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To: Education and Innovation Committee

Submission: Assessment Methods for Senior Maths, Chemistry and Physics.

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Background:

I am a teacher with many years of experience mainly in Senior Chemistry, but also Senior Physics, and Senior Mathematics (all). I have been teaching since 1980, and have been teaching at Ayr State High School for some years. Currently I am teaching Senior Chemistry and Maths A.

As a beginning teacher, I attended Moderation meetings in Townsville. After the ROSBA and the release of the syllabuses based on ROSBA, panels were formed. I was a member of the first Chemistry Panel in the Townsville District. Since then, I have served on the State Panel for Chemistry, 1995 syllabus, and I am currently the Panel Chair for Chemistry in the Townsville District.

Ensuring assessment processes are supported by teachers

I have met with many teachers over the course of my career. Some, like me, have always taught in Queensland. Earlier in my career, I worked with many people who had been assessed under and later taught under a system of external exams. I have also met many teachers who have worked in other parts of Australia and the world.

I myself fully support the model of teaching and assessment used in Queensland. I know many other teachers that I have worked with in schools and on district and state panels also support the teaching and assessment processes. It is clear that we cannot separate assessment from teaching here.

There are various alternatives to the assessment processes as currently used in Queensland.

Up until 1972, external Senior exams were held. As with any single external exam, the focus necessarily was purely on knowledge. The knowledge also generally had a fairly narrow definition in the sciences, and tended to focus on the mathematical problem solving aspects rather than on the full range of scientific thinking such as explaining concepts at a deep level, analysing data, evaluating and justifying. From what I have seen of the external exams in other places, this narrow focus is still the case.

After the external Senior exams were abolished, school-based moderated assessment began. As a high school student at the time, I was very glad that I could use prior assessment to indicate my progress towards my goals, and that all did not hang in the balance of a single test paper on a single day. At this stage, the results were what is called norm-referenced, where the ratings of 7 to 1 were used, in particular proportions. This did mean that standards could vary from year to year as the assumption was that student results were normally distributed in a mathematical sense.

This was seen to have some issues. A review (ROSBA) was undertaken, and recommended criteria based assessment. This simply means that if a student studying a subject meets a particular standard, then they will be awarded a particular grade at the end of the course. There were then five levels ranging from Very High Achievement to Very Limited Achievement.

Criteria based assessment officially began then. (early 1980s)

The Senior syllabuses in all subjects described criteria, which have been refined over the years as updated syllabi have been released.

A lot of discussion has centred around whether or not Mathematics and the physical sciences should use criteria and/or marks.

Somehow, marks have been portrayed as objective and criteria have been portrayed as subjective. This portrayal is inaccurate. A test can be set that is relatively easy and a student may gain a high mark. However, if they sat for another test, where the questions were more difficult, they may or may not gain a high mark. It actually does depend on the standard of the test. In the end, it comes back to ensuring that questions on a test, or the work in any assessment instrument, allows for a student to show the standard of work. Marks were and are only useful if the assessment instrument is carefully constructed.

Are marks still a valid way to assess?

Provided the school can show that the work is linked to the standards described in the criteria, they are able to use marks. Eg a group of ten or so multiple choice or short answer questions testing simple learned facts could be used and marked. A student who got nearly all of these correct would have demonstrated that they have achieved a C level for that group of questions. However, even if they got 10 out of 10, it would not mean they were an A standard, if the questions were testing simple facts, as the questions themselves would not have met the criteria for an A level. More complex/challenging questions could still be broken into a number of steps with part marks awarded for these steps and assessed for an A or B level. I personally find it much easier to simply record their actual achievement. Awarding part marks for tiny bits of responses, and adding up lots of part marks was actually a more time-consuming process than seeing if a student has met particular criteria.

Provided the link to any particular standard is shown, a school is able to use marks, as has been stated by the QSA. In the end though, the school must still be able to show that particular standards have been achieved.

It is not valid to suggest that simply achieving a certain mark indicates a standard. This idea has been pushed as though it is some sort of truth. It is also not as effective as a way to actually teach students how to perform better. On the other hand, criteria can be shown to students, and they can be taught in Year 11 which is formative what is necessary to achieve.

Are assessment processes supported by teachers?

As stated, I do fully support the processes used. The use of school-based assessment enables a school to tailor their work program to the resources within the school and the needs and interests of their students, while still covering mandated content and processes in the syllabus. The syllabi for each of these subjects is very clear about what is considered essential knowledge, as well as the other mandatory aspects.

My own experience in teaching the current Chemistry syllabus in particular will demonstrate what I mean. Students I teach currently tend to recall prior knowledge far better when it has been taught in an interesting context rather than in a traditional series of theoretical units. The use of major non-exam assessment tasks enriches students' understanding by developing their ability to analyse both primary and secondary data, and to evaluate and justify. For example, instead of just learning about elements, compounds and mixtures, students at our rural North Queensland school learn about them

in the context of local industries – the salt industry in Bowen, the sugar industry in our own town and the mining and processing industry, in the wider region.

I have seen over the years, many students become engaged and passionate about Chemistry, leading to their future career, simply as a result of a good context and a suitable ERT or EEI, set at school level. The same applies in Physics. The standard of work I have seen from some students in recent years is actually higher than I have seen in all of my years of teaching. I attribute this to the level of motivation once a student truly engages with their EEI topic for instance. For these reasons, I very much support the current model.

One area where some difficulty has been experienced is that the wording of the criteria in the current Chemistry and Physics syllabi is somewhat unwieldy, with long sentences. These were not as easy to understand as the criteria even in the Trial-Pilot syllabus which led up to the development of the current syllabus. I do believe that this has been a source of difficulty for some teachers in some schools. However, having said this, the standards it describes for each level are appropriate, and are able to be identified when student responses are judged. Criteria that describe a standard are valid.

In my work on both District and State panels, I have met a number of teachers who have described their experiences in other systems. Interestingly, some respondents to this enquiry have put forth opinions that school based assessment together with an external exam such as NSW and Victoria have are models they favour. Yet when I talk to teachers who have taught there, and now teach in Queensland, they have told me that the reality is far from rosy in those states. Basically, if a student has done well in school-based assessment, but not so well on the external exam, then it is the result from the external exam that 'counts'. In other words, there is a de-facto system of external exams only. Again, as expressed earlier, this can lead to a very narrow impression of a student's understanding, as only certain types of questions can be suitably assessed in such an exam.

Criticism of lengthy tasks was one of the factors cited that seems to have led to this enquiry. In reading some responses, their have been a range of statements made by both teachers and parents about wordy tasks. Initially, the word lengths for ERTs and EEIs was longer than it currently is, but it was amended to be in line with other subjects. Some teachers express that written tasks have no place at all, and discriminate against certain students, boys in particular. Some teachers even express that English is where writing would be taught. However, it is very clear that it is the responsibility of the teachers of Sciences and Mathematics to actively teach the types of written skills needed. All teachers are teachers of literacy. Several years ago, Education Queensland invested significant time and resources into Professional development on how to teach literacy. Every single teacher in the department completed at least five days of professional development. Why? Because it is important. It is important for teachers of all subjects to know how to teach the necessary literacy skills to their students. This applies equally to a question where a concept is explained in a paragraph as it does to how to write concisely about larger science ideas in an ERT or an EEI.

For many students, the issue is not that these tasks are too long, but it is how to express themselves concisely enough within the word limit. Currently, schools do need to include an EEI in the work students do, but ERTs are not compulsory. Some schools and teachers however, have allowed their students to write large tomes as a response. This is unfortunate, but the fault does not lie with the syllabus or the assessment in general, but rather with specific schools. Since the reduction of word limits for EEIs and eRTs, this has generally improved.

In Mathematics, the criteria are somewhat shorter to read. Do they provide a valid form of assessment?

A perusal of these criteria will soon reveal that they are important aspects of Mathematics. Mathematics is surely about more than getting a sum correct. In teaching Maths A, for instance, Financial mathematics is a fairly large and important topic. Not only should a student be able to perform calculations related to various types of investments or consumer credit, but they should also understand the meaning of these things, and be able to make decisions based on this. Eg selecting a loan or credit card. Being able to do the sum, but not understanding it, and therefore unable to make a decision surely means that a student is not as good as another student who is able to understand and apply their mathematical knowledge.

Student participation levels

QSA has presented data on this. When taken as an overall percentage of students completing year 11 and 12, it would appear that the proportion of students studying Physics, Chemistry, Maths B and/or C is indeed dropping. This trend is not unique to Queensland.

A number of factors need to be considered. In the 1970s, students who wanted a job frequently left school after Year 10 and gained employment. It was mainly students seeking to enter tertiary education that continued on to senior studies. Courses offered at schools were thus mainly what are now called Authority subjects. In the 1980s, more students began to stay at school for longer, even if they were not university bound. So they studied the subjects on offer then which did increase enrolments in subjects like Maths B/C and Chemistry and Physics. It was some time before more appropriate subjects began to be offered. Initially, schools could write their own courses but eventually, this was formalised with VET certificate courses, and SASs. These subjects are targeted at students who do not wish to get an OP and have no intention of enrolling in tertiary education. Naturally, with more suitable subjects now being offered, the enrolments in other less suitable subjects did not increase like it had been, and a small drop in enrolments was seen.

A number of other factors also impacted. Locally, in the 1980s, a major employer, the sugar mills, insisted that anyone who wanted an apprenticeship of any kind there should study Chemistry, Physics, Maths B and Maths C. For a time, this led to large classes in the local high schools. Nowadays, with other courses better suited to someone who wishes to do an apprenticeship, these students occasionally chose physics and Maths B if they are capable, but otherwise, tend to chose VET subjects.

To suggest that drops in enrolments caused by these factors is a negative thing is to fail to understand the fact that the senior school now caters to a wider variety of career pathways than in the past. It is actually a good thing that schools do this, not a bad thing.

A second factor that is an issue is that many universities no longer list certain subjects as pre-requisites, or even tell potential students it would be advisable to have studied these subjects. I am not sure why this happens. Unfortunately, what it tends to lead to is that students are then faced with arriving at university, only to be told that they must study an extra subject in their first semester eg Maths B. Had these students known that, many of them would have chosen it at school. In the past, when more subjects were listed as pre-requisites, then students studied more of the Maths and Science subjects to keep their options open.

A third factor, particularly related to the proportion of students who commence studies 0in these subjects but change to other subjects alter on is the introduction of the QCE. Prior to that, a Senior Certificate showed subjects and results. If the result was a Limited Achievement, they still obtained a Senior Certificate. Now students are faced with the prospect of not getting a QCE if they are not obtaining at least a Sound Achievement in their subjects, or five of their subjects. So, if they are finding a subject difficult, even if they are getting a Sound Achievement, they will frequently change

subjects, rather than risk dropping to a Limited Achievement and not getting a QCE. An anecdotal but relevant point is that my daughter studied Chemistry at high school and then Nursing Science at University. Even though she did not 'pass' Chemistry, she always says that what she did learn in Chemistry assisted her when studying Nursing Science. Yet this knowledge tends to be devalued by the rules for gaining a QCE. Better to switch to an 'easy' subject, rather than learn something in the difficult one, but not enough to get a QCE.

For a student that enjoys the Sciences and Mathematics, and/or needs to do them for a future course and career, they will study them. I have not seen anyone cite the type of assessment or the criteria as a reason to not select these subjects.

As you can see, the numbers and patterns of enrolments can be affected by a wide range of factors. These factors are quite independent of the nature of the criteria and the assessment.

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

The QSA has a number of processes in place to support valid and reliable judgements. The QSA processes include a range of other processes to monitor validity and reliability.

I believe that they are in a good position to report on this aspect.

At my own school level, I can honestly say that students who have achieved well in Mathematics and the Sciences do go on to University well-prepared and undertake tertiary studies in a wide range of courses successfully.

The processes involved with the QCS test, SAIs and so on, also work to ensure validity.

It is true that some universities in an effort to 'fill' courses do accept entrants with lower OPs than other universities do. Some students with lower OPs can find certain courses difficult. This does not mean that judgements were invalid; in fact, quite the opposite.

No single assessment system can ever be perfect. However, the system currently used is a good one, and achieves what is intended.

General comments

In reading some of the other submissions, I have seen comments that appear not to understand the role of every single teacher in teaching the literacy necessary for their own subject.

I have seen teachers and parents note things that are actually about decisions made at a school level, not about the subject, the criteria, the assessment or the syllabus. Eg it is not true to say that an assignment in Mathematics has to be weighted as much as an exam. The written sections do not have to be huge in Mathematics.

Schools can plan to ensure that students are not faced with doing two EEIs in different subjects at the same time. Schools can and many do plan to ensure that a student does not have six or seven assignments due in one week.

Drafting was mentioned. It is quite clear from the syllabus that students should not be submitting two or three drafts of things. The level of scaffolding should teach certain aspects of writing in Year 11, and be reduced in Year 12. In fact, for EEIs, I accept only a draft of the introduction.

The flowery wording of report cards was mentioned. Schools themselves write report comments. If there is an issue, then it is up to an individual school to do something about it.

Another comment wrongly indicated that students did not have deadlines, and can hand work in late without penalty. The QSA documents on their website clearly indicate that this is not the case. It is clear that the overall grade should not simply be lowered if work is submitted late. However, it is equally clear that every school is required to write a policy on this matter. Work is to be submitted on time. However, school policies can allow for extenuating circumstances. For example if a student is sick in hospital the week that something is due, the school policy may allow for an extension of time on presentation of a medical certificate and completion of an application for an extension. Students who simply hand in work late without an extenuating circumstance cannot be graded on that work. Rather, the teacher is required to base the achievement on work seen by the due date. This could be work the teacher has seen in class, and a draft handed in earlier.