Strategies for overcoming students' misconceptions in large class settings

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Large classes pose a challenge in higher education. They are undeniably efficient from a "teaching" perspective, but their deficiencies as tools for "learning" are well known. They are often associated with poor student engagement, low in-class participation and tend to encourage passivity in students (Mulryan-Kyne, 2010). For many students, these features promote superficial understanding and poorer learning outcomes (Hornsby & Osman, 2014). Unfortunately, in Australia the current social, political and economic framework appears to favour continued increase in undergraduate class sizes. As teaching academics, on a day-to-day basis we often ask, "What can we do to enrich the student experience in the large classes we teach?"

As part of a wider study on exploring misconceptions as a trigger for enhanced student learning, we have been developing a pedagogical approach that can be applied to large classes across STEM disciplines. Misconceptions are a particularly problematic issue as, when unresolved, they can significantly impede student learning progress (Chi & Roscoe, 2002). Key features of this approach are to:

a. identify student misconceptions and prioritise the target concepts;
b. develop suites of activities with explicit content, process and metacognitive goals; and
c. continuously monitor and provide feedback on student understanding.

One of our test cases is the University of Melbourne 2nd year Bachelor of Science subject *Biochemistry and Molecular Biology*. This subject is core to the Biochemistry major, but is also a prerequisite for postgraduate Medicine and, as such, has very large classes (>1200 students in 2016).

In *Biochemistry and Molecular Biology* we identify student misconceptions using a published, validated, discipline-specific concept inventory test (Villafańe *et al*., 2011). We prioritize the target misconceptions at a class level by measuring both % correct and student confidence in their answers on the test. We follow this up with a suite of questions designed to reveal the misconception to the students so that they experience surprise (Butterfield & Metcalf, 2006). The aim is that they question their understanding and are compelled to engage in peer-to-peer learning to resolve this cognitive dissonance (Nussbaum & Novick, 1982; Mazur 1997). A critical component is the use of an electronic in-class polling tool to encourage participation and to provide real-time feedback to the teacher and students in a large lecture theatre.

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