**Overarching themes:**

Solutions to better engage students

Lab work and assessment of lab work

Maths prerequisites for chemistry

Peer teaching and peer assessment

**A. Delivery in 5 years time**

How much lab work is necessary?

Will traditional labs still exist? Already time is being squeezed because of financial considerations; some online solutions (simulations, recordings) are being used.

Use of internet:

* flipped classrooms
* MOOCs
* Likely less face-to-face, more online teaching.
* adaptive pre-tutorials with marks, pre-lectures.
* students will be used to using soft books instead of hard texts
* everything immediately accessible and in small bytes - but need big bytes
* Need integrative problems, "end of chapter" issues. Problem when small bits are never put together.
* With more content delivered online, students may not be on campus as much. This may be another driver for a "recorded" lab experience.
* Google it to get an answer

What do our institutions want to fund and resource?

Decadal plan - teaching

**B. TLOs and assessment**

Can we increase sharing of assessment exemplars as a community via ChemNet?

Issues with implementing TLOs:

* Should "failure" in one TLO prevent graduation?
* Does assessment tell us anything about long-term knowledge and skill retention?
* Current content focus of chemistry subjects, lack of engagement with TLOs.
* Push-back from research-focussed colleagues who don't want to lose time from discipline knowledge and skills.
* Not enough time in the chemistry major.
* How do we assess life-long learning, and is this the only useful graduate attribute?

Authentic assessment is necessary for work-fitness. Where should assessment for work fitness fit in a general degree?

**C. Engaging: motivation and self-efficacy**

Engaging can be defined as making an effort to master the material conceptually

Are our students less motivated and engaged than we were?

How can we increase their self-efficacy?

* Provide a clear road map to students of what to do and when.
* Do not overload students.
* Peer-supported learning.
* Avoid assessing everything.
* Small groups with pre- and post tests.
* Online and face-to-face - need "bite sized" activities.
* A safe environment needs to be established first. Motivation and confidence can follow.
* Provide self-diagnostic opportunities - so the students know how they are doing.
* Iron out misconceptions.
* Lack of preparedness (eg not enough pre-requisite knowledge) can inhibit motivation and confidence. Online self-paced tutorials (eg rearranging equations) can help.
* Measure students' engagement with the learning management system, follow up with struggling students.
* Online pre-lab work, with videos, dramatically improves students' confidence in the lab.
* Attention span issues - both short term (use bite-sized chunks within lectures) and long term (attendance drops during semester).
* For distance education, have a mandatory attendance event midway through semester.
* Gamification (eg collecting badges) allows students to see the big picture and how they are tracking.

Problems with service vs core students, first vs second year.

ACER science aptitude test picks up students who are already highly motivated.

First year PhD students make great tutors outside contact hours.

**D. Employability**

Why would you employ a chemist rather than a physicist or mathematician?

Industry should come to uni to participate, eg viewing student work. Universities should provide mentoring and cater for the diversity of employment pathways.

RACI's role as mediator between higher education and industry.

To be employable, students need kkills beyond the research lab:

* problem solving, critical thinking and application
* teamwork - researching issues as a team
* awareness of level of skill achieved
* sense of self-belief and confidence in the ability to understand the microlevel makes a chemist more employable.
  + eg steady state, change and equilibrium and kinetics
* Communication skills:
  + should they be embedded into chemistry or sit outside?
  + is it necessary to be able to communicate to many audiences or just the relevant ones?
  + being able to tailor your communication to the audience, knowing target audience.
  + choosing the vehicle or medium appropriate for the communication.
* Work experience outside the univeristy is always a plus, improves:
  + communication skills
  + interpersonal skills
  + team work
  + ethical issues
  + experience of doing a placement, authentic tasks. Does it need to be actively taught?
* membership and participation professional societies - acknowledge in course
* demonstrators/tutors should also be acknowledged in a course.

Capstone units should bring skills together. Skills must be developed earlier on, with particular assessment tasks.

How do you take answers and information from google and be creative and innovative?

**E. Collaborative Learning, structuring and assessment of collaboration**

Do we need to assess all collaborative based assessments and if so, how can we best assess them?

Online (synchronous and asynchronous) and offline (face to face).

3-4 students in a group is optimal.

Peer Assessment:

* team members:
  + constructive comments shared with students showing how they can improve.
  + Feedback on collaborative skills.

Peer assessment platforms and tools:

* UTS - SparkPlus
* UQ - iCAS

Product of group work

* safety and legislative - groups analyse a scenario and related data
* video - lab based and communication

Important to scaffold students in how to work in groups, set expectations.

Rubrics for peer assessment and for group product are required, for peer review and instructor review.

Lab partners - change multiple times. Use peer assessment with simple criteria each week.

Issues - class with both face to face and online students in large numbers? Peer work helps minimise the isolation for distance students.

Collaborative task requiring team members to complete a section of the task to gain one overall mark.