SMC&PA Submission 53
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Dear Members of the inquiry:

I will address each of the issues the committee is considering.

1. Ensuring assessment processes are supported by teachers

We just don't know! Neither the QSA nor the QTU will undertake a survey of all Maths and all Science teachers to ascertain whether or not teachers support or oppose the current system.

Anecdotally, I can categorically state that ***all*** of the teachers I know working in senior maths and/or science subjects would happily and speedily change from a criteria based assessment system to a marks based system. I know of a small number of experienced teachers that have left either the teaching of senior sciences or teaching altogether due to the current system.

The committee only need read the comments on the "platoqld" website to find a number of teacher, student and parent complaints about the current system.

The committee only need read the archives of physics@discussions.eq.edu.au to find out how well teachers understand the current system. Teachers are struggling with their understanding and implementation IN PART due to their workloads and a big part of this WORKLOAD is due to the current assessment system. As an example of part of a normal teacher's workload let us examine the time to "run" an EEI.

Let us take the example of a full-time teacher with 6 classes with 120 students in total. One of their subjects is year 12 Physics. This class has 20 students. The EEI is conducted over 7 weeks in one term. The students work in groups of 2 or 3 and there are 8 groups EACH DOING A DIFFERENT EXPERIMENT.

By the end of week two of the term:
Each student completes:

- Research Plan: 100 words
- Materials requisition form (list of equipment they need)
- Risk assessment form

Teacher completes:

- Reading of each
  - Research Plan
    - And read up on the theory behind each experiment if the concept is not fully understood so that they UNDERSTAND all 8 experiments
  - Materials requisition form
  - Risk assessment form

- Time taken = 20 x 5 minutes for student forms and plan
  ≈ 1.5 hours + other theory readings
  = 1.5 + 3.5
  = 5 hours

- These times assume each student has their work read and commented upon and the times given are a conservative estimate.

By the end of week five of the term:
Each student completes:

- Draft: 1000 words

Teacher completes:

- Reading of each draft

- Time taken = 20 x 20 minutes for student draft
  ≈ 7 hours
  = a lot of weekend time

- This time assumes each student has their draft read and comments made across all the sections of the report and making note of the 9 criteria and how the student has addressed each of these criteria. This could include comments on table and graph design, use of equations, units used for variables, literacy etc.

Some schools may allow multiple drafts to be submitted. An example of this can be found in a research paper titled ***"Emotional Arousal of Beginning Physics Teachers during Extended Experimental Investigations".*** On pages 13 and 14 :

"… (pre-service teacher) reported an "amazing" outcome from her transformed practice in supervising student's report writing. Reporting that she had seen 3 drafts from her A students before the due date …".

If I were to go through 3 drafts and comment on each one then I am sure that my A students would show amazing outcomes.

By the end of week seven of the term:
Each student completes:

- Report: 1000 to 1500 words

THIS IS NOT TRUE!! See next page.

Teacher completes:

- Reading of each EEI assignment

- Time taken = 20 x 60 minutes (sometimes less for the lower performing students)
  ≈ 15 hours
  = a lot of weeknight time and weekend time and coffee!

- This is assuming the teacher reads and not scans each assignment, makes comments, finds evidence for all 9 criteria and that the evidence is consistent with all 9 criteria.

SO IN TOTAL, this EEI has taken about ***27 hours*** to assess. This is NOT ACCEPTABLE! This type of assessment must be changed.

Add to this the assessment requirements for the other 5 subjects that the teacher has and they are now spending an INORDINATE amount of time on assessment. The teacher IS NOT spending time on preparation and planning as this time is being usurped by assessment. Whole weekends are being given over to marking. This is not isolated to a few teachers who do not agree with and/or fully understand the current system.

Ridd raised the issue of word length of EEIs and ERTs in the Physics and Chemistry. For example, to complete an EEI it takes way more than 1500 words. FOR AN EEI A STUDENT NEEDS TO COMPLETE:

Topic	***Number of Words***	***Total Words***
Abstract	100	100
Aim	20	120
Hypothesis	30	150
Justification of Hypothesis	50	200
Relevant Background Theory	100	300
Method	100	400
Results/analysis of results/conclusion	1500	1900
Bibliography	100	2000
Appendix A First Trials	400 plus	2400
Appendix B Other Calculations/tables/photos	200	2600

These numbers are conservative. The student has now **doubled the official word count**.

What other problems are there with EEIs?

- If the design of the science laboratories of the school does not permit equipment to remain set up then each lesson the equipment has to be set up and dismantled.
- If the school is too small to warrant a Scientific Operations Officer (SOO) then the teacher has to organise and check the equipment.
- If the school is large enough to warrant a SOO then this person has to organise the equipment. This sounds easy enough BUT they may have several classes at once doing an EEI as well as preparing the normal day to day experiments and demonstrations for other science classes. The SOO may also be called upon to help out in class. The SOO may need to track down or even construct some pieces of equipment that are not readily available.

The workload for a teacher is enormous for ONE CLASS.

An area not often discussed is the role of the teacher in producing theory notes for EEIs, ERTs and every lesson they teach. As each school does their "own thing" the responsibility of producing the content for the entire course may fall to the Physics teacher as no textbook may match the school's workprogram.

Therefore the teacher becomes:

- An author
- An illustrator
- A proof-reader
- Researcher
- Publisher
- Printer

And using their creativity they produce:

- Word documents
- PDF documents
- Powerpoints
- Excel Spreadsheets
- Graphics calculator programs
- Animations
- Blogs/wikis
- Any other creative modern teaching techniques (youtube anyone?)

Keep in mind that all of the above work IS FOR ONE CLASS. The teacher must repeat most of that work for the other 5 classes. What more must we do?

Ah yes: School camps, subject excursions, school sport, school musicals, school magazine, lunch time detentions, lunch time tutorials, PGD, Bus duty, Professional Development, Staff meetings, Subject Area meetings, Swimming Carnival, Athletics Carnival, etc …

With all of the associated activities undertaken by schools to provide education to the "whole child" the fundamentals of each subject are now almost of secondary concern.

So the fundamentals taught at say an exclusive private all girls school with fees of $18 000 per year compared to a state high school with fees of say $160 will be the same. Could we therefore expect the same outcomes? (I do not like the word outcomes)

Yes we could but are there other factors at play? YES there are.
An article in the Sydney Morning Herald titled ***"The invisible backpack, and why it makes the education gap hard to close"*** states :

"Students backgrounds account for 55 per cent of performance differences between schools in the OECD's developed industrial economies – in Australia it's 68 per cent."

State school teachers, at say Woodridge State High School, have an added burden on top of EEIs, ERTs and being an author in that they are far, far, more likely to be trying to overcome the added weight of dealing with the invisible backpack a student carries with them if they are from a low socio-economic background or a student that is a refugee or a recent immigrant with English as a second language.

From ***" Queensland Schools, Key Statistics in Brief, 2012 Update"*** from Queensland Teachers' Union, page 10:

"The general trend since 1991 has been for government schools to show a significant increase in the percentage of students in low income families relative to the percentage of high income families and for non-government schools to show the opposite trend (Preston 2007)."

I say to the members of the inquiry that all teachers, but State school teachers in particular, carry a heavy visible backpack. It is full of drafts and assignments and EEIs and unfinished teaching notes. We, all of us teachers, work hard and we do the very best we can with the system given to us.

From a WorkCover Queensland article titled: "Queensland Teachers most stressed workers", the second paragraph is interesting and it states:

"SWA (Safe Work Australia) has reported applications for mental stress compensation leapt by a third in 2009-2010 as teachers cracked under the pressure of classroom life."

2. Student participation levels

- From data submitted by the QSA :

  Enrollments for Maths B show

Year	2002	2012
Number	**15 952**	***16 302***
% of population	30.26	25.78

- In the 10 years when the overall population of students went from 38 820 to 46 799 an increase of 7979 students only 350 extra students went on to enroll in Maths B.

  Enrollments for Physics show

Year	2002	2012
Number	**6692**	***6804***
% of population	12.7	10.76

- In the 10 years when the overall population of students went from 38 820 to 46 799 an increase of 7979 students only 112 extra students went on to enroll in Physics.

  Completions for Maths B show

Year	2002	2012
Number	**12 728**	***12 496***
% of population	24.15	19.76

- **In the 10 years there has been A DROP/FALL/REDUCTION in the number of students completing Maths B. What a sad statistic!**

  Completions for Physics show

Year	2002	2012
Number	**5683**	***5666***
% of population	10.78	8.96

- **In the 10 years there has been A DROP/FALL/REDUCTION in the number of students completing Physics. What a sad statistic!**

Ridd's assertion that boys are disadvantaged due to written assessment techniques is acknowledged by research.

In the paper ***" The Science of Sex Differences in Science and Mathematics"*** published in *Psychological Science in the Public Interest*, Volume 8 – Number 1 the authors state on page 40:

"By the end of grade school and beyond, females perform better on assessments of verbal abilities when assessments are heavily weighted with writing and the language-usage items cover topics with which females are familiar; sex differences favoring females are much larger in these conditions than when assessment of verbal abilities do not including writing. In contrast, males excel on certain visuospatial-ability measures. "

And

"Substantial evidence suggests that the male advantage in mathematics is largest at the upper end of the ability distributions, …These differences can be seen as early as adolescence, and, therefore, a greater number of males than females may qualify for advanced training in disciplines that place a premium on mathematical reasoning and/or visuospatial abilities."

Our current system may disadvantage boys but more so the boys at the top end of the spectrum.

What about the overall approach to engagement? What are students being engaged in?

Richard Cooper in his paper in *Issues in Educational Research* titled ***"An investigation into constructivism within an outcomes based curriculum"***, writes:

"The rational of the QSA's outcomes based syllabuses embraces constructivism as a learning theory. Constructivism guided the curriculum framework, where knowledge, process and skill were scaffolded over six cognitive levels. This "advance organizer" framework distinguishes QSA's outcomes based education from the failed values-based American outcomes education reform."

So we do live and work in a "constructivist, outcomes" based system despite any statements to the contrary.

However in a paper by Ken Rowe titled ***"Effective teaching practices for students with and without learning difficulties: Constructivism as a legitimate theory of learning AND of teaching?"*** states in his Abstract on page 1:

"Much of what is commonly claimed as "effective teaching practice" and implemented during the early and middle years of schooling in Australian schools, for either mainstream students or for those experiencing learning difficulties, is not grounded in findings from evidence based research . Of particular concern is that ***despite a lack of supporting evidence for its utility*** *(my*

emphasis), the prevailing educational philosophy of constructivism (a theory of self-directed learning rather than a theory of teaching) continues to have marked influences on shaping teachers' interpretations of how they should teach – aided and abetted by the content emphasis given during pre-service teacher education, as well as in-service teacher professional development programs. "

In a paper by Dr ACR Tavner titled ***"OUTCOMES-BASED EDUCATION IN A UNIVERSITY SETTING"*** published in *Australasian Journal of Engineering Education* states on page 10:

" Work by the author has demonstrated that a linear level-of-achievement model for individual outcomes does not reflect the non-linear way in which students learn. Even using a simplistic linear approach will lead to an outcomes structure of unmanageable complexity. A comprehensive outcomes structure containing outcomes based on knowledge of specific content will be such an elaborate, complicated and artificial construct that it will bear NO RELATION TO THE REAL-LIFE LEARNING EXPERIENCES OF OUR STUDENTS."(my emphasis)

I fully understand the term "unmanageable complexity" as do many of my colleagues.

From a paper by Richard G Berlach titled ***"OUTCOMES-BASED EDUCATION & THE DEATH OF KNOWLEDGE"*** I have generated the following quotes from Berlach's 5 key concerns:

"The language of OBE is the jargon of corporate business …"
"OBE is obsessed with … hyper-accountability …". **This should resonate with ALL teachers at the moment!!**
"It does not have much evidence of its own success …"
"Both the culture and associated gobbledegook of business is now firmly entrenched within the ampitheatre of education …"
"Jargon can so easily be mistaken for substance …"

From a DETWA report 2004 *"many retiring teachers noted that there had been a change in workload over many years with respondents stating that the paperwork took them away from their real job of teaching."*

"OBE suffers from assessment overload." **I fully agree!!**
"Conclusive research evidence supporting the notion that mountain-sized portfolios assess learning any more effectively than do time-efficient, teacher-made, pen-and-paper tests IS DIFFICULT TO FIND." (my emphasis)

So what happens in Qld compared to NSW?

First of all, a Queensland example of a marking scheme for an exam.
Is this unmanageable complexity? Assessment overload?

Queensland Example: Year 12 Physics. Marking Sheet

Name: _____ Criteria Sheet 12.1 Physics Year 12 Term 1, 2013

	A+	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E+	E	E-
	The student work has the following characteristics:			The student work has the following characteristics:			The student work has the following characteristics:			The student work has the following characteristics:			The student work has the following characteristics:		
KCU 1	reproduction and interpretation of complex and challenging concepts, theories and principles.			reproduction and interpretation of complex or challenging concepts, theories and principles.			reproduction of concepts, theories and principles.			reproduction of simple ideas and concepts.			reproduction of isolated facts.		
KCU 2	comparison and explanation of complex concepts, processes and phenomena.			comparison and explanation of concepts, processes and phenomena.			explanation of simple processes and phenomena.			description of simple processes and phenomena.			recognition of isolated simple phenomena.		
KCU 3	linking and application of algorithms, concepts, principles, theories and schema to find solutions in complex and challenging situations.			linking and application of algorithms, concepts, principles, theories and schema to find solutions in complex or challenging situations.			application of algorithms, principles, theories and schema to find solutions in simple situations.			application of algorithms, principles, theories and schema.			application of simple given algorithms.		
IP 3	systematic analysis of primary and secondary data to identify relationships between patterns, trends, errors and anomalies.			analysis of primary and secondary data to identify patterns, trends, errors and anomalies.			analysis of primary and secondary data to identify obvious patterns, trends, errors and anomalies.			identification of obvious patterns and errors.			recording of data.		
EC 1	analysis and evaluation of complex scientific interrelationships.			analysis of complex scientific interrelationships.			description of scientific interrelationships.			identification of simple scientific interrelationships.			identification of obvious scientific interrelationships.		
EC 2	exploration of scenarios and possible outcomes with justification of conclusions/ recommendations.			explanation of scenarios and possible outcomes with discussion of conclusions/ recommendations.			description of scenarios and possible outcomes with statements of conclusion/ recommendation.			identification of scenarios or possible outcomes.			statements about outcomes.		
EC 3	discriminating selection, use and presentation of scientific data and ideas to make meaning accessible to intended audiences through innovative use of range of formats.			selection, use and presentation of scientific data and ideas to make meaning accessible to intended audiences in range of formats.			selection, use and presentation of scientific data and ideas to make meaning accessible in range of formats.			presentation of scientific data or ideas in range of formats.			presentation of scientific data.		

The above sheet is filled in after the sheet shown below is filled in.

Name Criteria Sheet Physics Year 12 Term1, 2013

	Q no'	A+	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E+	E	E-
KCU 1	1															
	4															
	5															
	6															
	7															
	8															
	9															
	10															
	11															
	12															
	13															
KCU	3															

2	4					
	7					
	12					
KCU 3	7					
	10					
	12					
	14					
IP 3	2					
	9					
	11					
EC 1	2					
	3					
	4					
	6					
	7					
	8					
	9					
	10					
	11					
	12					
	13					
EC 2	4					
	7					
	8					
	10					
	12					
EC 3	1					
	2					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
	11					
	12					
	13					

And then the teacher makes a lot of judgements about answers and their worth and then the teacher makes a lot of judgements about the holistic mark given for KCU and IP and then EC. These are personal judgements and it is entirely conceivable that if another teacher were to mark the exam that an entirely DIFFERENT result would be generated.

Trying to explain this to a parent is a nightmare. Eventually they ask how their child is REALLY going.

What about NSW?

An example answer scheme from the HSC Physics exam 2012

Question 22 (b) Criteria	Marks
► Relates the correct polarity of the coil's field to the change in flux through the coil ► Relates the coil's magnetic field to the production of a force on the magnet that causes a reduction in the reading on the balance ► Relates the increasing distance between the magnet and the coil to the return of the reading on the balance to its original value before the coil was moved	4
► Relates the change in flux through the coil to the correct polarity of the coil's field ► Relates the coil's magnetic field to the production of a force on the magnet that causes a reduction in the reading on the balance	3
► Relates that the change in the reading on the balance due to a force caused by the current in the coil.	2
► Any relevant statement	1

Easy and simple for all to understand. And it uses Marks. Marks that can be justified/explained.

I have personally seen school based tests for senior and junior mathematics from a number of NSW high schools and ALL THEY CONTAIN are questions and marks. NO CRITERIA WHAT SO EVER. The student has the marks ADDED together and then GIVEN A PERCENTAGE and then given a Rating from A to E. It can be done.

AND HERE IN QUEENSLAND HOW CAN THE FOLLOWING BE ALLOWED TO PERSIST?

The paradigm of an outcomes-based, constructivist approach as Queensland uses, assesses a student's answers against a set of criteria and has no norm-based scaling or student ranking BUT then uses these results in…….
rank ordering students in a norm-based scoring system: THE OP SYSTEM!

As Berlach notes in his paper, **"OUTCOMES-BASED EDUCATION & THE DEATH OF KNOWLEDGE"** , page 10,

"Unfortunately, Australian education authorities have not addressed the contradiction of how norming fits into a criterion-based system."

3. Validity of assessment

The committee has already heard that:

- Students use tutors to do their EEIs or ERTs
- Students using online assignment completing websites
- Students using the internet to copy / cut and paste work into their EEI or ERT
- Students use a formulaic recipe and do what the teacher tells them to do
- Multiple drafts being handed in
- Students copying from each other for their EEIs and ERTs

It is truly difficult for me to comprehend the true validity of a student's EEI or ERT. Year after year I have seen students achieve much better results for their EEI and ERT than on exams that are conceptual and mathematical in nature and are definitely their own work!

To what level does a teacher "help" their students to complete the work for an EEI and ERT? How many drafts do they check? How much feedback do they give on a draft? The endless possibilities for the EEI or ERT to be done by someone else raises the concern of validity.

In conclusion:

If the inquiry does decide to change the current assessment regime how will that matter to students or teachers when the National Curriculum requires:

Literacy, Numeracy, Information and Communication Technology (ICT) capability, Critical and creative thinking, Personal and social capability, Ethical behavior, Intercultural understanding, Aboriginal and Torres Strait Islander histories and cultures, Asia and Australia's engagement with Asia, Sustainability, Safety, Animal ethics ?

What more do the reformers want me to do? When can I teach Physics for part of any lesson?

Stanley Pogrow in an article ***"Reforming the Wannabe Reformers"*** outlines 8 myths of educational reform. None of these would surprise teachers that have undergone the reforms that have led to the current system. Pogrow goes on to write about REAR: the REsearch/Academic/Reform community (University Education Faculties??) and here are a few quotes:

- "Unfortunately, the answers provided by REAR are more often than not illusory."
- "It is time for them to … stop viewing education as a playing field for their idealologies." The NC??
- "The dissemination of research knowledge and inservice training as the *primary* vehicles for reform has failed and is unworkable."

  Does any teacher know of this scenario?? It is what will happen with the National Curriculum. C2C anyone? Current senior science and maths syllabuses!

- "Education can no longer afford a research and academic community that is detached from the real processes that take place in schools and from the large – scale consequences of the ideas that it proposes."

The REAR community in Queensland is having its fundamental paradigm questioned and that can only be a good thing.

I am reformed out. Maybe this is why I am writing to change (a reform?) the system from its current (re)form.

After 25 years of teaching Science and Mathematics in a variety of locations in Queensland and in schools ranging in size from 120 students up to my current school of 1000 students all I can say is:

I love Teaching but I hate Education.

Thank You.

Ian Pink
Thursday, May 02, 2013