The Companionship Courses focus on helping students build better study skills, practice problem solving strategies, and better utilize study groups both in and out of the classroom. Ultimately, our goal is for students to ‘learn how to learn’ and gain confidence in their ability to problem solve so that they are able to persevere in the face of any new challenges that may lie ahead.

### Structured Group Work

Students often need guidance in learning to use study groups effectively. Build concrete opportunities into your class to help facilitate student discussion.

- Find a learning space conducive to group work
- Give students a common space within which to work – a chalk board space, huddle board, giant post-it, etc.
- Generate group concept maps and present their work to the class
- Documented Problem Solving
- Design ‘Parallel Problem’; groups can then exchange problems

### Exam and Study Strategy Reflection

Lead student reflection and group discussion after each exam to reinforce growth mindset in both content knowledge and study skills.

- Pair-Ram Reflection Exercise
  - What steps did you take to study for this last exam? Were any steps different from the first exam?
  - In what areas of the exam did you feel most confident? What study strategies helped you prepare for these areas?
  - In what areas of the exam did you most struggle? (was it not understanding a certain topic? not interpreting the question correctly? stuck on answering a question? etc.)
  - How did I address that area in my studying before the exam? How could I think of ways to help me prepare for this area?
  - What new strategies will I incorporate into my study plan for the next exam? How will I make time to incorporate this new strategy?
- Effective time management and prioritizing practice with material are top concerns
- Self-reported study strategy studies
  - I make a point of preparing for lecture by reviewing notes, thinking of questions, etc.
  - I always review my notes after lecture and make sure to find answers to any points that don’t make sense

### Student written Parallel Problems

If a person consumes 20000cal/day, how much power does it take to run a human? If commercial jet fuel contains 3.5*10³J/L of energy, and it requires 1.8*10⁴L/watts to power the jet, what mass of fuel is required for a 6.0 hour flight across the country?

- Power is measured in watts, 1 watt = 1 J /sec
- Does it take to run a human
- Commercial jet fuel contains 3.5*10³J/L of energy
- It requires 1.8*10⁴L/watts to power the jet
- What mass of fuel is required for a 6.0 hour flight across the country

### QUEST: Questions Exploring Scientific Thinking

Students apply key course concepts to real world challenges and applications

- Imagine you are a policy maker at the US Environmental Protection Agency (EPA). According to Intergovernmental Panel on Climate Change recommendations, in order to have the best chance to avoid catastrophic warming exceeding 2°C above preindustrial levels, the US (and other countries) would need to cut CO₂ emissions back to 1990 levels by 2090 and to 80% of 1990 levels by 2050.
- What minimum fuel efficiency in vehicles (in mpg) would you recommend setting a target for, in order for the US to reach this 2050 goal?
- Briefly discuss how realistic your answer is. Is it feasible to meet this goal simply by improving vehicle efficiency?

### Acknowledgements

- The Companion Course Series is supported through the School of H & S, VPUE, and the Department of Chemistry at Stanford
- Data compilation and analysis was done in collaboration with Heci Jiang from Stanford’s Institutional Research and Decision Support.
- Academic Skills inventory was constructed together with Adina Glickman in VPTL.
- Many thanks as well to all of our advanced Chem30-31 series students' TA’s who have assisted in the teaching of the companion courses!