The Formative-Summative Interface:

Strategic incorporation of computer-based assessment in a first-year molecular biology module

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Context...

- adults (aged >20 y)
- majority are full-time employed
- variety of educational backgrounds
- reflect the cultural diversity typical of London

Our classes...

- are held in the evening, 6 to 9 pm
- meet once per week
  - x 11 or x 22 weeks
- "face-to-face" delivery
- 4 years to BSc

Constraints...

- Lack of TIME!
  - students have many commitments outside their academic work
  - attend 2-3 evenings per week, maximum
  - no timetabled academic tutorials

Pedagogical problem...

- Typical student is returning to education, so soon must...
  - develop habit of regular study
  - learn to study effectively
  - build a foundation for further study
    - Knowledge
    - Skills
    - Confidence

Toward a solution?

- Frequent assessment to provide timely and structured learning support
  - to encourage regular study
  - timely diagnosis of learning deficits should promote effective study patterns
  - feedback should build students' confidence and strengthen foundational knowledge

Effectiveness enhanced by…

- Attention to test design
  - highly structured tests, targeted to key learning objectives
  - target understanding rather than recall of facts
- Strategic administration of tests
  - *summative* mode first, to focus students' attention
  - same test in *formative* mode afterward, to permit revision and self-testing

Why computer-based?

- Saves teacher time in marking!
- Remote access, 24 x 7, etc.
- Opportunity for targeted revision and for self-testing
- Dynamic question styles: can't do this on paper!
  - randomised variables
  - animations
  - simulations

Molecular Cell Biology

- 1st year, obligatory module, covering:
  - DNA replication
  - transcription, translation
  - simple genetics
  - key techniques and strategies in molecular biology

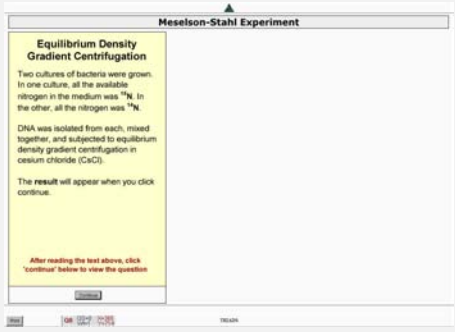
Molecular Cell Biology Week-by Week, 2004

Week	Session	Summative CBA
1, 2	Lecture	
3	TEST	TRIADS: 13 items, 35 min
4	Lecture	
5	Lab Practical	
6	TEST	TRIADS: 15 items, 50 min
7, 8	Lecture	
9, 10	Problem Solving Sessions	CaseIT! simulation
11	TEST	TRIADS: 11 items, 45 min
12	Practical Test	CaseIT!: paper/computer-based
13	TEST (Final Exam)	TRIADS: 19 items, 70 min

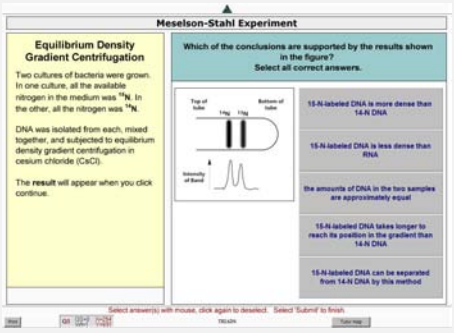
Details of CBA

- TRIADS was used to deliver all of the CBA
  - "TRIADS is a toolkit for users of Authorware Professional…rapid and easy production of computer aided assessments… sign-on, question sequencing, results calculation and filing are handled automatically."
  - http://www.derby.ac.uk/ciad/lough99pr.html

A TRIADS question (1)



A TRIADS question (2)

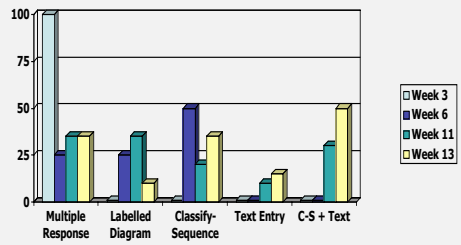


CBA Modes

- **Summative**
  - initially delivered during timed, in-class sessions
- **Formative**
  - "re-runs" of originally summative tests
  - one version of each test gave feedback *on submission of each answer*
  - a second version gave feedback only *after completing the test*

CBA structure: Question styles

- Items by question style (% of all items)



Cognitive type inventory

- **ReCAP***
  - Recall
  - Comprehension
  - Application
  - Problem solving
    (= analysis + synthesis + evaluation)

* Imrie (1995) *Assessment & Evaluation in Higher Education* 20 (2): 175-189.

CBA structure: Cognitive type inventory

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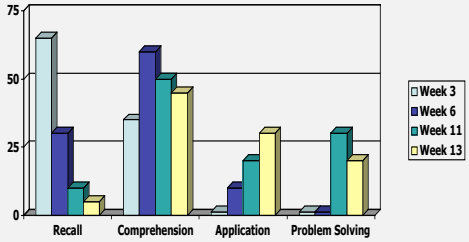
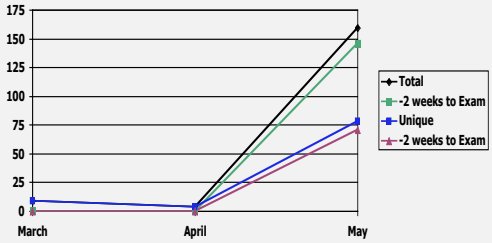


Use of the formative tests

- Number of sign-ons to web-based tests (Week 6 test as an example)



The Final CBA

- Contained 7 questions (of 19) that were the similar to questions that had appeared in the preceding 3 CBAs
  - x3 identical
  - x4 same concept, but a different instance
  - *none were recall questions*

Did students improve their scores on repeat items?

- On the whole, yes…
  - Good: for all 7 of these items, there were impressive improvements
  - Not so good: for all 7 items, there were some 'backsliders'
  - Best example:
    - 46 of 58 people improved
    - average score, 1st instance = 16 (yikes!)
    - average score, 2nd instance = 77 (good going!)
    - only 6 went down; 6 stayed the same at 100%

Utility of the 'repeat' approach

- Students get an opportunity to explicitly demonstrate learning
- Identifies 'problem areas' where instruction can be improved

Conclusions

- the CBA provided support
  - a majority of students made use of, and most benefited from, the formative tests
- this support promoted learning
  - some strong improvers on repeat questions (non-recall)
- 'Foundation-building' aspect is supported
- Regularity and effectiveness of study?
  - Surveys: SPQ and AEQ

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