

e-Assessment Scotland - Dundee - August 23rd 2013

Certainty Based Marking: Benefits of a switch to CBM in self-tests and exams

Tony Gardner-Medwin – UCL

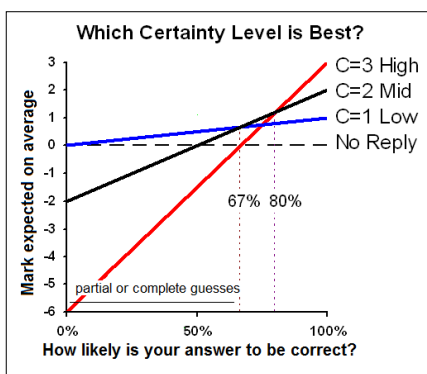
- CBM : is fundamental to knowledge assessment
- Self-tests (private challenge & practice): fundamental to learning
- Worrying inadequacies of conventional marking
- CBM: performance in self-tests & enhancement of exams
- New available software: offline CBM module + institution links

Publications, software, try-out, contact , etc:

www.ucl.ac.uk/lapt www.TMedwin.net/cbm (new modules)

CBM is simple, and ensures honest reporting of uncertainty

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



*But I don't like negative marking!
I've never used it in 40 years of teaching!*

Fixed -ve marking is seldom rational. It can reduce variance if students refrain from guessing, but at the cost of disadvantaging on average those students who do just that.

CBM also reduces guessing variance, but rewards students on average for identifying uncertain answers. It is always best to answer each Q.

CBM rewards acknowledgement of uncertainty.

“When you know a thing, to hold that you know it,
when you do not know a thing, to allow that you do not know it
– this is knowledge.”
Confucius



“... there are known knowns;
... there are known unknowns;
... But there are also unknown unknowns” *Rumsfeld*

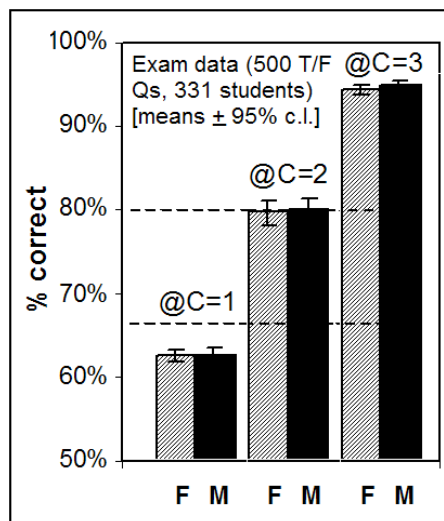
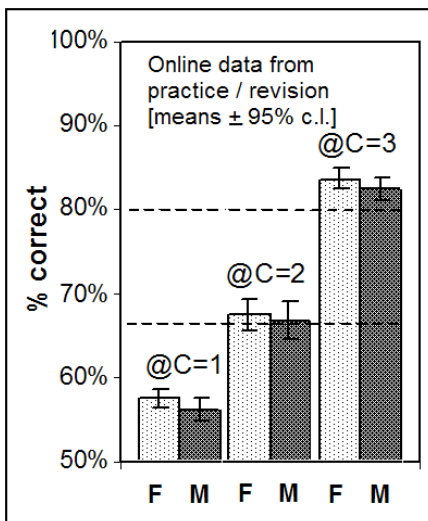
“It's not ignorance does so much damage;
- it's knowin' so derved much that ain't so.”
attr.: Billings



“A lucky guess is not knowledge.
A firm misconception is worse than acknowledged ignorance.
So why do we mark students as if these things weren't true?” *TGM*



How well do students discriminate reliability ?



What is knowledge ?

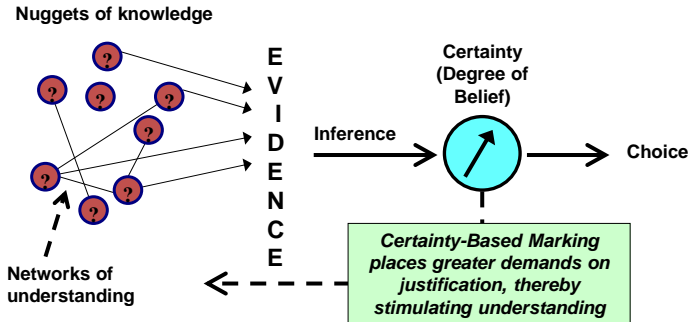
✓ knowledge	↓ Decreasing confidence in what is true, Increasing confidence in what is false ↓
✓ uncertainty	
0 ignorance	
× misconception	
✘ delusion	

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

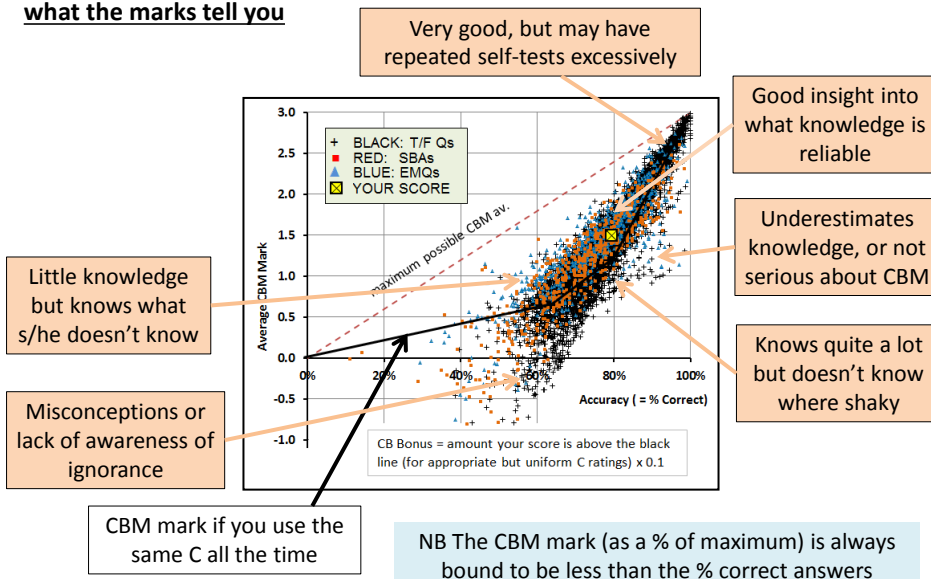
What is understanding?

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

(How you tell a student from a parrot !)

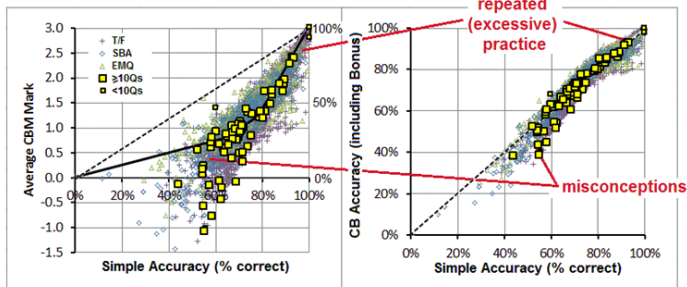


CBM Self-tests: what the marks tell you

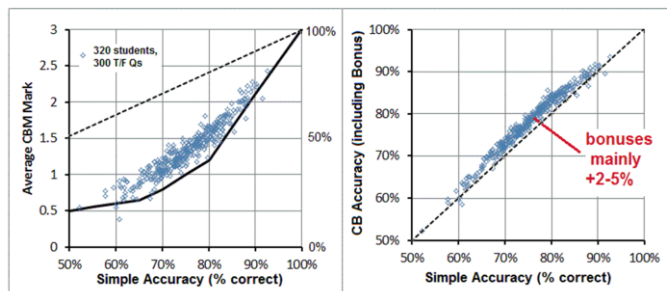


Presentation of CBM marks as a 'bonus' added to accuracy

Online self-test practice data



Exam Data



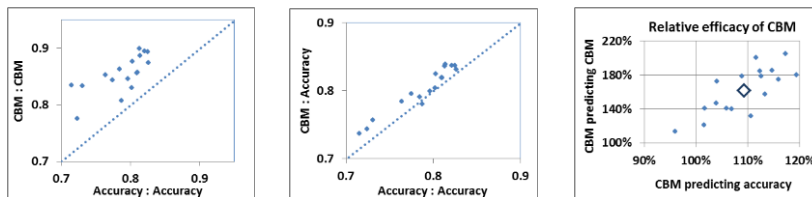
CBM in Exams

T/F	Confidence	SBA /EMQ	Confidence
1	A <T> <F> <1> <2> <3>	1 <A> <C> <D> <E>	<1> <2> <3>
	B <T> <F> <1> <2> <3>	2 <A> <C> <D> <E>	<1> <2> <3>
	C <T> <F> <1> <2> <3>	3 <A> <C> <D> <E>	<1> <2> <3>
	D <T> <F> <1> <2> <3>	4 <A> <C> <D> <E>	<1> <2> <3>
	E <T> <F> <1> <2> <3>	5 <A> <C> <D> <E>	<1> <2> <3>

Speedwell OMR styles for CBM

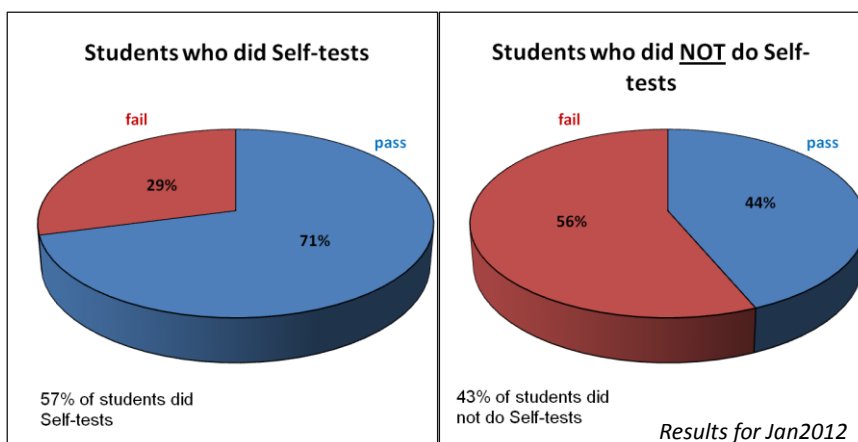
- Standard setters get conventional accuracy (% correct) as well as CBM
- For the same accuracy, students gain if they correctly identify strengths and weaknesses
- CBM is a more soundly based measure of ignorance or knowledge
- CBM yields exam data with much greater statistical reliability
- CBM is better than accuracy for predicting the accuracy on a separate set of Qs

Data from 1000 random splits of 17 exams (250-300 T/F Qs) into equal subsets:
Correlations are between student rank order on each set, based on Accuracy or CBM



- ↑ of reliability with CBM was equivalent to a 62% ± 7% (sem) ↑ of Q numbers
- ↑ of predictive power for accuracy was equivalent to a 9.2% ± 1.5% (sem) ↑ of Q numbers

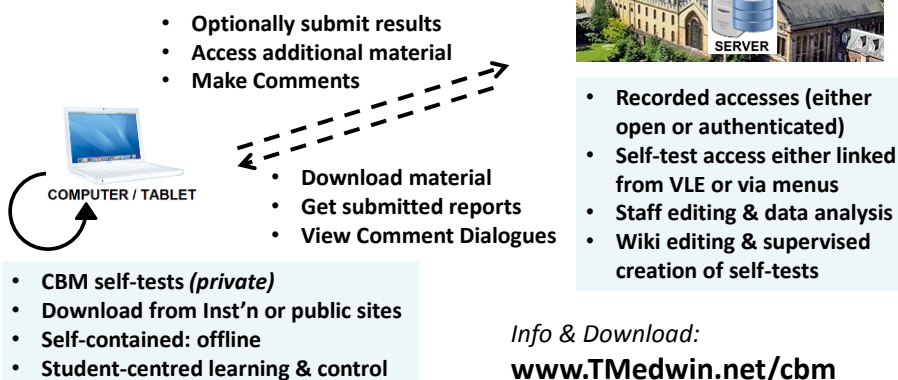
Performance in January Formative: first on-paper test in Med Sch



- Students who did NOT do Self-tests are about twice as likely to fail as students who did Self tests.
- Pattern similar every year: Use is a good predictor of Formative performance

N.A. Curtin, Imperial College

New software: downloadable student module for practice & learning, loosely linked to an institutional server module



SUMMARY

www.TMedwin.net/cbm / www.ucl.ac.uk/lapt

CBM makes Sense!
 Is easily implemented
 Doesn't require writing special questions
 Always motivates students to identify & acknowledge uncertainty

SELF-TESTS

↑ reflection & cross-linking of Info
 ↑ realism about uncertainty
 Highlights misconceptions
 Challenge and practice *in private*
 Offline & online implementation

EXAMS

↑ psychometric reliability
 ↑ psychometric validity
 ↓ number of questions required
 Familiar standard-setting info retained
 Students understand and value CBM

Contributors to the project, over many years:

David Bender, Nancy Curtin, Chris Dean, Mike Gahan, Kim Issroff, UCL & Imperial students

Earlier pioneers of work on confidence assessment & learning:

Andrew Ahlgren, Jim Bruno, Robert Ebel, Jack Good, Kate Hevner, Darwin Hunt, Dieudonné Leclercq, Emir Shuford