
memory

↓
Increase
impulsivity
or
avoidance

In lab environments, the result of stress and anxiety can be:

- Misuse of equipment or chemical
- Poor concentration and lack of focus
- Skipped safety checks or overlooked hazards
- Poor communication in shared workspaces

Encouraging a Proactive Safety Mindset

A proactive safety mindset involves:

- Taking **ownership of personal and team safety**.
- Identifying and addressing potential hazards **before** an incident occurs.
- **Continuously learning** from near-misses and adapting practices.

To promote this mindset:

- Use real-world case studies to reflect on preventable incidents.
- Encourage active participation in risk assessments.
- Create space for open dialogue around safety concerns.

Role of Supervisors and Mentors in Modelling Safe Behaviour

Supervisors and mentors set the tone for lab safety culture. They can:

- **Model safe behaviour** (e.g. using PPE properly, following SOPs).
- Reinforce that **asking questions is encouraged**, not penalised.
- Show empathy and awareness of students' mental load and anxiety.

Mentors who acknowledge uncertainty and mistakes demonstrate that:

- Safety is an ongoing, **shared responsibility**.
- Making improvements is more important than being perfect.

Source: Kamenetzky, A. (2021). *Psychological safety in teaching laboratories: How to create safe spaces for mistakes and question*

Risk Assessment & RAMP Framework



Risk Assessment: The RAMP framework



Recognise Hazards: Identify any potential dangers in the environment.



Assess Risks: Evaluate the likelihood and severity of harm.



Minimise Risks: Take steps to reduce or eliminate hazards.



Prepare for Emergencies: Develop plans and protocols for dealing with unexpected events.

However, the crucial element is also to enable effective supervision and teacher empowerment in Lab safety.

Why does RAMP matter?

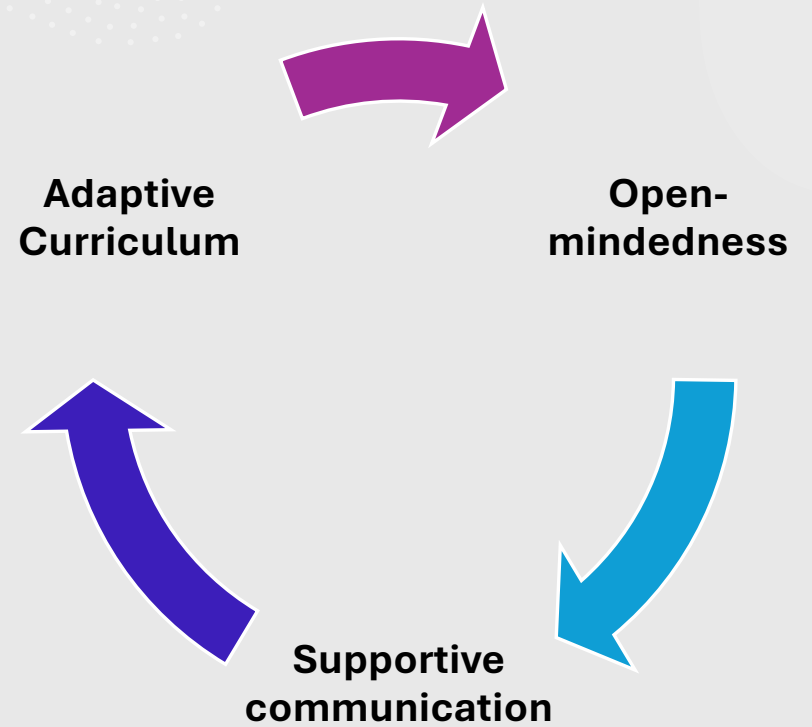
Structured & Proactive

Holistic Approach

Customisable

Prevention-Focused

Universal Design for Learning (UDL)





Learning from Incidents

Safety Culture in Chemistry Labs

ACS and NRC (2016) report highlighted:

- ~80% of academic labs conduct comprehensive safety training.
- ~90% have standard operating procedures for hazardous activities.
- ~85% hold regular safety meetings and conduct routine inspections.

Identified GAPS:

- Only ~50% use a centralised safety incident database;
- ~70% follow a formal safety review process for new experiments.

Implication for practice

- **Regular safety documentation and reviews lead to continuous improvement.**

- Documenting hazard evaluations and risk assessments
- Importance of Standard Operating Procedures (SOPs)
- Experiment-Specific Safety Documentation

- **A culture of improvement starts with regular safety reviews.**

- Quarterly or biannual safety reviews are recommended to identify emerging risks and assess the effectiveness of existing safety measures.
- Importance of reflection and integration of lessons learned into future practices.
- Update existing SOPs and safety protocols to reflect the latest research, technology advancement and regulatory changes.

Practical application of UDL

- **Multiple presentation modes and diverse assessment methods:**

- Videos (e.g. animated demonstration of chemical reactions)
- Tactile models (e.g. 3D printed molecular structures)
- -Interactive simulations (e.g. virtual reality lab safety training)

- **Inclusive Lab Organisation:**

- Use clear labelling and signage to assist students with visual impairments or cognitive processing differences
- Safety documentation to be user-friendly (plain language and visual aids)
- Improve organisation of lab and its accessibility



Managing Stress & Anxiety in the Chemistry Lab

Common Lab Stressors and their impacts

Stressors	Effects on Learning and Safety
Heavy Workloads and Time Pressures	Increases anxiety, reduces focus, raises risk of errors (McLaren et al., 2022).
Hazardous Chemicals and Safety Risks	Heightens fear, leading to avoidance behaviours or poor risk assessment (Nies et al., 2020).
Tight Deadlines and High Expectations	Triggers perfectionism, discourages asking for help, increases burnout.
Inadequate Supervisory Support	Leads to uncertainty, lack of confidence, and increased stress in decision-making.

Stress Management using Mindfulness and Relaxation techniques

- **Deep Breathing (4-7-8):** Inhale for four seconds, hold the breath for seven seconds, and exhale for eight seconds.
- **Squared breathing:** a simple breathing technique involving inhaling for a count of four, holding for four, exhaling for four, and holding for four, mirroring the shape of a box.
- **Progressive Muscle Relaxation (PMR):** Tensing and relaxing muscle groups to relieve tension, stress and anxiety.
- **Grounding exercises:** Identify five things you see, four things you touch, three sounds, two smells, and one deep breath to refocus.

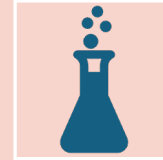
Supportive communication to reduce anxiety

- **Active listening through the use of paraphrasing, rewording, and validating feelings** (e.g. "I understand that this is overwhelming. From what I heard, it seems X is the problem. Let us work together.").
- **Constructive feedback with positive framing:** e.g. "This is a good effort; we need to refine this further."
- **Importance of a mistake-friendly environment**
- Students need to feel comfortable seeking help

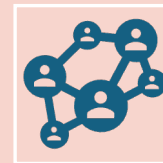
Importance of Work-Life Balance

- It is important to schedule breaks to prevent students from feeling overwhelmed (e.g., a 5-minute reset every 45 minutes in the lab).
- It is important to set realistic expectations to avoid overburdening students.
- Promote work-life balance.

Best supervision practices



Pre-Lab Briefings



Structured Communication and supportive mentorship (Kuhuradin et al., 2022; Pizzolato and Dierickx, 2022)



Involving the team in decision-making (Price and LaFiandra, 2017)

Dr Ehsan Ghadim



Experience 1: Unexpected Burette Error



- The demonstrator's abrupt warning distracted me, explaining why communication must remain clear.
- Pausing to run a quick RAMP checklist before critical steps helps manage risk.
- Recording every near-miss in a shared log uncovers recurring problems.
- SOPs need a step to stop and confirm the burette tap position at the endpoint.
- A short mental readiness check and "pause-and-confirm" drill improves focus.

Experience 2: SEM Near-Miss



- **Structured Risk Assessment**

1. RAMP: Recognise distraction, assess risk, minimise harm, prepare checklists
2. Incident Reporting & Analytics
3. Logged near-miss and notified technician
4. Personal Preparedness & Self-Monitoring
5. Recognised loss of concentration and paused work

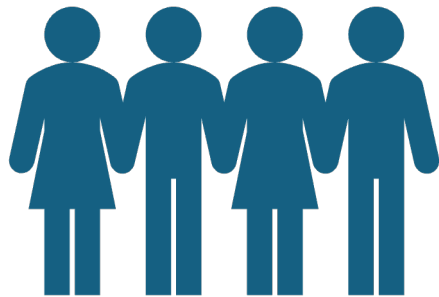
Experience 3: Mislabeled Vials



- **Inclusive & Accessible Lab Design**

1. Clear workspace boundaries to prevent sudden interference.
2. Structured Risk Assessment
3. Quick distraction check before critical steps like labelling.
4. Clear Documentation & Protocol Updates.
5. SOPs including workspace zone maintenance and interruption handling.

Experience 4: Lab Interruption



- **Cultivating a Strong Safety Culture**

1. Norms for protected focus time and respectful communication.
2. Inclusive & Accessible Lab Design
3. Designated quiet zones and scheduled social periods.
4. Personal Preparedness & Self-Monitoring.
5. Use 'Do Not Disturb' signals to set work boundaries.

Inclusive & Accessible Lab Practices



Why Inclusive and Accessible Lab Practice Matters?

- Accessibility is not a checklist—it is a mindset for design.
- Inclusive labs ensure all students can participate fully, safely and confidently.
- Inclusive labs improve learning for everyone.
- Inclusive and accessible lab practices are about more than just compliance—they're about equity, confidence, and empowerment.

Key Practices:

- Labs should be designed for diverse needs and abilities (Science Council UK, 2021).
- Clear signage and communication (RSC, 2021)
- Use of multimedia and flexible training approaches (Jariwala and Pellock, 2022)
- Workspace layout and flow (National Academies of Sciences, Engineering and Medicine, 2019)

The background of the slide is a solid purple color, overlaid with a pattern of numerous speech bubbles. Each speech bubble is a lighter shade of purple and contains a dark purple question mark. The bubbles are scattered across the entire slide, creating a textured, repetitive pattern.

Thank you for
joining us!

Summary

- Psychological safety in chemistry labs helps reduce accidents, supports mental wellbeing, and improves learning outcomes. It fosters a culture where students and researchers feel empowered to speak up, ask questions, and learn from mistakes without fear of judgment.
- A culture of continuous learning, formalised safety reviews, and incident reporting can further enhance safety practices in academic and industrial labs.
- Enhanced hazard evaluation tools and centralised safety databases can reduce the severity of incidents by identifying risks early and promoting knowledge sharing.
- Proactive safety documentation, coupled with regular safety reviews, ensures continuous improvement and adaptability in safety practices.
- Implementing these strategies helps foster a sustainable safety culture in chemical laboratories, ultimately protecting researchers and minimising risks.
- RAMP: ensures that both physical hazards (chemical spills, fires, explosions) and psychosocial risks (stress, fatigue, cognitive overload) are identified and managed effectively.

Summary

- Applying UDL in chemistry labs ensures that all students—regardless of ability or learning preference—have equitable access to learning and can meaningfully engage in scientific discovery (Meyer et al., 2014).
- By adopting flexible instruction, accessible resources, and diverse assessment methods, educators can create a chemistry lab experience that fosters participation, motivation, and success for every learner.
- By recognising lab stressors and integrating stress management techniques, students and educators can create a safer, more productive, and inclusive learning environment.
- Implementing mindfulness, supportive communication, and structured breaks can help reduce lab-related anxiety, ultimately enhancing learning and improving safety outcomes (McLaren et al., 2022).

Inclusive lab practices:

- Improve **safety, engagement, and learning outcomes**.
- Reduce **stress and anxiety** by providing clarity and predictability.
- Support the full participation of students and staff with diverse needs.

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