CBM : Certainty-Based Marking
www.ucl.ac.uk/lapt

The Teachers' and Students' Perspectives

CBM marks a student according to his/her degree of certainty (or 'confidence') in each answer. At UCL:

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)

Such a scheme rewards students who reflect to the point that they can either :-

(a) justify a high level of certainty so that they are prepared to risk a penalty if wrong, or
(b) identify reasons for reservation so that they lower their confidence and eliminate risk.

Both ways they gain by thinking more deeply and by correctly judging reliability. A student who distinguishes reliable from uncertain areas of knowledge does better than one with the same number of correct answers who cannot judge this correctly.

CBM discriminates more significant levels of knowledge than does mere correctness. Roughly :

3=***knowledge*** 2=***uncertainty*** 1,0=***ignorance*** -2=***misconception*** -6=***delusion !***

or 3,2=***usable knowledge*** 0,1=***unusable knowledge*** -2,-6=***dangerous knowledge***

In assessment, CBM weights uncertain answers less than confident ones. This reduces the variance due to 'guessing' and increases the statistical reliability of exam results. This has been replicated in many research studies and borne out in analysis of exam data at UCL. CBM scores have been found to be the best predictors of 'number correct' on a separate set of questions, as well as of CBM scores.

Students really like the fairness and critical probing embodied in CBM. They appreciate the option to avoid penalties by opting for low confidence, and the wake up call of a -6. They know that a confident misconception is worse than acknowledged ignorance. They improve the ability to judge and express reliability, which is a valued communication skill in any discipline. We find no evidence at all in our data of gender bias, sometimes a concern of teachers. If diffident or overly self-confident students lose out at the start, our data show that they soon learn to calibrate their judgements nearly optimally.

Practical Issues

- For **experience and practice** with CBM, publications, etc. see **www.ucl.ac.uk/lapt**
- CBM is applicable to every discipline. Misjudged confidence is a problem everywhere, from language comprehension to medicine, and even (dare I say it) politics!
- You don't need new questions or styles - existing question banks are fine
- All objective question styles (provided they have right/wrong answers) are suitable
- If you think Objective Testing only tests factual learning, try www.ucl.ac.uk/lapt?bmat1 (© UCLES)
- You can try CBM with your own exercises on your computer or server, using the software at UCL
- ... or you can obtain and maintain the full programs on your own server
- Students can access exercises from a **VLE** such as WebCT, with grades returned to the **VLE**
- Students can run exercises offline from a **CD-ROM** or local drive, using downloadable files
- Question files are easily adapted from any systematic text/graphic/HTML format
- An **authoring tool** and **exercise manual** help you with the full flexibility of Q types and feedback
- For **summative tests**, CBM data includes **'number correct'** to help set pass standards
- **Optical Mark Reader** processing is available at UCL and from Speedwell: www.speedwell.co.uk.
- Advice & assistance from UCL is supported by HEFCE (FDTL): email **cusplap@ucl.ac.uk**

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An example file, showing different Q types

This file has just one SECTION and several question types. Everything on a line after // is comment (ignored by the program). Most files are simpler than this one - typically with many Qs and Sections, but only a few question types. If you want, the authoring tool can handle fussy bits of syntax, or you can simply edit example Qs in WORD.

```
TITLE("EXAMPLE FILE");

S("Questions about Britain");    // This heading will be shown with all the questions in the section.

// True/False Question
Q("Britain is in the Northern Hemisphere",T);  // The specified answer is True.


//Text answer Q
Q("What is the capital of England?");    // A question requiring a text answer
A("London");         //This is one acceptable answer, and is shown as the model answer
A("Londres","Yes, but the English name is London");      //a different acceptable answer with a special explanation
A("lond* ");          //accepts anything beginning with lond (NB by default, checking of the reply is case insensitive).


// A multiple choice Question (the students chooses just one of the options as correct)
Q(MCQ,"Which is the capital of Scotland?");
M("Glasgow");
M("Edinburgh");
M("Sterling");
A(2);  // the correct answer is the second option listed above
I(1,"This is not the capital, but it is the largest city");
   // this picks up a particular incorrect response (option 1) and gives a special explanation when it is chosen.


// A multiple response Question
//  NB the student is asked to select two options in this case, one at a time, with confidence expressed for each choice.
Q(MRQ,2,"Which two of these towns has a cathedral?");
M("Chester");
M("Preston");
M("Gloucester");
M("Banbury");
M("Bath");
A(1); A(3);

// A Multiple Response Q marked all in one go. Confidence is expressed that the exact set of ticks is correct.
// NB the Q text could include, if you want, an indication of how many ticks the correct selection would include
Q(MRQ,0,"Make an exact selection showing which of these towns is on the coast");
M("Birmingham");
M("Southampton");
M("Leeds");
M("Liverpool");
M("Nottingham");
A(2);  A(4);

// Another text question, but with answers that may be given in numeric form.
Q("How many separate countries or provinces make up the UK?");
A("4");  // model answer
A("four"); //allows text version
A("{4}  * ");  // A bit unnecessary in this case! - but would allow as correct '4.0 countries'  (any format of 4 (±1%) with or without a following word).
E("They are England, Scotland, Wales and Northern Ireland: The 'United Kingdom of Great Britain and Northern Ireland' . It does not include the Channel Islands or the Isle of Man but for VAT purposes the Isle of Man is treated as part of the UK.");  // Explanation shown after the student's response has been marked.


//A question with a range of quantities (number + units) permissible as correct answers
Q("British shops sometimes still use the 'pound' as a unit of mass. How many kg is one pound, within ± 10%?");
A("0.454 kg");  // The model answer
A(" {0.45 0.46} * ");  //gives a permissible range, and the wild card * allows any or no unit, since the unit was specified in the question.
A(" {450 460}  g* ","Correct, but actually you were asked for it in kg!");  //also the correct answer in grammes, with comment
```