SMC&PA submission 275
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To: The Education and Innovation Committee

Dear Committee Members,

I'm a statistical consultant working mainly in medical research with 30 years of university and high school teaching experience in mathematics and statistics. Since 1980 I have been active in extra-curricula mathematics activities for Australian high school students through involvement with the Australian Mathematical Olympiad programme, a local interschool competition and an enrichment workshop programme for high school children. I am a recipient of a BH Neumann award from the Australian Mathematics Trust for contributions to the enrichment of mathematics learning in Australia.

Commentary on the issue of appropriate assessment in senior secondary mathematics and science disciplines I leave to those at the coal-face who are directly involved on a day to day basis. The message I wish to convey is the need to be wary of claims made on the basis of educational research. From a statistician's perspective most studies in the educational area are flawed because of the difficulty in controlling or allowing for the many variables involved.

In comparing practices or techniques, the gold standard experimental design is a randomised controlled trial (RCT) involving random allocation of individuals from a population of interest into two (or more) groups where the only difference between treatment of the groups is in the techniques of interest. Few changes in medical and agricultural practice in the Western World since the 1930s have occurred without support of RCT findings.

Unfortunately, for ethical, cost, time, and practical reasons the RCT design is seldom feasible in an educational setting. Even if students are randomly divided into two groups groups, and are therefore equal in all respects except for chance differences, differences in performance of the two groups due to differences in treatment are potentially confounded by factors not linked to the treatments. For example, each group may have a different teacher, different learning environment, scheduling differences, resourcing differences, within-class interactions influencing outcomes, etc. Even if the one teacher is involved with each group, teacher-student interaction for example, where the teacher is influenced positively or negatively by individual students may confound outcomes.

Enormous effort have been expended to reduce or allow for the impact of confounding (see eg Education Research On Trial: Policy Reform and the Call for Scientific Rigor edited by Pamela B. Walters, Annette Lareau, Sheri Ranis). However, without RCT support (and indeed, in some cases, even with RCT support), serious questions may be asked of the reliability (ie repeatability) and validity (ie accuracy/relevance/applicability) of any causal inferences. For examples, see an easily accessible article by Wilf at http://www.math.upenn.edu/~wilf/website/PSUTalk.pdf.

Claims such as "world's best practice" in an educational setting are at best indefensible and at worst a snowjob intended to stifle discussion.

I'm not suggesting educational research should be dismissed. I'm saying that educational research needs to be viewed sceptically and robustly questioned. Are the results teacher dependent? Are the claims applicable to all students or just a select few in a few schools? Can the technique be implemented efficiently? Does the theory translate into practice?

The way to proceed is to listen to the experienced teachers. Their accumulated knowledge is gold. Consider what works elsewhere and use research results but remember "Findings are rarely definitive; they are usually suggestive." (Alan H. Schoenfeld, Purposes and Methods of Research in Mathematics Education, Notices of the AMS 47 (6), 2000, 641-649.)

Sincerely,

Dr Ashley Plank