

Develop understanding, with Self-tests & Certainty Based Marking

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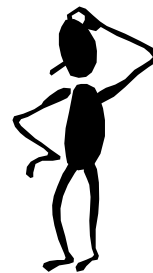
- **Important features in Self-Tests**
- **What can CBM add?**
- **Using CBM in Blackboard Links**
- **CBM in exam assessment**



Teaching & Learning Day
23rd April 2010

ABSTRACT

- Learning is about thinking - relating knowledge, developing arguments, weighing likelihoods, and analysing mistakes.
- Self-tests, properly engineered and conscientiously used, are incredibly valuable to aid this learning process. But they are often dismissed as simply diagnostic or as practice for exams.
- Self-tests with Certainty-Based Marking (CBM) have been developed at UCL and Imperial, often with student-written questions and explanations. The goal is to help students take charge of their own basic learning tasks, using online exercises to free teachers' time for interactions that stretch students and give perspective.
- Self-tests should provide immediate feedback (while the student's thought processes are still fresh) and should (through Certainty-Based Marking) reward identification of either uncertainties or justification for each conclusion.
- Open exercises, discussion and publications are available on the UCL website: www.ucl.ac.uk/lapt. Links to the software and to student records are easily made from a VLE such as Blackboard.



Example of how we use self-tests at UCL

CHEM160x - Chemistry for Biologists 2009-10

You are logged in as A Gardner-Medwin (Logout)

UCL MoodleDevCBM ► CHEM1602_3

Switch role to... Turn editing off

Course Menu

- CHEM1602_3
 - Section A - Self-...
 - Section B - Seei...
 - Section X: Appli...
 - Section C - The B...
 - Section D - Rive...
 - Section E - Archi...
 - Section F - Ion...
 - Section G - The S...
 - Section H - Beyon...
 - The 160x Lab
 - The Library...
 - The Time Machine
 - The Test Centre...
 - Past Exam Papers

CHEM 1602/3 - Chemistry for Biologists

Revision Questions

Here you will find well over 200 questions in this section across a variety of topics, styles and formats.

LAPT questions use certainty-based marking, and LAPT is a system developed at UCL. To get the best marks you will need to decide whether you can justify high confidence in an answer. If you see reasons for reservation, you will gain by expressing lower confidence, and reducing the risk of a penalty if you are wrong. Click on 'CBM Help' in the exercise window to get more explanation and advice.

- Using formulas and Equations in Anger - a revision quiz (Maths Grouping)
- Simultaneous Equations Quiz (Maths Grouping)
- Logarithms Revision Quiz (Maths Grouping)
- Permutation and Combinations Revision Quiz (Maths Grouping)
- Indices revision quiz (Maths Grouping)
- Fractions revision quiz (Maths Grouping)
- Expanding brackets - the revision quiz (Maths Grouping)
- Rearranging equations - a revision quiz (Maths Grouping)
- Quadratic equations revision quiz (Maths Grouping)
- Working with straight lines - A revision quiz (Maths Grouping)
- Differentiation Revision Quiz (Maths Grouping)
- Integration Revision Quiz (Maths Grouping)
- LAPT: Functions and equations, basic differentiation (Maths Grouping)
- LAPT: Further differentiation - products, quotients and functions of functions (Maths Grouping)

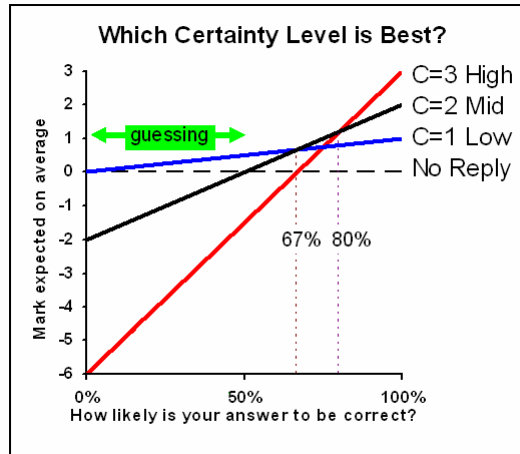
What are important features in SELF-TESTS?

- Immediate feedback for each Q
 - A stimulating / didactic sequences of Qs
 - mix easy & difficult Qs : for engagement, reward, realism
 - include classic misconceptions
 - make chains of Qs : lead through the logic of a topic
 - Explanations should widen an issue into other contexts
 - prompt the bringing together of different kinds of knowledge
 - Clear navigation – students should be choosing what to do
 - Allow use of study materials – tests shouldn't be time-limited
 - Encourage comments & dialogue
 - linked to specific quiz/question contexts
 - Encourage working in pairs (or more)
- Certainty Based Marking (CBM)

Certainty-Based Marking (CBM)

Degree of Certainty :	No Reply	C=1 (low)	C=2 (mid)	C=3 (high)
Mark if correct:	0	1	2	3
Mark if wrong:	0	0	-2	-6

- CBM rewards thinking:
 - identification of uncertainty
 - or of justification
- Highlights misconceptions
 - negative marks hurt!
- Engages students more
- Enhances reliability & validity



A large browsable self-test in Physiology – open access on LAPT

Exercise on LAPT-lite - Windows Internet Explorer

645 question/

Information: Mr
Information: Int
Sect. 1 (5 Qs):
Sect. 2 (5 Qs):
Sect. 3 (5 Qs):
Sect. 4 (5 Qs):
Sect. 5 (5 Qs):
Sect. 6 (5 Qs):
Sect. 7 (5 Qs):
Sect. 8 (5 Qs):
Sect. 9 (5 Qs):
Sect. 10 (5 Qs):
Sect. 11 (5 Qs):
Sect. 12 (5 Qs):
Sect. 13 (5 Qs):
Sect. 14 (5 Qs):
Sect. 15 (5 Qs):
Sect. 16 (5 Qs): Cardiac output is decreased: ...

The following are true of human red blood cells:
Qu. 1: Red cells are rigid biconcave discs

TRUE (or YES)
 FALSE (or NO)

X Mark = -6 (conf=3)

Proceed to the Next Question

Correct Answer: FALSE
They are not rigid, and indeed undergo considerable reversible deformation as they pass through capillaries. They only appear as biconcave discs when unstressed.

(lbmcq) TOTALS: Qs done=0, Marks=0 © UCL 2009.11.12 EDIT (Staff) []

Continue Next Section Index Score COMMENTS Submit CBM Help Problems FB off

Internet 150%

Using SELF-TESTS & CBM as learning tools

- Stimulates thinking & reasoning – enhances study
- Students learn from mistakes – errors in self-tests are valuable
- Stop students kidding themselves –
 - reading is not the same as understanding !
 - copy & pasting doesn't mean you know it !
 - correct guesses are not the same as knowledge !
 - errors through misconception are not bad luck – they are hazards !
 - do away with the “go-for-it” culture
- Distinguishing reliable from uncertain knowledge is important
- Students must learn to own & manage their learning
- Free up teachers' time to discuss / guide / inspire

**Call them 'self-tests', 'practice' or 'exercises'
– not 'exams', 'tests', 'assessments' or 'quizzes' !**

CBM in a VLE

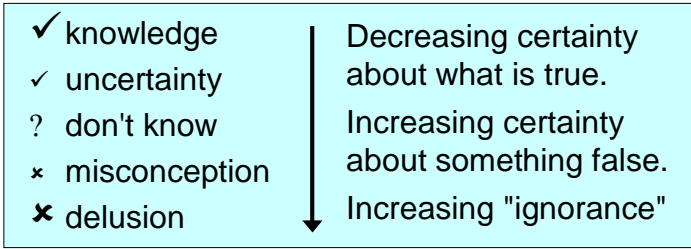
BlackBoard (as at Imperial), Moodle (as at UCL) etc. :

- Secure links transfer authenticated userid to LAPT
- Students can see their own data on LAPT
- Staff can see data for all students
- Staff can view Question Analysis, edit Qs, respond to comments

Moodle Development:

- Open Source code allows CBM within Moodle quizzes

Ordinary words we use to describe Knowledge



- Knowledge is a function of certainty (confidence, degree of belief)
- There are states a lot worse than acknowledged ignorance

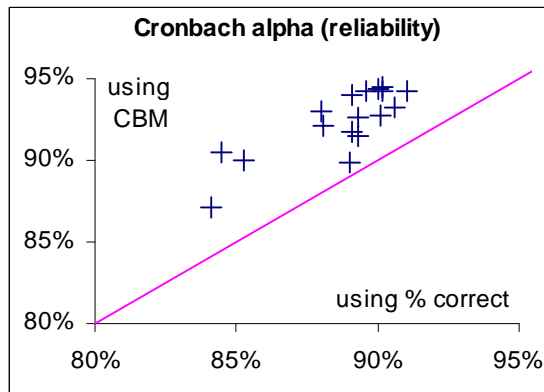
"It's not ignorance does so much damage - it's knowin' so derned much that ain't so."

attrib J. Billings



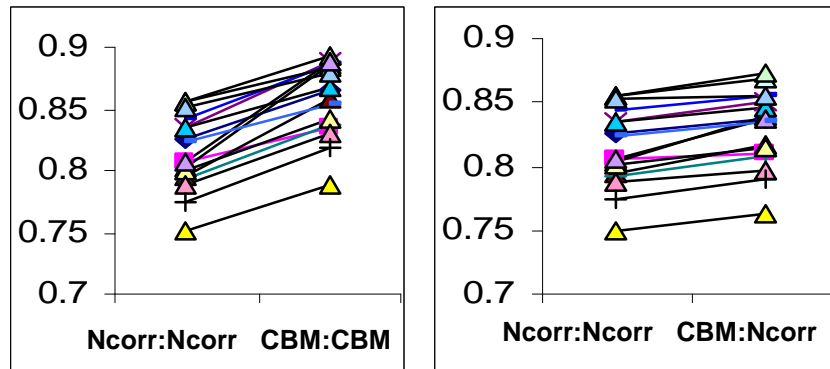
CBM increases the reliability of exam data with True/False Questions

'Reliability' indicates to what extent a score measures something about the student's ability, as opposed to 'luck' or chance.



To achieve these increases using only % correct would have required on average 58% more questions.

Correlation coef. (r) showing how well scores on odd numbered Qs are correlated with scores on even numbered Qs, from 17 exams.



Even if you think (wrongly!!) that NUMBER CORRECT is the gold standard as a measure of knowledge, CBM scores are better predictors of this (on a different test) than is the number correct itself.

How should one handle students with poor calibration?

Significantly overconfident in exam: **2 students (1%)**

e.g. 50% correct @C=1, 59%@C=2, 73%@C=3

Significantly underconfident in exam: **41 students (14%)**

e.g. 83% correct @C=1, 89%@C=2, 99%@C=3

Maybe one shouldn't penalise such students

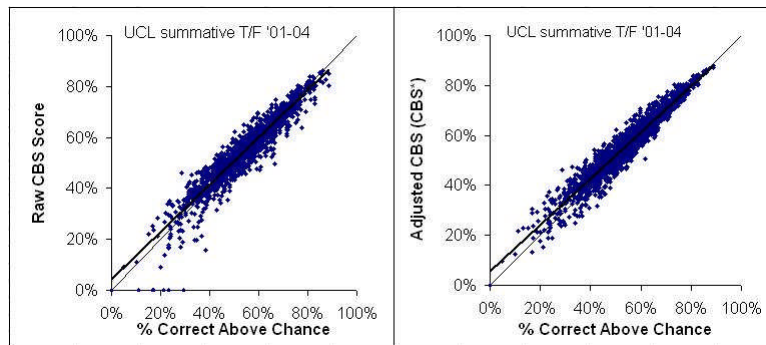
Adjusted confidence-based score:

Mark the set of answers at each C level as if they were entered at the C level that gives the highest score**.

mean benefit = 1.5% ± 2.1% (median 0.6%)

** (first combining sets if %correct is not in ascending order)

Adjustment of Scores can take account of broad mis-calibration of confidence

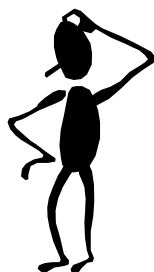


Why doesn't everybody already use CBM ? - a puzzle

- Enthusiasm was exhausted before the age of 'online'
- Some CBM methods were complex, opaque or non-motivating
- Reluctance to treat certainty as integral to knowledge
- Mistaken worries about 'personality bias'
- Under-rating of self-assessment & practice as learning tools
- Worry that CBM would need new questions
- Worry that CBM would upset standard-setting
- Inertia and vested interests

www.ucl.ac.uk/LAPT

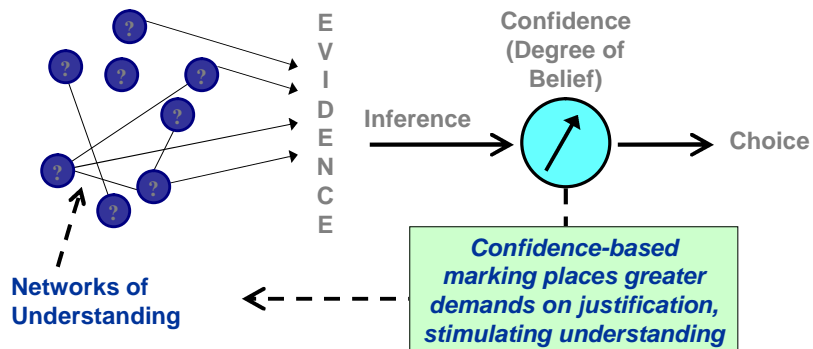
Google any two of: UCL CBM LAPT
a.gardner-medwin@ucl.ac.uk



*We fail if we mark a lucky guess as if it were knowledge.
We fail if we mark misconceptions as no worse than ignorance.*

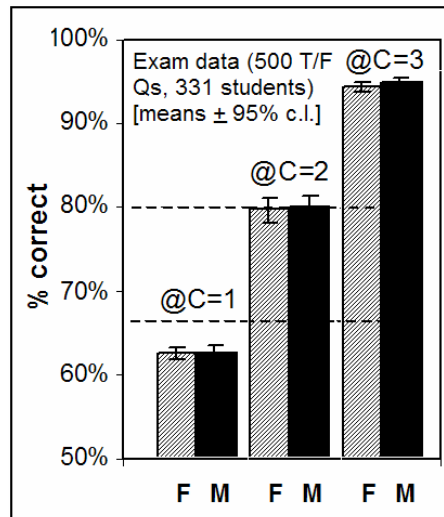
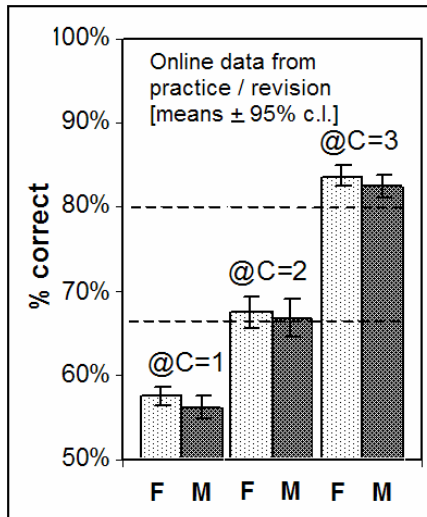
Thinking about uncertainty and justification stimulates understanding

Nuggets of knowledge



To understand = to link correctly the facts that bear on an issue.

How well do students discriminate reliability ?



Will it rain next weekend?

Does a (good) weather forecaster have knowledge?
- obviously yes, but expressed through a probability

How can you measure and reward this knowledge?
- this was the origin of CBM >100 years ago.

Does insulin raise blood glucose levels?

Similar, even though the Q is not about a probability.
- the probability is your certainty that your answer is right

The key is to have a "proper" or "motivating" reward scheme, which ensures that the person does best by expressing their actual level of uncertainty