[P28] Computer-assisted and computer-based testing to assess procedural and conceptual knowledge in bioscience undergraduates

Richard C. Rayne and Glenn K. Baggott
OLAAF Project
Birkbeck, University of London
r.rayne@bbk.ac.uk

We have used TRIADS-based CBA (see Mackenzie, 1999) in several undergraduate biology modules for a number of years. Here, we will report on work undertaken in a first-year, BSc-level molecular cell biology module of ca. 60 students. This module features a regime of frequent CBA which has proved especially beneficial for students whose first language is not English, as we reported previously (Baggott and Rayne, 2001). CBA presented early in the module are targeted to building foundational knowledge, comprising items primarily designed to assess recall and comprehension; as the term progresses, the proportion of items assessing application and problem-solving increases. On the computer-based final exam, in addition to items assessing understanding of key concepts presented throughout the module, a block of additional items focus on students' understanding of a 'classic experiment' (Meselson and Stahl, 1958).

Also in the same module, we have extended our assessment approach to include what is probably best-termed a computer-*assisted* (rather than computer-based) technique. Over the past 3 years, we have made use of the freely available (for academic use) CaseIT! simulation package (Bergland *et al*., 2004) in a practical test. CaseIT! includes a component in which basic DNA manipulation techniques are simulated, including restriction digestion, DNA electrophoresis and Southern blotting. Using the software, it is possible to simulate an experiment to determine the genotype of individuals (the 'case') with respect to a given genetic disease (e.g. sickle-cell anaemia, Duchenne's muscular dystrophy, and many others). About 1 month after a class-based session using CaseIT!, we administered a computer-assisted test. This involves presentation of an unseen 'case' on a paper-based test. Students must analyse and solve the problem using the CaseIT! software to generate the data; they use this data to answer the paper-based test items.

These approaches, we believe, tap cognitive processes in test-takers that draw upon conceptual and procedural knowledge relating to reasonable mimics of 'real-life' scientific problems. We will present our analysis of the student responses (over three academic years) to these new assessment approaches and will describe the principles we followed in constructing these assessments, e.g. through application of logical task analysis (cf. Shavelson *et al*., 2002).

REFERENCES

Baggott, G. K. and Rayne, R. C. (2001) Learning support for mature, part-time, evening students: providing feedback via frequent, computer-based assessments. In: Proceedings of the 5th International Computer-Assisted Assessment Conference, 2001, Loughborough University. M. Danson and C. Eabry, eds. pp. 9-20.

Bergland M., *et al*. (2004) DNA Electrophoresis Module for CaseIT!, version 4.0.2. http://www.uwrf.edu/caseit/caseit.html

Mackenzie, D. (1999) *Recent Developments in the Tripartite Assessment Delivery System* (TRIADS). In: Proceedings of the 3rd International Computer Assisted Assessment Conference, 1999, Loughborough University. M. Danson and R. Sherratt, eds. For information about TRIADS, see: http://www. derby.ac.uk/ciad/

Meselson, M. and Stahl, F. W. (1958) The replication of DNA in Escherichia coli. Proceedings of the National Academy of Sciences, USA, 44 (7), 671-682.

Shavelson, R. J., Li, M., and Ruiz-Primo, M.A. (2002) Evaluating new approaches to assessing learning. Keynote address to the Joint Northumbria/EARLI Assessment Conference, Newcastle, UK. August 2002. http://www.stanford.edu/dept/SUSE/SEAL/Presentation/Presentation.htm