SMC&PA Submission 173
Received 13 May 2013

To: The Education and Innovation Committee eic@parliament.qld.gov.au
About: Assessment Methods for Senior Maths, Chemistry and Physics

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From: Dr. Ian Wilson
[redacted]

Dear Committee Members,

I have taught senior mathematics and physics at Queensland's high schools for 16 years [1995 to 2010]. I am currently semi-retired and teaching casually in the NSW Catholic System.

I am sending this submission to the Education and Innovation Committee because I am deeply concerned about the negative impact of the current QSA assessment approach has upon Queensland's secondary physics (and mathematics) students.

The ability of assessment to support valid and reliable judgments of student outcomes.

In order to access the terrible damage that is being done by the current QSA assessment approach, one only needs to ask the question:

What type of physics student does the QSA want by the end of year 12?

The answer to this question is probably best provided by the three main types of assessments QSA expects the student to master in their two years of senior physics education. These assessments include:

 # Supervised Assessments (SA) – which primarily allow the teacher to access the student's knowledge and understanding of a particular topic, with additional limited opportunities to determine the student's processing and problem solving skills in a few limited contexts. This is the current equivalent to the classic written exam.

 # Extended Response Task (ERT) – which primarily allows the student to use research and secondary data to write a project report that allows the teacher to access their ability to develop a scientific argument(s) through the synthesis of their knowledge and understanding of key physical concepts. This is the current equivalent of the classic (research) assignment.

 # Extended Experimental Investigation (EEI) – which allows the student to investigate a physical hypothesis or answer a practical research question by conducting an extended experimental investigation that involves the collection and analysis of scientific data. It also requires the student to collect and analyse their data, discuss the outcomes of their experiment and evaluate and justify their conclusions. This particular assessment item has no equivalent in the past QSA assessment practices.

I believe that the education of senior physics student is being seriously undermined by QSA's insistence that they complete EEI assessment item in both years 11 and 12.

In order to understand why this particular requirement is so destructive to student learning outcomes, it is necessary to have some basic understanding of how most students go about learning physics.

Physics is a concept based science. This means that each sub-topic in the subject (e.g. electromagnetism) requires a student to slowly master a series of interrelated concepts that enable them to successfully describe the world around them. Each time a typical student first encounters a new concept in physics, they require a series of measured learning steps before they can confidently understand and use that concept to solve simple multi-step problems.

It is **extremely important** that the students be given as much time as possible to familiarize themselves with the basic concept, preferably in an easy to understand context(s). Even the most proficient HA and VHA physics students require at least a few weeks to be able to build up their academic confidence to the level that they can use a particular concept in a small number of un-related contexts.

I believe that the EEI assessment instrument, as currently designed, completely sabotages the typical physics student's ability to learn new physical concepts and ideas. It does this by:

- forcing the student to spend inordinate amounts of (precious) time in designing and carrying out a full length experimental investigation. Much of this time is spent laboriously collecting enough data to make sure that their extended investigation achieves a meaningful result. This is time that could be better used mastering basic physical concepts.

- providing insufficient time for the student to acquire and build academic confidence in their ability to understand and use the necessary concepts and ideas that are required to conduct even the most rudimentary long-term physics investigation.

- giving the students a false sense of their level of "understanding" of the main physical concepts involved in their investigation. This lack of understanding becomes all too evident when the students are asked to discuss their findings in a logical and scientific manner.

Bottom line: ***I believe that year 11 and 12 High School students are not academically ready to carry out the extended experimental research investigations. This belief is backed up by most Australian Universities, since even they do not expect their best science students to master the higher level investigative skills that are required until their honours year.***

Ensuring assessment processes are supported by teachers.

The QSA has a long history of ignoring the concerns of its secondary teachers when it comes to assessment policy. Indeed, many teachers believe that the QSA would rather coerce teachers into unilaterally accepting their preferred assessment practices. This leaves them with the genuine feeling that the QSA's assessment practices are based more upon the latest education fashions rather than the latest evidenced-based educational research.

One such example of this madness is the QSA's insistence that all subjects [including the sciences and mathematics] adopt the use of criteria-based standards.

The cumbersome and subjective nature of these types of standards is not suitable for assessing much of the work that is produced by science and mathematics students. It would be much better for science and mathematics students and teachers if marks and percentages were used to judge performance.

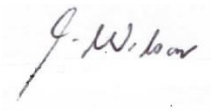
Bottom line: The question needs to be asked, if QSA genuinely believes that criteria-based standards are the best method for assessing student achievement then why aren't they calling for Queensland Universities to immediately abandon marks and adopt this "wonderful new assessment technique"?

Another such example of this madness is the insistence by the QSA that more long writing tasks be used to judge student achievement in mathematics and the physical sciences.

Bottom line: Long essays have little or no place in the study of physics and mathematics. Many students who excel in these subjects are not great at writing long essays. The over-emphasis that the QSA places on writing skills directly discriminates against these types of students. This is particularly true of boys and students from non-English speaking backgrounds.

With the current QSA policy in place, there is a danger that a whole generation of students (boys in particular) will be prevented from pursuing careers in mathematics, engineering and sciences simply because they are not good at written expression.

Yours Sincerely,



Dr. Ian Wilson