

Rewarding the identification of uncertain and confident answers

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CBM-selftests (online):
Certainty-Based Marking

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Self-Tests for Medical & Biomedical Students

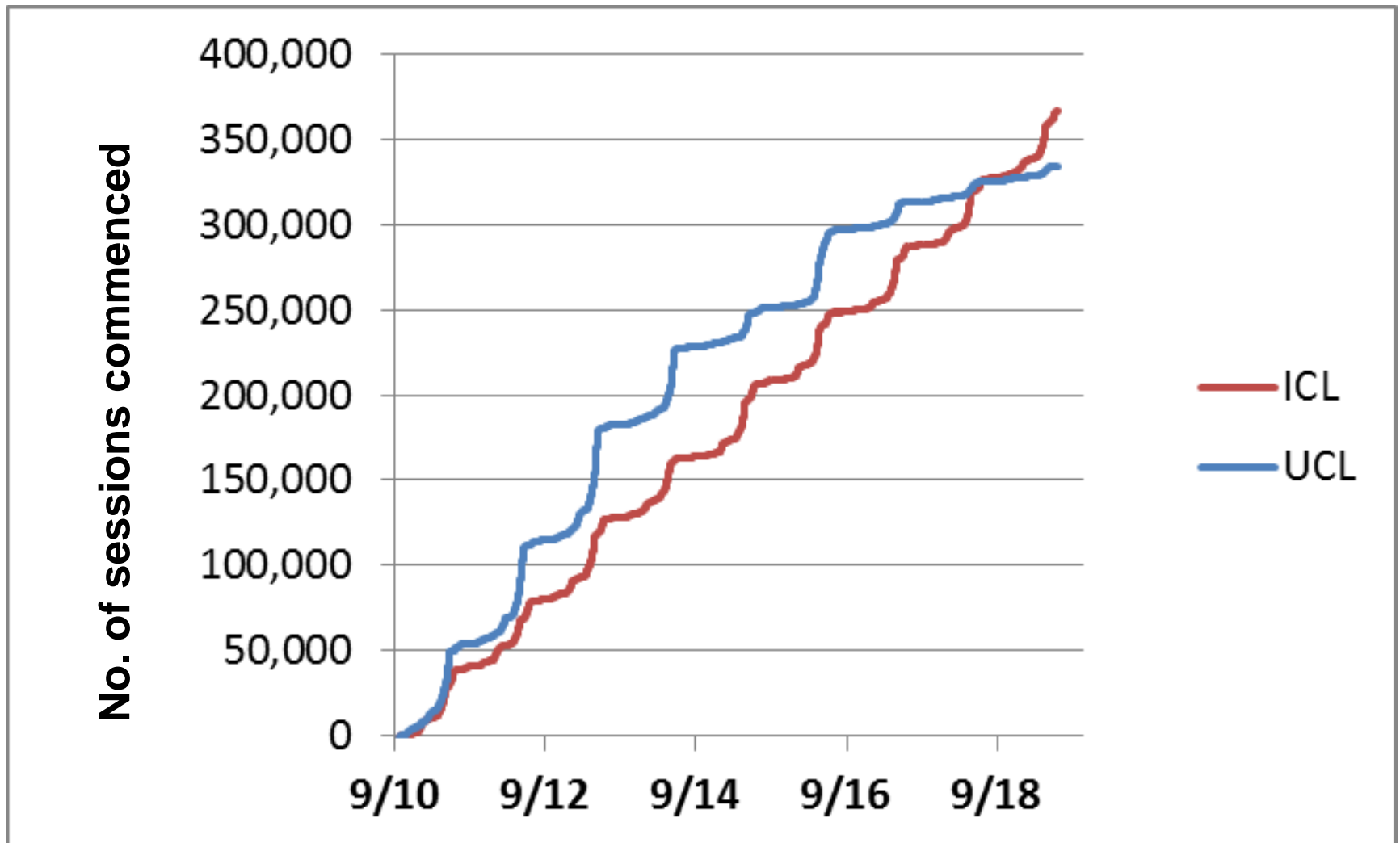
- Topographic Anatomy with explanations
 - [Vol. 1: \[380 Qs\]](#)
 - [Vol. 3: \[375 Qs\]](#) (explanations) by
- Physiology
 - [Physiology 1 MCQ Questions in Physiology \[645 Qs\]](#), L.Bindman, P.Ellaway, B.Jewell & L.Smaje, • [Physiology 2 \[515 Qs\]](#) - MCQs (UCL & Imperial)
 - [ECG practical \[34 Qs\]](#) Practical follow-up (UCL), • [Endocrinology \[569 Qs\]](#) (UCL)
 - [Kidney Physiology Workshop \[40 Qs\]](#), • [Membrane Potentials and Action Potentials \[38 Qs\]](#) (basics), [Vision \[44 Qs\]](#) by TGM (UCL)
- Biochemistry
 - [Amino-acids \[123 Qs\]](#) (UCL), [AA Nutrition \[179 Qs\]](#) (UCL), • [ATP \[32 Qs\]](#) (UCL), • [Diet \[80 Qs\]](#) (UCL)
 - [Digestion \[241 Qs\]](#) (UCL), • [Energy Balance \[144 Qs\]](#) (UCL), • [Enzymes \[104 Qs\]](#) (UCL), • [Overview of Metabolism \[59 Qs\]](#) (UCL)
 - [Metabolism \[303 Qs\]](#) (UCL), • [Molecular Biology \[224 Qs\]](#) (UCL), [Oxidative Phosphorylation \[82 Qs\]](#) (UCL), • [Proteins \[63 Qs\]](#) (UCL)

Academic Practice & Technology

UCL, July 1st 2019

How can we help our students to thrive?

Preclinical medical student CBM self-test sessions 2010-2019



Education is about developing Metacognition

Learning how to acquire knowledge

Knowing what you do & don't know

Strategies for inference and justification of conclusions

Knowing how & when to seek help

What (online) strategies aid this ?

Questions to stimulate thinking, not rote learning

Questions that target relationships, not just facts

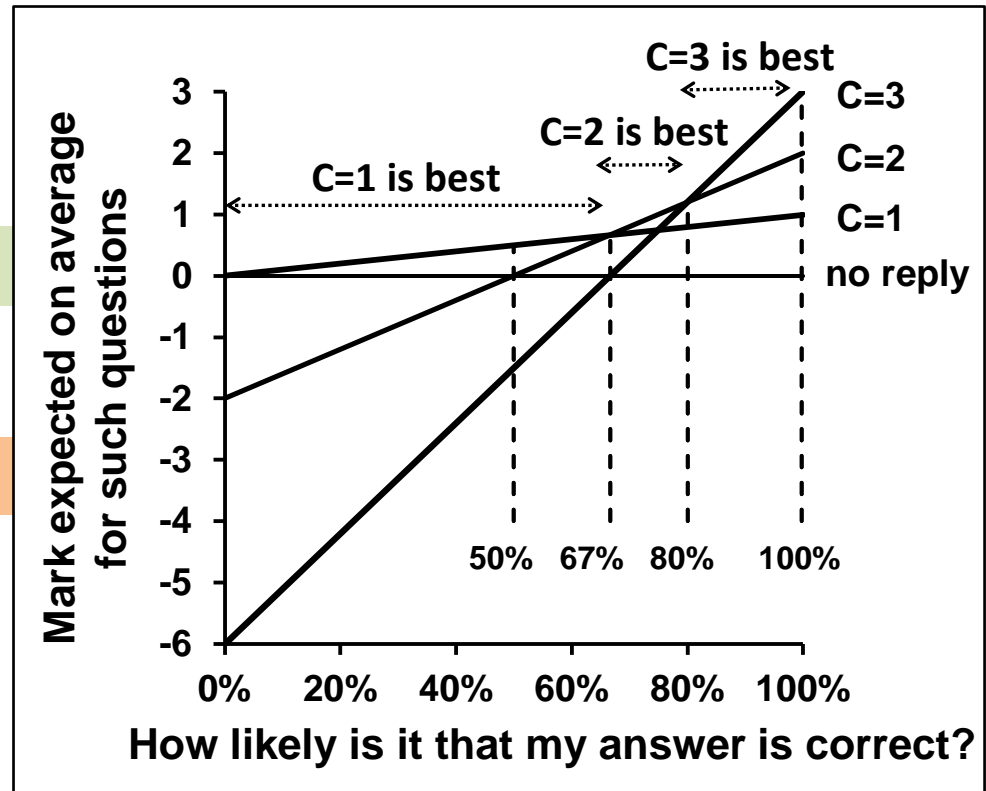
Motivate justification & questioning of answers. (*How?*)

Reward the identification of uncertain & sound answers

Certainty Based Marking (CBM)

Obviously best if you are very sure

Certainty Level	Mark if Correct	Penalty if wrong	
C=3 (high)	3	-6	>80%
C=2 (mid)	2	-2	
C=1 (low)	1	0	<67%
No Reply	0	0	



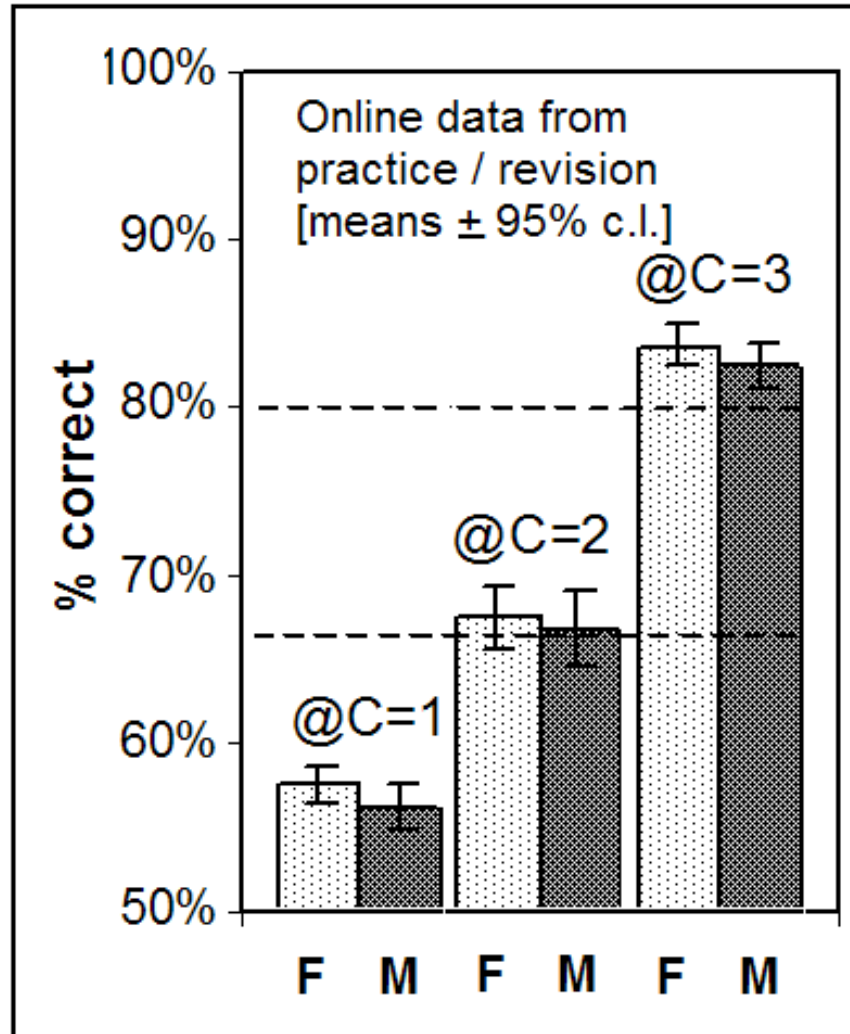
Obviously best if you are very unsure

NB the student gains:

EITHER by finding justification for high confidence

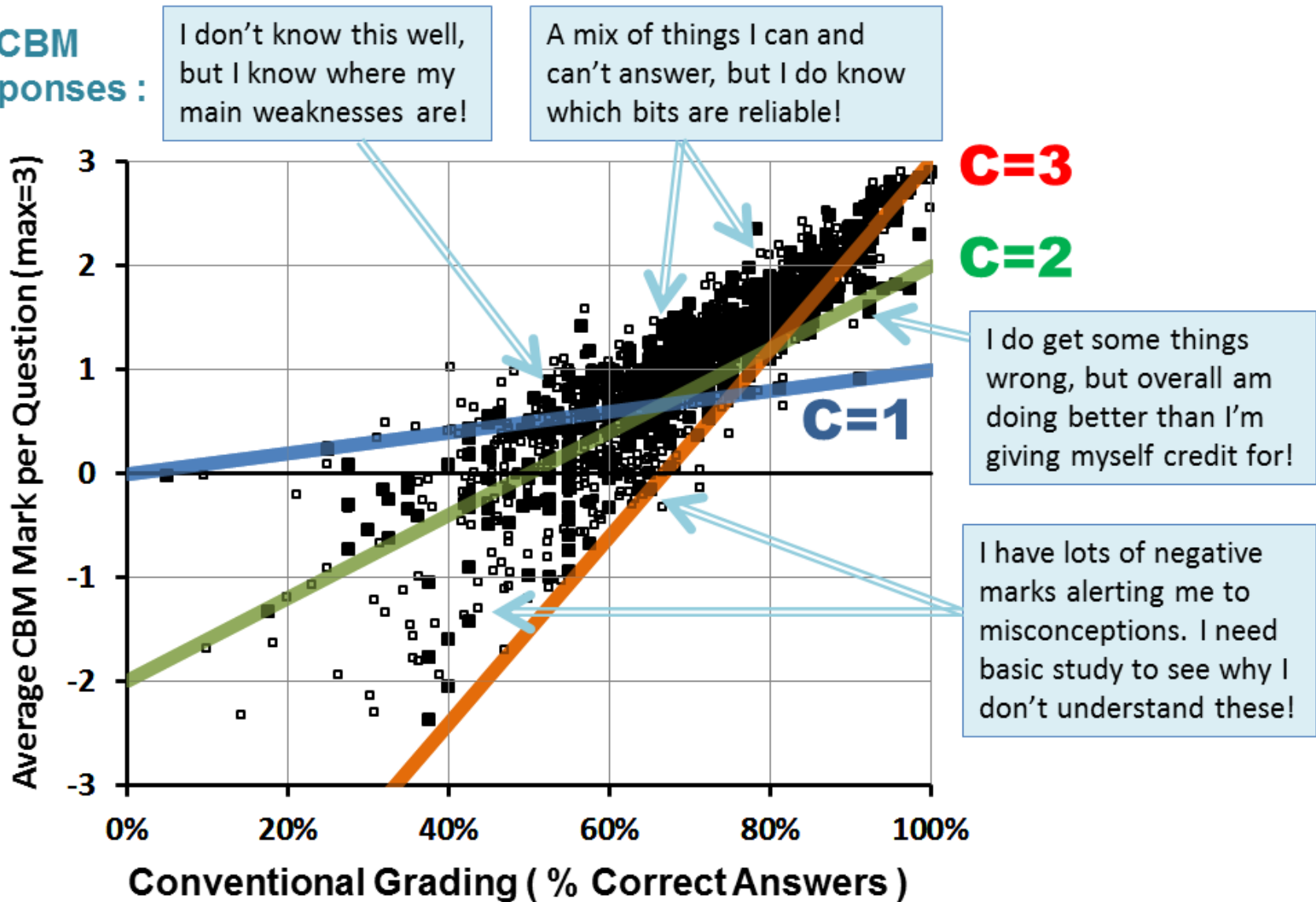
OR by seeing reasons for reservation about an answer

Students on average judge their confidence well in self-tests to optimise their scores



What insights does this bring to students?

CBM Responses :

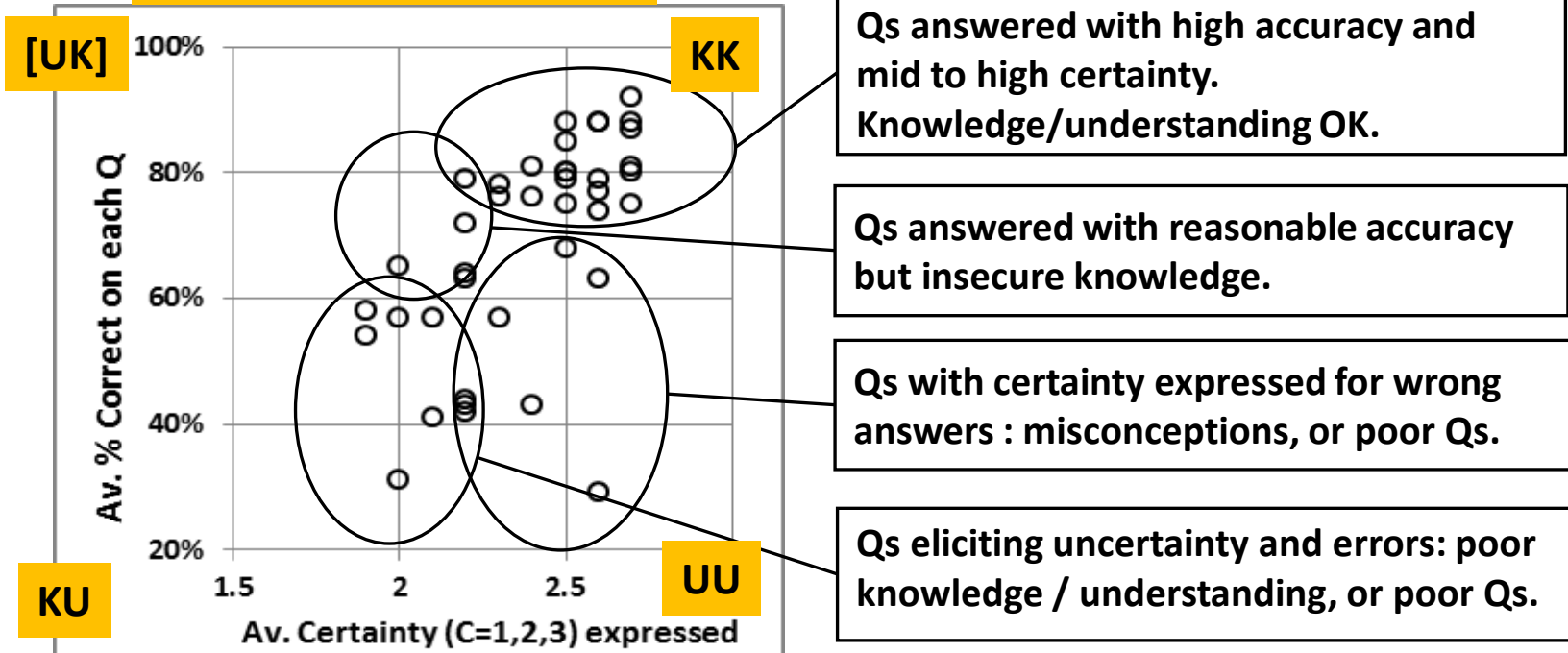


Conventional Responses :

I'm no good!	Borderline!	I'm great!
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Insights for staff – what CBM performance on individual questions can reveal

Rumsfeld's Encapsulation



Unusual (but important!) features of CBM selftest software

Privacy: students mustn't think mistakes could in any way count against them

- mistakes are for learning from, not for humiliation

Selection: Students select topics and Qs to answer & are marked on these

- emphasises the value of challenge, and identifying areas of weakness

Immediate feedback: (computed locally for each Q – not by the server)

- important to think why you made a mistake

Anonymous data submission (optional)

- still helps staff, though it means students can't review their data later

Anonymous comments on Qs: openly visible, with delivery to relevant staff

- improves Qs & explanations; staff responses added in context

Simple editing and file creation: much simpler than Moodle or Blackboard!

- edits are annotated in relevant comment files

Mixed exercises: Didactic sections interspersed with quiz sections

- together with answer explanations, provides a full learning structure

Simple access: direct URL links from web or LMS (optional authentication)

- e.g. tmedwin.net/st?words , ucl.ac.uk/lapt/ucl?words

Future Developments & possible collaborations

Ensure portability & self-contained installation –

- current software is on my own site (with some test files elsewhere)

Mobile Use – optimisation of software

Promote visibility & discussion – e.g. of published papers, ST & Moodle use

VocTech & Staff Training – a major market opportunity

Money - Grants / business opportunities / research projects

New topic areas: Uni & school topics, self-tests written by students & staff

Interested ? – Contact me (a.gardner-medwin@ucl.ac.uk)

Take-home thoughts on CBM

- *Lucky guesses are not knowledge.*
- *Confident errors are serious, even dangerous – worse than ignorance*
- *CBM is more reliable & more valid than accuracy in assessments*

Students intuitively recognize these as obvious truths.

Teachers and examiners should recognize them too!

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Abstract

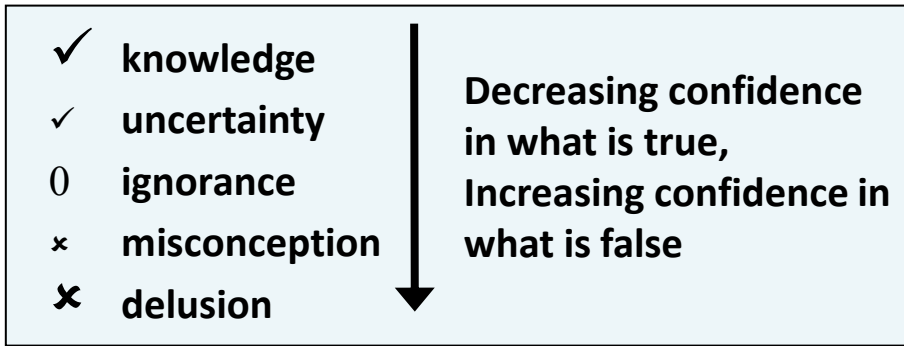
We can learn facts individually by rote, or, much more efficiently, we can learn how facts inter-relate so that we can deduce new facts and check tentative ideas by seeing whether they fit with other knowledge. Efficient study and learning must develop these skills. But standard assessment and self-testing seldom address the metacognitive aspect of this: *Am I sure? Does this fit with other things?* A lucky guess at an answer is marked as if it were knowledge, and a strongly held misconception may never get flagged as dangerous, or as a potentially serious impediment to further learning.

Computerised confidence-based, or certainty-based marking (CBM) [1] was introduced 25 years ago at UCL and CXWMS (now Imperial) to reward students in self-tests for identifying uncertain and confident answers (on a certainty scale 1,2,3 yielding 1,2 or 3 marks if correct and 0,-2 or -6 if incorrect).

The session will discuss the past and future evolution of important features - mark schemes [2], student and staff feedback [3], self-test privacy, interactive comments, open access [5], and application to exams [4], with increased assessment reliability.

Collaboration would be welcomed for future development.

What is knowledge ?



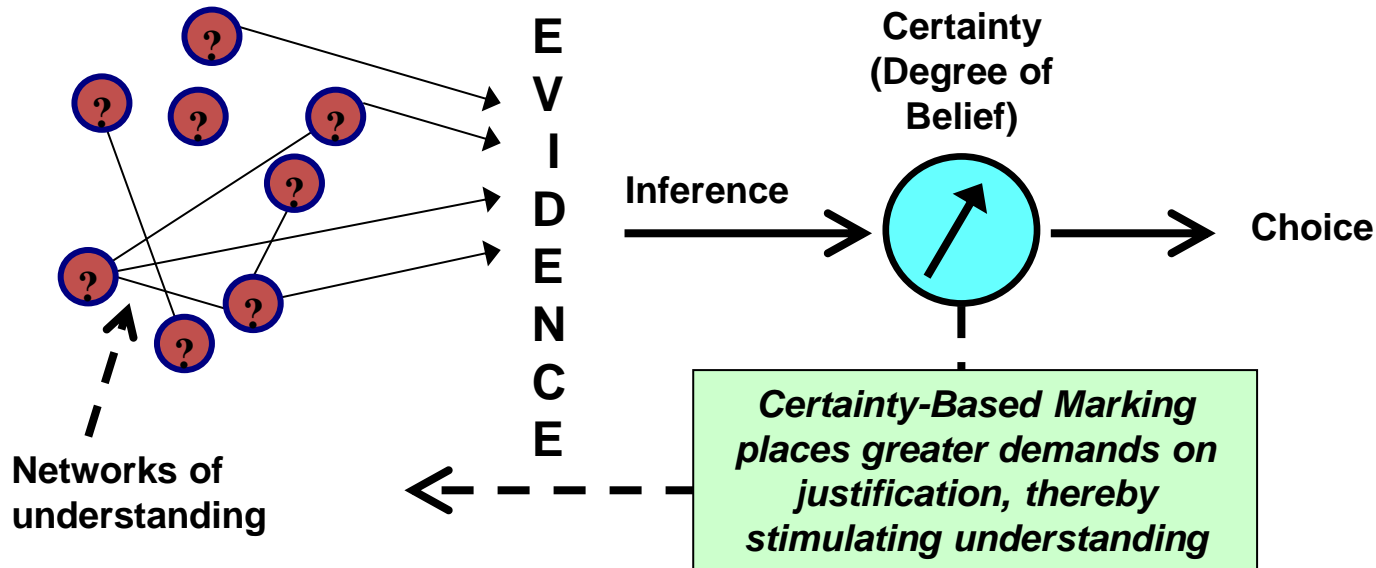
Knowledge = justified true belief
Certainty = degree of belief
Justification requires understanding

What is understanding?

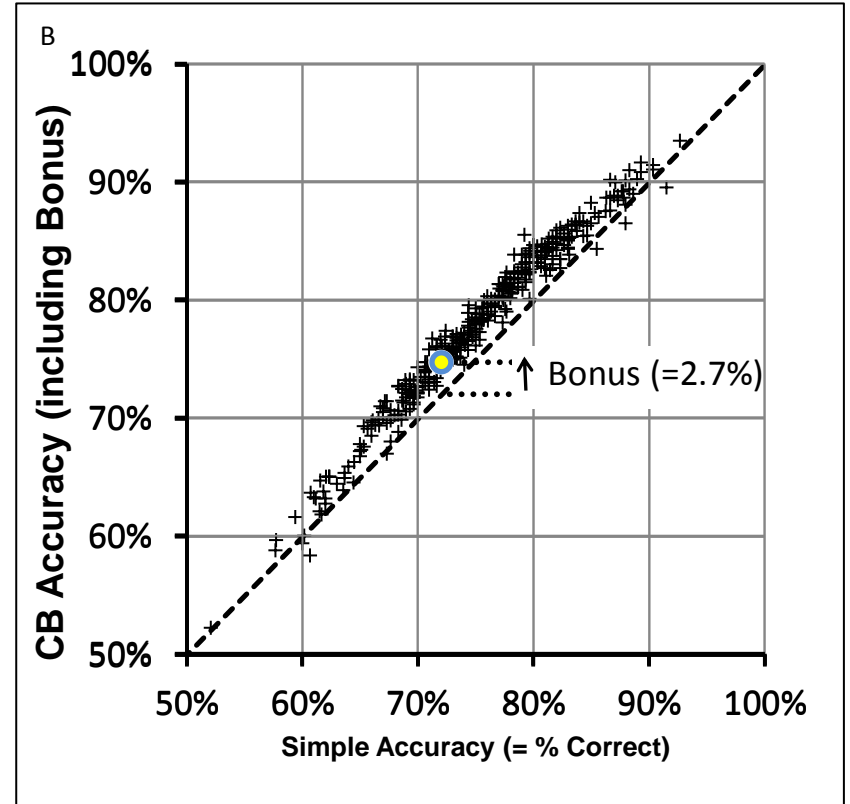
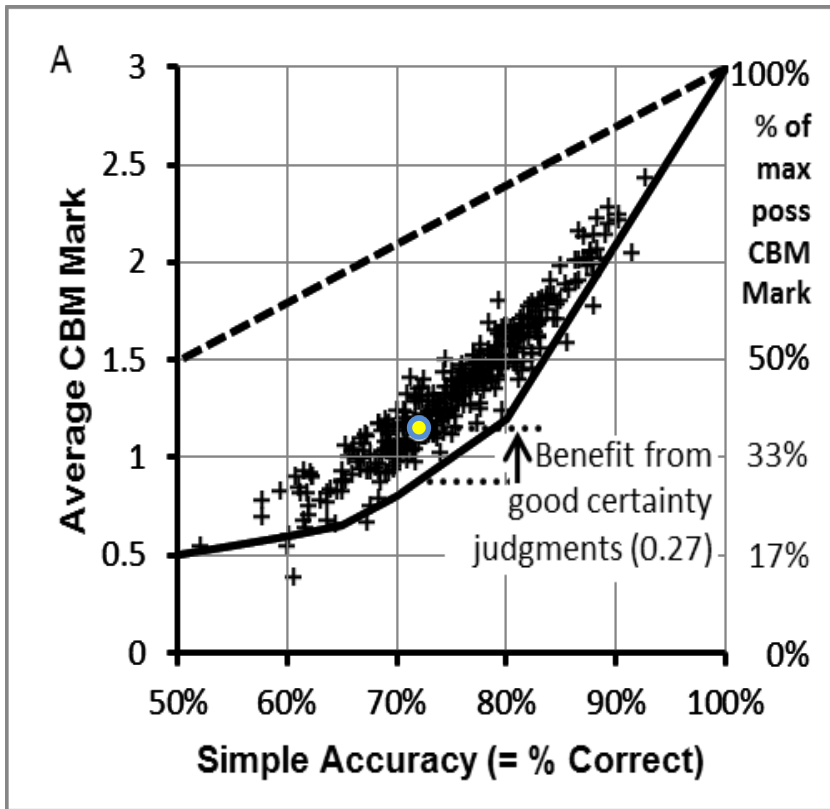
To understand = to link correctly the facts that bear on an issue.

(How you tell a student from a parrot !)

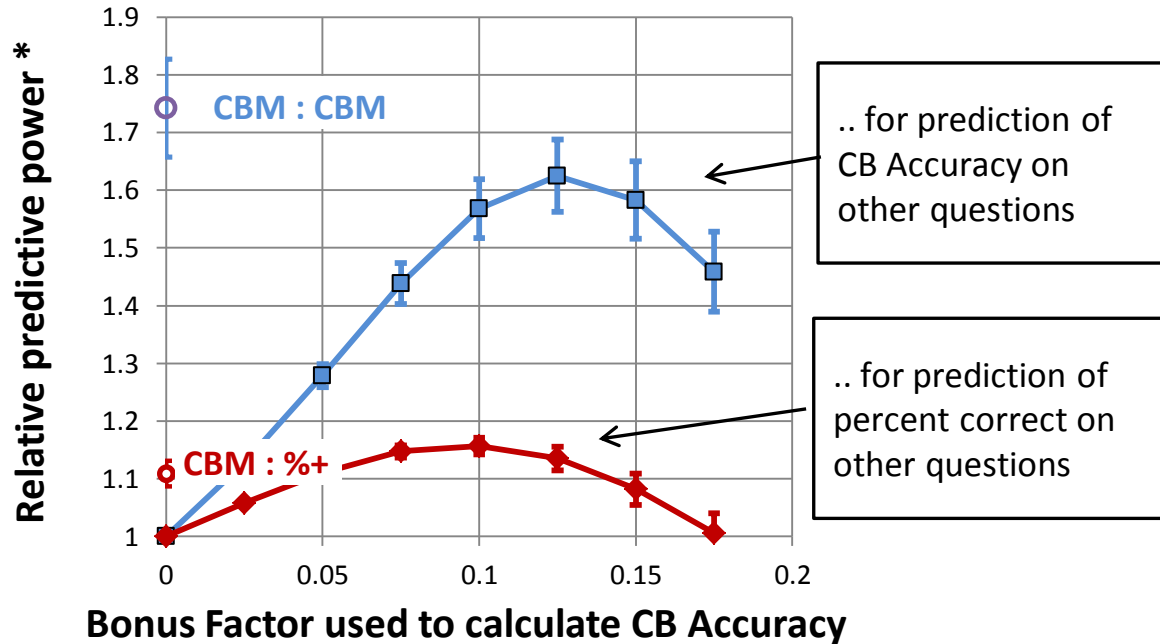
Nuggets of knowledge



CBM in exam assessment



CBM enhances reliability and validity of exam scores



* Factor by which $r/(1-r)$ is increased where r =rank correl. coeff. between scores on odd & even numbered Qs. Mean \pm sem for 17 exams, each 250+ t/f Qs, 300+ students.

