



Self-tests and Certainty Based Marking as learning tools - putting learners in charge

*Tony Gardner-Medwin - Physiology (NPP), UCL
Matt Jenner, Peter Roberts - LT Support, UCL*

- **Important features in Self-Tests**
- **What can CBM add?**
- **Self-tests & CBM in Moodle**

ABSTRACT

Self-tests and CBM as learning tools - putting learners in charge

Tony Gardner-Medwin, Matt Jenner, Peter Roberts

We learn from mistakes, from practice and from thinking about what we get right and get wrong. Self-tests with Certainty-Based Marking (CBM) have been developed in LAPT (www.ucl.ac.uk/lapt) at UCL and Imperial over many years to enhance study, often with student-written questions. Students need to learn to direct their learning process - what questions they address, when, and with what access to notes etc. LAPT optimises this, using immediate feedback (while the student is still thinking), a rich comment environment and CBM to reward reflection on the basis of answers - identifying uncertainties or justifications based on checks and links to other knowledge. This works well with simple links from Moodle (at UCL) or Blackboard (at Imperial), but the present project embeds key features directly into Moodle code for easier access. An open demo site (www.ucl.ac.uk/lapt/moodle19/moodle, with code for Moodle 1.9.7, 1.9.8) shows how existing quizzes are used with/without immediate feedback and CBM. CBM analysis of chosen responses appears in reviews but gradebook entries are conserved unchanged (to avoid introducing database changes). The adaptations are easily installed in 1.9 and complement parallel developments at the OU for 2.0 - hopefully encouraging discussion of what are optimal interfaces and tools for effective study.

Example of how we use self-tests at UCL

CHEM160x - Chemistry for Biologists 2009-10 You are logged in as A Gardner-Medwin (Logout)

UCLMoodleDevCBM ► CHEM1602_3 Switch role to... Turn editing off

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 \(Maths Grouping\)](#)

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

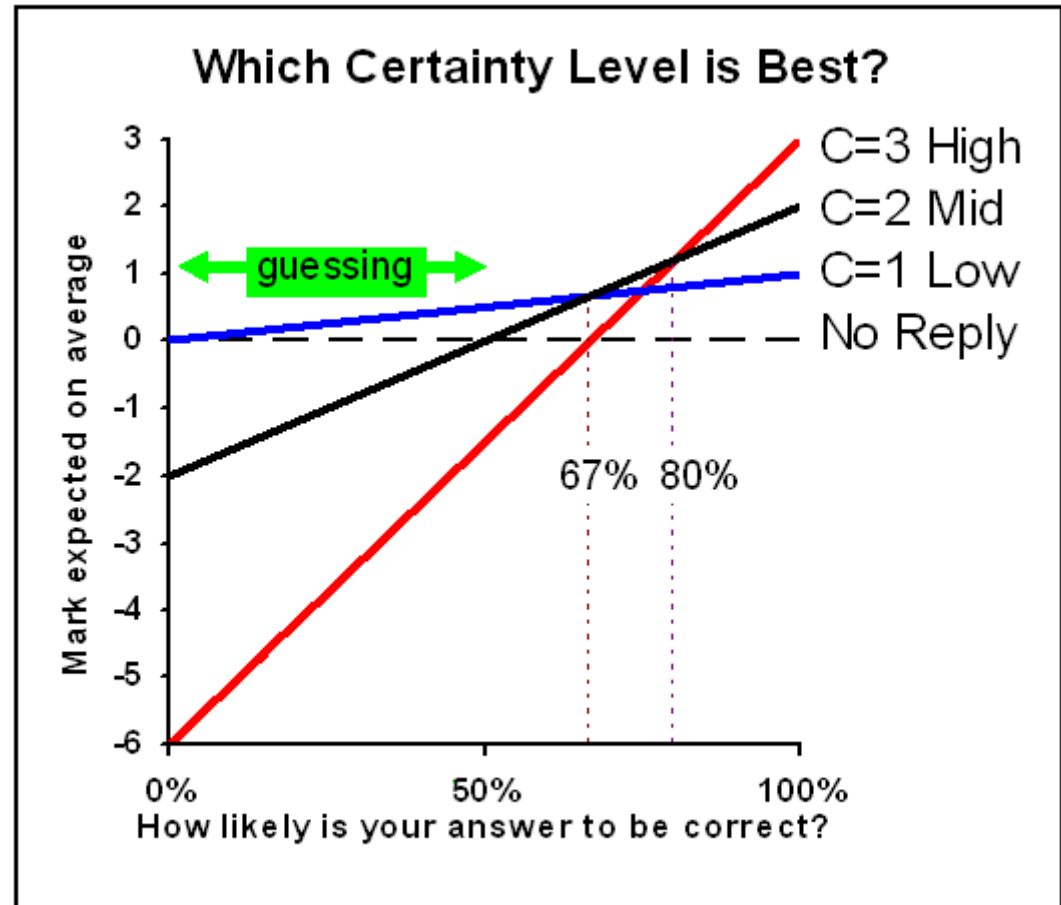
What are important features in SELF-TESTS?

- 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

E_it **F1**

645 question/

[Information: M](#)
[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

X 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 2009.11.2 [EDIT \(Staff\) \[/\]](#)

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

Internet 150%

Mods to Quiz Update Page

Normal

Grades

Grading method ?	Highest grade ▾
Apply penalties ?	Yes ▾
Decimal digits in grades ?	No
	Yes

With CBM mods

Grades

Grading method ?	Highest grade ▾
Mark Scheme ?	Certainty Based Marking (CBM) self-test with immediate feedback ▾
Decimal digits in grades ?	No Penalties
	Penalties for Multiple Attempts
	Certainty Based Marking (CBM) self-test with immediate feedback
	CBM test without immediate feedback

Mods to Review Page

Review

Started on	Saturday, 16 January 2010, 16:21
Completed on	Saturday, 16 January 2010, 17:01
Time taken	40 mins, 5 secs
Correct	56 out of 200 questions in the whole exercise: 28 %
CBM marks	80 out of 600 (maximum for the whole exercise).

Performance breakdown for the 100 questions to which you responded:

Click here to see [CBM Explanations](#) in a separate window.

	Breakdown by Certainty:				Overall
Certainty (estimated P correct):	No Idea	C=1 (<67%)	C=2 (67-80%)	C=3 (>80%)	
Correct / Actual Responses:	-	31 / 70 (44%)	16 / 21 (76%)	9 / 9 (100%)	56 / 100 (56%)
Number Incorrect:		39	5	-	44

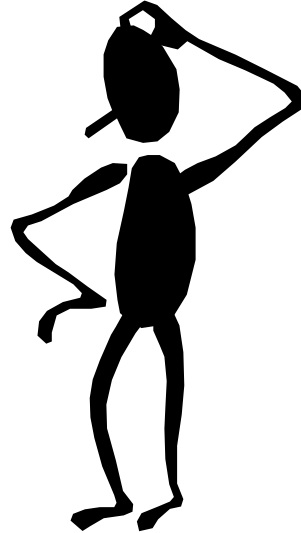
Your CBM marks (total = **80**) correspond to a **CBM score of 54%**.

... followed by just those Qs answered or responded to
with “No Idea”

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' !***



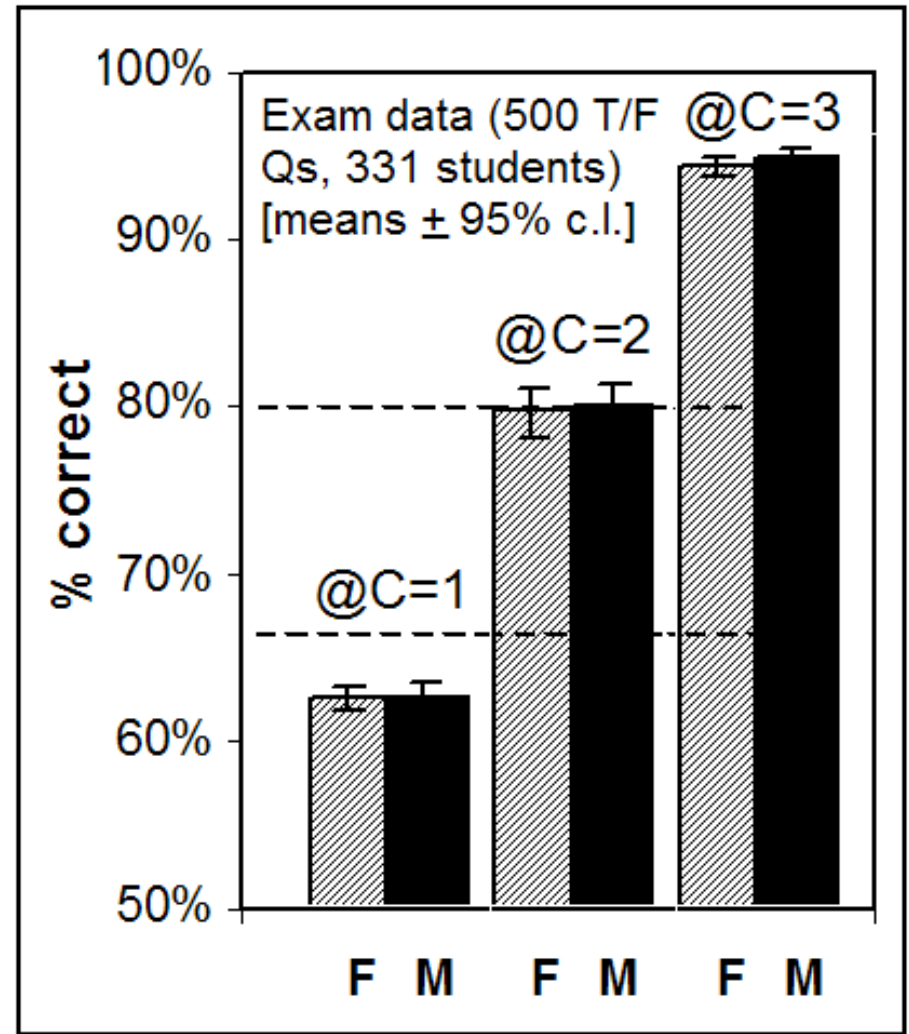
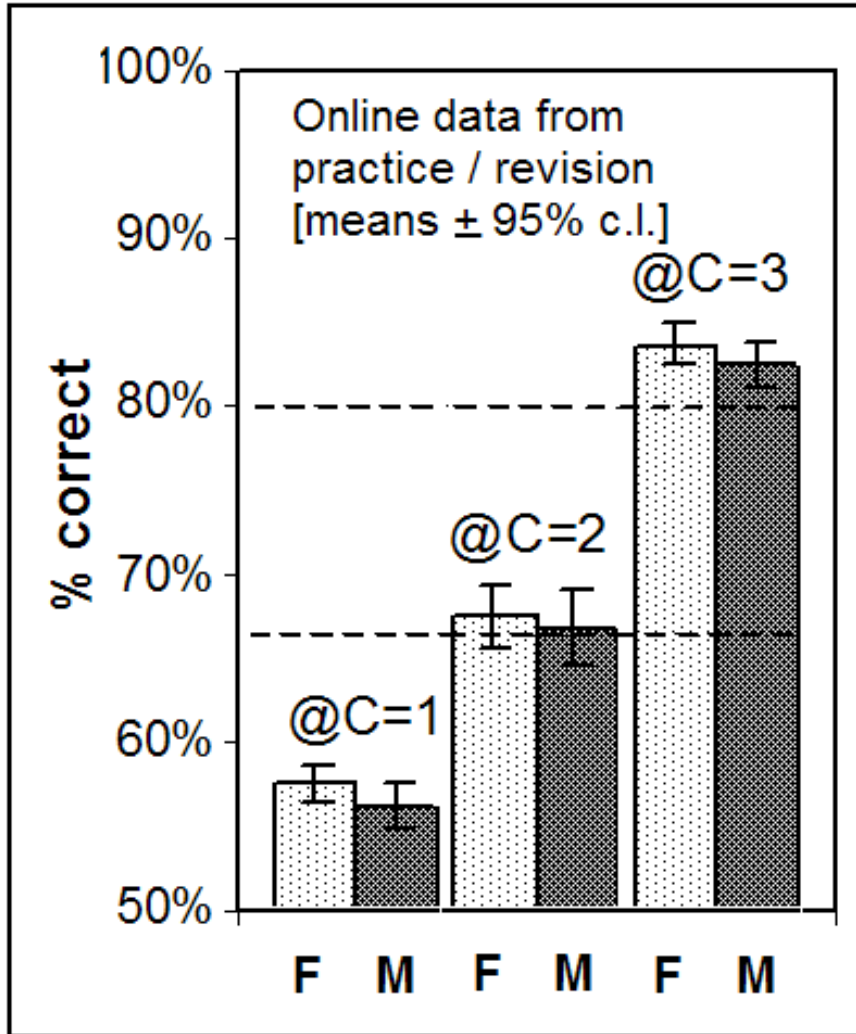
www.ucl.ac.uk/lapt

www.ucl.ac.uk/lapt/moodle

Google any two of: UCL CBM LAPT Moodle

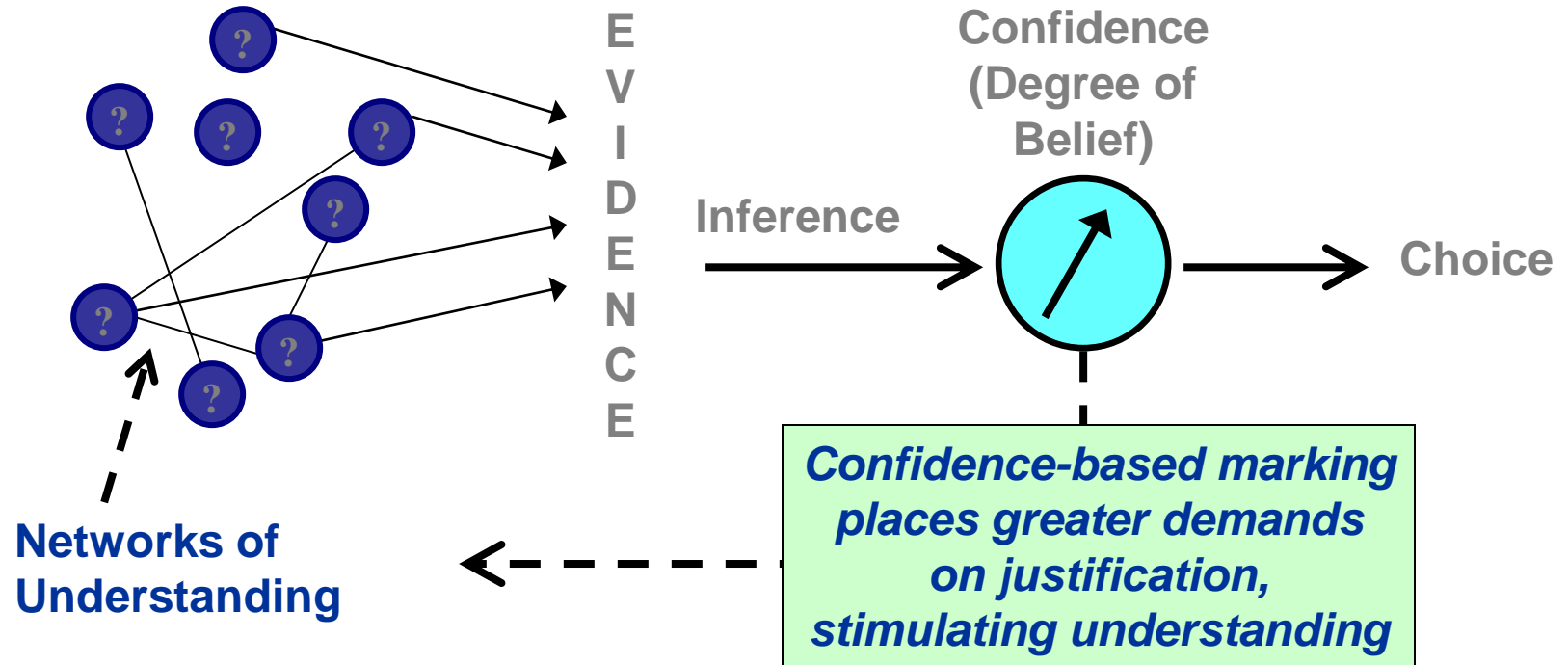
a.gardner-medwin@ucl.ac.uk

How well do students discriminate reliability ?



Thinking about uncertainty and justification stimulates understanding

Nuggets of knowledge



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

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

Student Learning: Principles they readily understand

- You need to know the reliability of your knowledge to use it
- Confident errors are serious, requiring attention to explanations
- Expressing uncertainty when you are uncertain is a **good thing**
- Confidence is about **understanding why things cannot be otherwise**, not about personality
- if over- or under-confident, you must calibrate through practice
- **reflection** and **justification** are essential study habits

In evaluation surveys, a majority of students have always said they like CBM, finding it useful and fair.

They asked to include it in exams, and after 5yrs exam use at UCL they voted 52% : 30% to retain it (in 2005/6), though this was rejected by the conservative medical establishment.

Why test knowledge? Google makes it so easy to find !

Cheap information (& *increased teamwork*) require :-

- 1) *Identifying things you will get wrong and not Google!*
 “unknown unknowns” rather than **“don't knows”**
- 2) *Judging reliability and uncertainty correctly*
 - setting a threshold for seeking help
 - evaluating conflicting and corroborating information

In olden times, you had to rely on your own stored information
 you would make a best choice and **“go for it”**
School leavers have more sparse (though broader) stored info,
but still have a “go for it” culture - to a scary extent!
 *responding with an immediate idea & not thinking much*

These lessons are core things that CBM teaches