

***A Methodology that Makes Self-Assessment an Implicit Part of the Answering Process –Results from a Year Long Study (0618)***

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**Abstract**

This presentation introduces a format for multiple choice questions (MCQ), implicit in which, are measures of student confidence. We will initially outline the MCQ protocol and how it was applied in a pre-registration pharmacist training programme. We will then discuss the analysis of our results and how they have informed the future design and implementation of clinical decision making training in our pre-reg programme, as well as the relevance of this work to a wider HEFCE funded “learning gains” study.

**Introduction**

In addition to our studies at the University of East Anglia into new pedagogical practice and its effect on self-assessment and learning gain, we are also interested in the development of new self-assessment metric methodologies.

There have been many reported studies in the education research literature for the measurement of self-assessment as a function of academic performance. The most popular methodology employed across these studies is a multiple-choice quiz followed by a confidence tier questionnaire (a Likert scale rating system which “*aims to gain an understanding of how confidently students rate specific responses*” (Brandriet and Bretz, 2014)). This methodology has produced some very interesting outcomes, most of which display the Dunning-Kruger effect. For the uninitiated, Dunning, Kruger and their collaborators have argued for years that the unskilled lack the metacognitive ability to realise their incompetence (Kruger and Dunning, 1999). This “double curse” for less skilled students manifests as poor calibration between their test score and the score they predict for themselves in the type of study described above.

At the UEA we have undertaken the task of developing novel self-assessment metric methodologies. Towards this end we have posed ourselves the question: “*does the Dunning-Kruger effect persist when “reporting confidence” becomes an implicit part of the process of answering a summative assessment question?*” Previous research methodology doesn’t necessarily account for the differing motivations a student will experience when answering conceptual questions and then reporting their own confidence in a separate process. We felt that if we were able to tie the motivation to correctly self-assess to the motivation to perform we would have a method that allowed us to see through the fog of subjectivity and irrational optimism. This work was presented at the 2017 annual conference and we now wish to build on this discussion to include results from a yearlong study in which we applied this methodology in the training of pre-registration pharmacists. Qualitative analysis of the outcomes from this project will be presented and discussed in the context of the “influence of teaching practice on the learning behaviours of our students”.

**Methodology**

For a number of years we have employed an active learning approach that involves a multiple choice quiz (MCQ) on material that will have been studied prior to class. The answer format for this MCQ has been designed so that students distribute 4 marks across the answer options in a strategic manner to gain the best possible score. There is only one correct answer so if the student is 100% confident they will put all 4 points on one answer option. If they are split between two options they may place two marks on each or split the marks 3 and 1. If they have no confidence in their answer they can place one mark in each answer option to guarantee a point (see Figure 1 below). It is our hypothesis that each answer strategy gives a clear indication of the student’s confidence, and furthermore, they do not know they are providing this self-assessment data. They have a different “motivation” as they are focussed on an effort to maximise their grade (the incentive).

Completed answer grid						Acetate answer sheet						Overlay								
Answer Sheet for Hand Scoring						Answer Sheet for Hand Scoring						Answer Sheet for Hand Scoring								
Name	John Smith				Team	3	Name	John Smith				Team	3	Name	John Smith				Team	3
Q. #	A	B	C	D	pts.	Q. #	A	B	C	D	pts.	Q. #	A	B	C	D	pts.			
1	4					1						1	4				4			
2			2	2		2						2			2	2	2			
3			3	1		3						3			3	1	3			
4	1	1	1	1		4						4	1	1	1	1	1			
5	2	1	1			5						5	2	1	1		2			
6				4		6						6				4	4			
					Total Points						Total Points									
											Total Points	16								

Figure 1: Example Answer Grid and Marking Method (Images courtesy of Larry Michaelson, Uni of Central Missouri)

This methodology was used for a series of formative clinical pharmacy MCQ assessments with the aim of gradually increasing trainee confidence in clinical decision making. The tests were given at regular intervals during the East of England pre-reg training programme which spanned a year. Our objectives were to monitor trainees' progress by tracking their scores and level of confidence in sequential formative assessments as well as to evaluate trainee perceptions of the benefits of this innovative approach.

## Results

In the quantitative analysis of our data we ranked each answer strategy in order of increasing entropy whereby placing 4 points on one answer corresponds to the entropy minima and placing 1 mark in each option is the entropy maxima. This allowed us to plot entropy as a function of grade. Our results showed a negative correlation between entropy and student grade with values in the range -0.4 to -0.67 (p-value <0.05). This data does not follow a Dunning-Kruger pattern and very clearly we can see that lower performing students use higher entropy strategies which we can attribute to lower confidence in their answers. In contrast higher performing students very clearly use lower entropy strategies presumably as a result of greater confidence in their own knowledge.

For the qualitative analysis of our research we used a questionnaire and focus group to assess trainees' opinions of this process. Analyses of the data indicates that individual trainees are performing better at confidence-based formative assessments as the year progresses. They also report that the tests are helpful in terms of improving their clinical decision making skills and boosting their overall confidence. However, information gathered from the focus groups also indicated that additional measures are required if we are to positively influence the learning behaviours of our trainees as they build towards a very important assessment.

Nonetheless, these are exciting results that warrant further analysis. We believe we have discovered a self-assessment metric that instantly measures the correlation between trainee confidence and actual performance. What is even more pleasing is that this methodology can be seamlessly incorporated into the active learning pedagogies that we currently employ. This methodology has now been used in earnest

which has yielded invaluable insight into our trainees' metacognitive skills and learning behaviours.

## References

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