

Panic spirals and deposits in the Bank of Previously Seen Problems: Epistemology, metacognition, emotion and community in first-year Imperial Physics students' approaches to problem-solving

Abstract

Problem-solving is a key attribute of professional physicists. Robust problem-solving requires higher-order thinking and is one of the stated goals of the Imperial College Physics degree. However, in practice, undergraduate students, and particularly those in the earlier stages of a degree, often find problem-solving challenging and struggle to make progress. For example, scores on questions in Imperial Physics students' first exam calling for a simple application of such skills have been rather low over the past two years, with averages around or below the pass mark. In order to try to tease out the approaches first-year Imperial physics students take to problem solving, and influences on these, I have carried out a qualitative investigation, conducting interviews with six first-year undergraduate students. The interviews have provided a detailed in-depth snapshot of the students' perspectives on problem-solving in the second term of their degree, shortly after they have attempted their first university exam. Epistemology, metacognition, emotion and community all appear to be important —and interwoven— influences on the students' problem-solving. Participants described a background of a lack of challenge at A-level, a corresponding shock at the big step-up in level at university and removal of scaffolding in problems, and associated negative emotional reactions that were at times difficult to manage. Participants however also reported having made significant progress during their time at university and described particularly benefitting from group work. Novice epistemology appears to be important in initial difficulties, and progress appears to be associated with a transition to a more expert-like epistemology and developing self-regulation and self-efficacy. The results should inform improvements in both the teaching-and-learning environment and the Physics department's understanding about what to expect from incoming students —in terms both of the component elements of problem-solving and also for understanding how students' starting point affects how they approach difficult problems at university level.