Problem-solving as a Learning Threshold in Biology?

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In this session we will report on our investigation of differing ability of biology students at The University of British Columbia to learn to solve cell biology problems in Biology 200, a core undergraduate course in UBC's Life Sciences program. Failure rates in Biology 200 are consistently high, reaching almost 18% in 2007. Assessment of students in Biology 200 focuses heavily on student ability to solve cell biology problems. Instructors report that while most students perform well in recall and writing tasks, many struggle with problem-solving.

We have explored student challenges with problem-solving in this critical lower-level biology course by exploring the identities, educational circumstances and experiences of students in Biology 200, and by investigating the problem-solving strategies and expectations of expert problem-solvers (instructors). What knowledge and strategies are required for effective problem-solving in biology? How do students describe their learning experiences in biology? What difficulties do students encounter in the process of learning to solve cell biology problems? How might student differences in learning biology be explained? Can we uncover relationships between problem-solving ability and the student context?

In particular, we have used one-on-one structured interviews and guided writing tasks to learn more about students' individual educational experiences, perceptions and challenges, in order to illuminate the student context (for example, their ethnic origins, cultural practices, gender, and social class), and the institutional context (for example, dominant ideologies, disciplinary practices and tacit knowledge in the biological sciences). Interviews and think-aloud problem-solving activities with Biology 200 instructors offer added insight into the institutional context.

We employ the notions of threshold concepts (Meyer and Land, 2006), liminality (Land et al. (2008)and proactive knowledge (Perkins, 2008) as theoretical tools for examining the relationship between identity and learning, and student difficulties in learning and performing biology problem-solving. According to Meyer and Land (2006), threshold concepts are "troublesome" areas of knowledge, that are "bounded": they serve as boundary-markers for conceptual understanding. Learners who are unable to enter or pass through the liminal and troubled zone of conceptual confusion will not be able to make further progress in this domain. For Perkins (2008), "proactive knowledge has something of a threshold character" because it leads to transitions in thinking. We therefore examine, student experiences of liminality and proactive knowledge in an effort to understand the interplay between individual context, institutional context and the learning experiences of students in Biology 200, and we consider the degree to which 'problem-solving' in biology may function as a learning threshold.

References:

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