COMMUNICATING THE UNKNOWN: USING A CONCEPT ASSESSMENT TO CHARACTERISE STUDENT MISUNDERSTANDING

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Background

Why do students give exam answers that are incorrect in such strange ways? How can I understand what they are really thinking? Approaches that reveal what students are thinking and how they think within a context should lead to more effective teaching and learning strategies (Smith & Tanner, 2010). Concept assessments (or inventories) are sets of multiple choice questions that indicate students' understanding of core concepts and principles. Of particular interest would be to identify concepts that are commonly misunderstood, especially those for which a high proportion of students give a common, incorrect answer. Such misconceptions have the potential to reveal much about how students think about a topic and thus learn a subject. Misconceptions are notoriously difficult to shift, but identification is a necessary first step. Furthermore, the suggestion that common misconceptions might arise from underlying more-fundamental misconceptions (Garvin-Doxas & Klymkowsky, 2008) raises the potential of focussed interventions being able to head off incorrect understanding of later topics.

Aims

The current study aims to characterise learning gains and student misconceptions in a medium-large second year genetics course. The resulting picture of understanding of student learning will inform the design of learning activities and assessment for this course. Furthermore, it is hypothesised that some concepts are commonly misunderstood together. I aim to identify these connections, and hypothesise that such connections between misconceptions can be aligned with specific cognitive principles (Coley & Tanner, 2015).

Description and Results

The Genetics Concept Assessment (GCA; Smith, Wood & Knight, 2008) was completed by two cohorts of students (each ~150) in a second year genetics course for science students. Useful lessons on implementation were encountered. The GCA questions were mapped to the course content and objectives. Students' results were compared with previously published patterns (Smith & Knight, 2012), and analysed for correlations within the GCA, within the course, and with other measures of academic success.

Conclusions

By working to explain the underlying causes of misconceptions, the aim is to suggest strategies to minimise the establishment of misconceptions, maximise their replacement with deep understanding. Thus, students' potential to learn and understand more advanced topics in genetics would be maximised. The current study involves concepts in genetics, but the underlying misconceptions could have consequences for student learning in other areas of science.

References

Coley, J. D. & Tanner, K. (2015). Relations between intuitive biological thinking and biological misconceptions in biology majors and nonmajors. *CBE-Life Sciences Education*, *14*, 1-19.

Garvin-Doxas, K. & Klymkowsky, M. W. (2008). Understanding randomness and its impact on student learning: lessons learned from building the Biology Concept Inventory (BCI). *CBE-Life Sciences Education, 7*, 227-233.

Smith, J. I. & Tanner, K. (2010). The problem of revealing how students think: Concept inventories and beyond. *CBE-Life Sciences Education, 9*, 1-5.

Smith, M. K., Wood, W. B. & Knight, J. K. (2008). The Genetics Concept Assessment: a new concept inventory for gauging student understanding of genetics. *CBE-Life Sciences Education, 7*, 422-430.

Smith, M. K. & Knight, J. K. (2012). Using the Genetics Concept Assessment to document persistent conceptual difficulties in undergraduate genetics courses. *Genetics, 191*, 21-32.

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