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Submission to the Education and Innovation Committee Inquiry into Assessment Methods in Senior Maths, Chemistry and Physics

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1. Background

I have been a science and mathematics teacher in Queensland state high schools for 35 years and have taught Senior Chemistry for the past 32 years.

I have been a member of District Review Panels in Chemistry in [redacted] and [redacted] districts and held the position of Review Panel Chair in [redacted] for 5 years. When the Extended Trial Pilot of the Chemistry syllabus began in 2005 I was appointed to the Chemistry State Panel. I continued on the state panel through the introduction of the 2007 Chemistry syllabus and in 2009 was appointed as the State Review Panel Chair.

I was the Science Master at [redacted] from 1987-1988 and have been the Science HOD at [redacted] for the past 25 years. Consequently I have a very detailed understanding of the Chemistry (and Physics) syllabi and the assessment methods that have been used in the past and particularly in the current syllabus.

2. Position on the current criteria based assessment system used in Chemistry

I whole heartedly support the current system of school based moderation of assessment used in Queensland secondary schools. I have an intimate knowledge of the system as it has developed over many years having been a student in the first cohort of Year 12 students (1973) to be assessed through school based moderation and not a public examination system. To explain my strong support for the current system I want to briefly outline some of the main changes that have occurred to the assessment process in the past 40 years in Queensland.

The early days of the system involved marks based assessment carried out using 2-3 hour examinations every semester rather than one final examination at the end of the two year course. The results of every semester were totalled to determine the overall result achieved at the completion of the course. This system continued through the time of my university training and was still in place when I began teaching in 1979.

There were various changes made to the chemistry syllabus between 1980-1994 but the assessment processes still centred around having students sit for examinations only to measure their ability in the subject. In 1995 a new syllabus introduced the idea of assessing student ability in three areas; Knowledge, Scientific Processes and Complex Reasoning. As well as this there was the opportunity to have some other forms of assessment tasks besides examinations. These included experiment reports and some form of research based assignment tasks that focused on the application of chemistry in the real world. Examinations were still seen as the primary means of determining a student's ability and more specifically the 'complex reasoning' sections were used to identify the

more capable students as this required them to solve more difficult, multi-step type questions – usually problems involving a strong mathematical based response.

Other senior subject areas outside of the science and mathematics areas began to start using criteria standards to assess student outcomes but science (and mathematics) continued to use a marks based process to determine threshold percentage cutoffs in each of the areas of knowledge, scientific processes and complex reasoning, to determine overall levels of achievement. For example to gain High Achievement (or a 'B') the cutoffs were 65% for both knowledge and scientific processes and 40% for complex reasoning. There was a trade-off system used whereby if a percentage gained in one area was above the cutoff value it could be used to 'lift' a deficiency in another area.

The percentage cutoffs for credit in these three areas supposedly represented a direct measure of specific objectives and outcomes (listed in the syllabus) that were evident in student responses. While the job of teachers and panellists who looked at students responses in assessment tasks was to determine whether the questions addressed the stated syllabus objectives and outcomes the focus was usually firmly fixed on whether students got sufficient marks to reach a particular threshold percentage. My own experience is that many teachers often selected poorly constructed questions for test papers on the basis of whether it was a hard, medium or difficult question. Teaching of the subject was primarily focused on covering content and having students practice solving routine problems and some that were more complex in terms of being multi-step and requiring higher level maths skills. Minimal attention was paid to whether the assessment items really provided the opportunity for students to demonstrate the general objectives of the syllabus.

Critics of the current use of profiles that include letters (A-E) to represent the standards awarded for different areas of an assessment task in the current assessment process should note that just as there was a tradeoff allowance in the percentage cutoffs when marks were used, there is also some degree of flexibility allowed in the determination of a standard achieved near a threshold (eg; B+ or A-).

There are some critics of the current system that also point to a reduction in the number of students studying science subjects as a result of the current assessment requirements. This has not been my experience at [redacted], where in fact since the implementation of the 2007 syllabus, there has been an increase in the numbers of students studying Chemistry and a consistent number studying Physics. There has also been no noticeable difference in the proportion of boys and girls opting to study chemistry or physics. Potential students in these subjects when in Year 10 are provided within learning experiences that prepare them for the type of assessment tasks they will encounter.

3. The Current Assessment Process

In the early 2000s a trial-pilot syllabus in Chemistry (&Physics) was developed that formed the basis for the current 2007 syllabus. I was very wary of several aspects of this syllabus and in particular the assessment process that it involved. It involved using written criteria standards to make judgements about student work rather than just assigning marks and summing them up to get a percentage. I did not opt to be involved in the trial-pilot program but following discussions with colleagues who were involved decided to take part in the Extended Trial-Pilot. As a safeguard for what I had been doing

for many years as a chemistry teacher, I decided to run a marks-based background check of the assessment that I did using the standards criteria and assigning A-E levels for different aspects of each assessment task. To my surprise there was an extremely good correlation between the marks/percentages and the results from making judgements with the standards criteria.

Critics of the current system often site the fact that they are not allowed to use marks for assessment. This of course is totally incorrect as there is no mention of this in the syllabus. My experience is that you could use marks in the current system but the syllabus requires that the criteria standards be matched to student responses and outcomes. Once you overcome the idea that marks provide no better means of determining a result than letters do you find it is more informative to you as a teacher and to students to use standards descriptors to provide feedback for what is understood or able to be done in assessment items.

The key thing that becomes apparent through using the new process is that you need to ensure that the assessment items given to students are carefully designed to provide them with the opportunity to be able to demonstrate their ability according to the standards descriptors. Coupled with this is the fact that teaching practice also must change in respect to showing students in class what is involved in processes such as; explaining complex and challenging concepts, linking and applying concepts to find solutions to problems, systematically analysing data, providing justification for conclusions and recommendations etc. This is at the heart of the skills set that students need to have in order to cope with the type of changes that they will encounter in the future. There is a certain proportion of students studying Chemistry (and Physics) that will need specific content and skills associated with the discipline in university courses they will do (such as engineering) however there is a significant number who this does not apply to. For these students the more general skills identified by the criteria in assessment will be invaluable.

4. Types of Assessment Tasks Used

There has been a concern raised by some that the current syllabus requires students to complete excessive written type assessment tasks. I must point out that this is most certainly not the case. The syllabus indicates that there are two types of assessment tasks that students must do as a part of the course; Supervised Assessments (SA) and Extended Experimental Investigations (EEI). There is a third type that is optional called an Extended Response Task (ERT). In reviewing a large number of the work programs for schools across the state I typically see that the assessment program in both Years 11 and 12 of courses include 2-3 supervised assessments in the form of written examinations, 1 EEI and in some cases 1 ERT. In the past 18 months when checking programs that have been submitted for amendment, ERTs have often be replaced with some type of SA instead.

The concern about EEIs that has been raised does have some merit as initially the word limits set in the syllabus were high compared to other subjects and there was much misinformation about what is required of students in carrying out these tasks. In 2009 the QSA issued an amendment to the Chemistry and Physics syllabi in regard to this, reducing the word limits so that they were in line with other senior subjects and linking it to the discussion/evaluation/conclusion/recommendations sections only of the EEI report. Students are usually also required to write some other sections in the report such as an introduction, background information and procedure. Every school manages this

to suit their students so that it is not excessive. Much of the writing of the EEI report is done in class or as part of homework while the EEI laboratory work is being carried out in lessons. The time required for this is no different to what was done in courses based on earlier syllabi when several lab reports had to be written up and submitted for assessment. The overall value of this type of assessment task is that students gain a very good insight into what is involved in the scientific process of investigation which is at the heart of scientific endeavour. Carrying out recipe type experiments has value in reinforcing concepts and principles but does not instruct about what happens when the unexpected occurs.

ERTs do involve an extended written response (within specified word limits) but provide students with learning experiences that involve researching sources of scientific data and the selection and presentation of relevant information. Once again a significant portion of these tasks are often done in class time or instead of regular homework. ERTs also provide a means of assessment that some students find less daunting than formal supervised examinations.

Conclusion

The system of school based moderated assessment that has been in place for many years in Queensland has paved the way for secondary education to focus on the development of student learning for understanding far more than in any other Australian state. At the heart of this is a system that continually looks to monitor its performance and to implement procedures to ensure that there is comparability between schools across the state whose locations and student backgrounds vary considerably.

The Queensland school based assessment process is not always an easy one to work with and many teachers do have some challenges in its implementation and operation. There are situations where more professional development and support for beginning teachers and those in remote locations certainly need to be addressed. However the vast majority of teachers that I have worked with in several different schools during the past 30 years see that the system we have is far superior to those offered elsewhere in terms of what it delivers for all students. Refinement of the system for improvement is not a concern but the loss of such a system would be.