



EDUCATION AND INNOVATION COMMITTEE

Members present:

Mrs RN Menkens MP (Chair)
Mr SA Bennett MP
Mr MA Boothman MP
Mr RG Hopper MP
Mr MR Latter MP
Mrs DC Scott MP

Staff present:

Ms B Watson (Research Director)
Mr G Thomson (Principal Research Officer)
Ms E Booth (Principal Research Officer)

PUBLIC HEARING—INQUIRY INTO ASSESSMENT OF SENIOR MATHS, CHEMISTRY AND PHYSICS IN QUEENSLAND SCHOOLS

TRANSCRIPT OF PROCEEDINGS

WEDNESDAY, 22 MAY 2013

Brisbane

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Committee met at 9.03 am

CHAIR: Good morning. I would like to introduce the members of the Education and Innovation Committee. I am Rosemary Menkens, the member for Burdekin and the chair of this committee. With me are my committee members: the deputy chair, Mrs Desley Scott, the member for Woodridge; Mr Michael Latter, the member for Waterford; Mr Ray Hopper, the member for Condamine; Mr Steve Bennett, the member for Burnett; and Mr Mark Boothman, the member for Albert. We have an apology as well from Neil Symes, the member for Lytton, who is unable to be here today. Today's hearing is being recorded and will be transcribed by Hansard for future publication on the committee's webpage. It is also being webcast live and the video will be available on the committee's webpage until it is superseded by a subsequent webcast recording.

On 14 February 2013 the Queensland parliament directed the Education and Innovation Committee to inquire into and report on the assessment methods used in senior mathematics, chemistry and physics in Queensland schools. It directed that in conducting its inquiry the committee should consider 'ensuring assessment processes are supported by teachers, student participation levels in these subjects, and whether assessment processes support valid and reliable judgements of student outcomes'.

Written submissions to this inquiry have now closed. We have received a very large number of submissions, and the secretariat is now in the final stages of processing them. This reflects a really high level of community interest in this topic. We have heard some very strong views on a range of different aspects of the current methods of assessment. The committee has invited to appear as witnesses at this hearing some people and organisations who asked to appear before the committee and some who did not but whose submissions were generally representative of the range of submissions received by the committee. In addition, we want to hear more about some proposed ways forward.

Today's hearing is the first of three scheduled hearings and follows public briefings held on 6, 7 and 20 March. The committee has also held an expert advisory forum with a range of academics from education, maths and science disciplines to help us address particular parts of our terms of reference. The transcripts of all of these are on the committee's webpage. Details of future hearings are published on our webpage as they are finalised.

Parliamentary privilege applies to all committee operations, including this briefing. On the other hand, to mislead the parliament, including this committee proceeding, is a serious offence. If a witness is unable or unwilling to provide an answer to any question the committee might put to them, he or she should advise me accordingly, giving reasons. We will consider the reasons and provide ample opportunity for a witness to seek any advice or assistance needed. Witnesses might also wish to take questions on notice if you do not have information at hand. As well, you may request that any material you provide be kept private and, again, the committee will consider that request. For the benefit of Hansard, I ask that those speaking state their name the first time they speak.

DARBEN, Dr Peter, Executive Member, Queensland Teachers Union

MERTENS, Ms Leah, Research Officer, Queensland Teachers Union

CHAIR: This morning I welcome representatives from the Queensland Teachers Union: Dr Peter Darben, who is the executive member, and Ms Leah Mertens, who is the research officer. Thank you both for coming this morning. We have allocated 20 minutes for you to appear this morning. Would you like to make an opening statement?

Ms Mertens: Thank you, Madam Chair, and thank you for the opportunity to attend the hearing to elaborate on our submission to the parliamentary inquiry. As you would know, the QTU has a long and proud history over the last 124 years of representing state school teachers in primary, secondary and special schools as well as TAFE teachers in TAFE institutes. We are the professional and industrial voice for more than 44,000 members across the state.

QTU policy in relation to the principles of senior assessment is outlined in our submission. We support the current system of assessment which is school based, standards referenced and externally moderated. This position was again confirmed at our meeting of state council held on Saturday, where over 100 delegates from all areas of Queensland who have been duly elected to their position through ballots run by the Queensland Electoral Commission reaffirmed their support for school based, externally moderated assessment practices. These delegates also strongly rejected any moves towards external examinations in senior subjects.

The QTU submission was developed using feedback from members who are current practitioners in classrooms around the state—maths, chemistry, physics and biology teachers who provided feedback to the QTU. Given their firsthand experience at determining student achievement levels, their ideas, thoughts, concepts and arguments were included in the submission, which was then endorsed by members of the QTU executive. Members of the QTU executive under the rules and constitution are elected by and from our state council, which is, as I said earlier, our chief decision-making body. One of our executive members Dr Peter Darben joins me today.

Peter is the coordinator of the SPARQ-ed program. SPARQ-ed stands for Students Performing Advanced Research Queensland. SPARQ-ed is a joint initiative of the University of Queensland's Diamantina Institute and the Queensland Department of Education, Training and Employment. The aim of SPARQ-ed is to engage students in the process of scientific research by connecting them with world-leading biomedical scientists. Peter is an experienced registered senior science teacher with a biomedical research background who has also made his own submission to the inquiry quite separate from the QTU submission. I will leave it there, Madam Chair, and I will hand over to Peter to go through the more technical points of our submission.

CHAIR: Thank you, Ms Mertens, and I welcome Dr Darben.

Dr Darben: Thank you, Madam Chair, and thank you to members of the committee. Our submission has been put up there. I guess a bare bones summary of what we have put in it is that we do support, as Leah said, the current system of senior assessment in Queensland, and that is across all subject areas as well as the sciences and maths. If there is some criticism that can be made, it is possibly the way that it is being implemented and supported. The rest of the report goes into a little bit more detail there. However, I am a big fan of not throwing a great system out that does good things by our students just because it could be done a little bit better.

Another interesting thing to note is that, even in the two weeks between when this submission was lodged and when the date for submissions closed, the QSA itself has made enormous steps towards addressing some of the concerns that we have raised in this document, mostly in the manner of actually providing support and examples and training for teachers, and I think that needs to be acknowledged. Possibly if you look at the difference in the tone between this report which I contributed to and the report of my own which I submitted on the last day of submissions, you can actually see some of the differences there. I think that is very important to note and it is also something that underlines why we need to retain this system in Queensland. The QSA responded to concerns by teachers and it responded in such a way that, although things still are not perfect, they are a lot better than they were. I do not believe that an externally mandated system would be so responsive to the professionals who actually have to implement this at the chalk face, if you like. In the interests of time I would be happy to take any questions that the committee has.

CHAIR: Thank you, Dr Darben. You have made some very encouraging comments there. I turn to the committee now for any further questions.

Mr BENNETT: Dr Darben, if I can just make a point, a lot of the submissions that we have received over the last couple of months have been particularly about students' preparation for tertiary or further education. I suppose a lot of the submissions that we have been receiving on the other side of the equation is about their preparedness for even the first year or the preliminary university studies. I acknowledge that you are saying there is a need for some change or for some modifications to the QSA grade system, I think were your words. Would you like to comment about the perception or the reality of our year 12s not being quite tertiary ready and the fact that external exams may have some influence on improving that statistic?

Dr Darben: Sure. I think there are a number of ways to look at that. In the situation in which I am currently working I am very fortunate to be able to interact with scientific researchers and university academics on a daily basis. I know of some of those comments that are being made out there. I think the best way to start is to point out that, when I went on to tertiary study in 1987 under a system that was still externally moderated, the same comments were being made. Always there have been comments from education professionals at all levels about the level of preparedness of

the students coming into their care. I would say that university academics have always said that the kids who are coming to them are not well prepared. I only need to look back at my first year of university, which was in a biomedical course, where we spent the first year not doing biomedical stuff but doing year 11 and 12 physics and chemistry and maths. So that perception has been around for at least 25 years and possibly even longer.

You also see those attitudes unfortunately in the school sectors. You hear secondary school teachers complaining about the level of primary school students coming into secondary school. You hear university academics complain about the level of secondary school students coming into university. I might add, on top of that, that the institute that I work at is part of UQ. It does not do undergraduate teaching; it does postgraduate honours and upwards. The researchers there are always complaining about the standard of university undergraduate teaching and that the honours students they get in there are not quite up to the task. I think that needs to be taken into account.

It is probably also important to note the level of tertiary uptake. I believe—and I do not have the statistics from the QSA in front of me—from memory that the figure is only around the 30 per cent mark. Our subjects are very important for getting students into university, but they should also be subjects which prepare students and educate students about science and maths for other purposes. They might not go on to study a science course at university and we need to take that into account as well. Yes, I think their primary concern is to get kids ready to face the rigours of university, but if fewer than a third of our students are going on to pursue those studies then the subjects do have to cater to other needs as well.

CHAIR: Would you be able to explain why the Queensland Teachers Union views qualitative criterion based standards reference assessment as the preferred method of assessing extended responses to assessment tasks but not of assessing shorter answer tasks?

Dr Darben: I guess it comes down to the mechanics that you actually use in assessing things. If I had an extended response task and I were to use a quantitative method for assessing that I would in my head be essentially following a qualitative process. I would be looking at the students' work and saying, 'They did pretty well there; they get nine out of 10.' I would still be making a qualitative judgement.

The difference in the new standards is that they specifically mention qualities of the student work that you need to find. You need to find complexity in the student's work for them to get an A level of achievement in many of the standards. You need to be able to see the student explaining things. That actually is a lot easier to talk to students and parents about. When they come up to you and say, 'Why didn't I get an A?', under a quantitative method you just say, 'You did not say enough stuff that I could add together.' As opposed to under a standards reference I can say, 'You explained things, but you didn't actually make those complex links which would push you up into the A. So the next time you do it that is what you want to do.' It is all about giving much richer feedback to the students and guidance in how they can get higher levels.

When you come to a shorter response task, such as what we might think of as an exam—they are now called written tasks—they are about accumulating knowledge. Some sort of quantitative method of bringing that information together certainly makes life a lot easier. Even if you do use standards and each question has standards associated with it, at the end of the day you still have to use—even if it is in your head—at least a semiquantitative way of accruing all those marks together to make it fair.

I guess the place where the QTU believes the QSA could be a little bit more flexible is this. We support standards referenced we just believe that some of the standards descriptors need to be flexible enough to allow some quantitative assessment in single items.

Mrs SCOTT: It is clear that a very dedicated teacher has huge contact with the students and a lot of feedback is required plus assessment and so on. I just wondered if you wanted to expand more on the workload that teachers have under this system?

Dr Darben: The workload for individual tasks is certainly higher. If I have a look at the difference between an old-fashioned tick and flick exam where you added up the number of the things that students got right divided by the number of things they were supposed to get right and multiplied by 100 to get a percentage that is an easy thing to do. It is an easy thing to set those exams. The benefit in the new system is that you have less of that assessment. For a single assessment piece you might have to put more time into it but you have fewer of them.

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I believe that the thing that has contributed most to the workload of teachers is the fact that it has been a bit of a choose your own adventure in doing this. I do not believe in the early times that teachers were given enough guidance and examples of how to do this. Ten years ago the QSA was vehemently opposed to providing any examples of work and I am very happy to say that they have changed that idea. There is still a long way to go, but they have been making inroads into that.

It would be a lot easier if teachers could have a template or a sample assessment piece that they could say, 'Okay that is how they did it in that area. This is my context, I can see what they have done there.' That would save teachers a lot of time as well. There are other things, but I will end it there.

CHAIR: Thank you Dr Darben and Ms Mertens for the information you have given us this morning. I am sorry the time is so short, but we really do appreciate your time. Thank you very much.

DUNN, Ms Miriam, Research Officer, Queensland Independent Education Union

GILES, Dr Paul, Assistant General Secretary and Treasurer, Queensland Independent Education Union

CHAIR: I welcome representatives from the Queensland Independent Education Union. Thank you both for coming along this morning. We have allocated 20 minutes for you to appear this morning. Would you like to make an opening statement?

Dr Giles: Thank you for the opportunity to appear. I will provide a little bit of clarification about our union. As the Queensland Independent Education Union we are a state based, state registered union. We are also the Independent Education Union of Australia Queensland and Northern Territory branch, which is a federal based union. The other thing I would highlight is that I am in fact our union's nominee on the govern body of QSA. For transparency I think that needs to be said as well. Miriam Dunn is our research officer and will address our submission today and the submissions we have formally put to you previously.

Ms Dunn: I will give a little more background about our interest in this matter. QIEU and its antecedent unions have a long history of engagement in professional issues relevant to the education sector dating back to the 1920s. Our union has a long history of support for the recognition of professionalism of the highly qualified teachers of this state. Moreover, our union has at its core the belief that we respond to and support the will of our broad membership. We do not make arbitrary decisions on their behalf, but engage in genuine consultation and dialogue to ascertain and represent their views as honestly as possible.

To this end, when the public debate around assessment and moderation in mathematics and science started to become increasingly vocal, we became aware that while some of our members were highly critical of the current system there appeared to be many who were supportive of it. It was determined that we could not take a public stand on the matter until we had valid data to support one view or the other.

The QIEU assessment and moderation survey was designed to provide clear direction from our membership as to their views on the matter. So our position on assessment as a result of that feedback is that we continue to endorse the use of standards based criterion reference assessment in mathematics, chemistry and physics as outlined in the current syllabus documents from the QSA.

Our reasons for this are as follows. Firstly, and probably most importantly we believe that is the direction we have received from our members. But also we believe that this provides the most effective means by which students can demonstrate the full extent of their knowledge, understanding and skills. We also believe that, in line with the Melbourne declaration on the rights of students, this form of assessment and these current syllabi also provide opportunities for creativity that an external examination system, by its very nature, tend to kill off to some extent or certainly seriously reduce. I think that would be contrary to the good of our students moving into this century.

Secondly, it enables students at the culmination of their secondary education to engage in authentic mathematical and scientific practices that more closely model practices in university and in the workforce. No system will ever be perfect, but I think we come close to a more acceptable way of preparing our students for their ongoing work either in university or in the broader community.

This system enhances the professionalism of our teachers, and makes them better prepared to explain the learning requirements to students. It also provides a framework for a discussion with students about what they need to do to improve their results and this it can provide in quite precise detail, rather than the old system that I knew when I went through school that you got perhaps 19 out of 20 for your essay and nobody could ever really tell you why you did not get 20 out of 20. It was never really apparent and if you got 15 out of 20 they would just say something like, 'Well, you just need to work harder, Miriam,' which is really quite inadequate, I think.

However, some of the problems I think that we currently face have arisen due to in large part funding inadequacies. The QSA should be appropriately funded to ensure that aspects of the current system that are not or are perceived not to be working well can be addressed. In particular, resources need to be applied to the professional development of those teachers who have not yet come to terms with the demands of the new processes. Many appear not to comprehend fully how criterion can be differentiated to determine the difference between the different levels of achievement—the VHA, or the HA, and so on—at exit standard and even on individual assessment

tasks. Some criteria in particular seem to be a little more difficult than others and I am thinking particularly of the communication criteria quite often. Provision of exemplars of work program and of assessment tasks with criteria sheets and student responses that are annotated—when I wrote this I was not aware that QSA has started to put more of these up online and, while I think it is very good that they are online, I think with something as complex as criteria based assessment, which I have worked with as an English teacher, I think if you do not get it automatically you actually need a fair amount of one-on-one working or very close to that small group work to really come to terms with the complexities and the demand that it presents, particularly as an assessor of student work and certainly in terms of setting assessment tasks that cater to the demands of the criteria that are going to be addressed.

To address the perception, real or otherwise, that district and state panels are inconsistent and/or biased in their judgements, strict guidelines should be developed to guide these processes and every panellist should be provided with induction into the process. I believe that that induction should occur at the hands of QSA officers, not long-serving panel members who may have fallen into habits of use that deviate, however slightly, from what the procedure should be. I think if there is a consistent group of people involved in this induction of panellists who are giving a consistent message over a period of time, that perhaps some of these issues could be resolved. They should also ensure that there is regular, ongoing training of panellists to make sure that there is ongoing compliance with the procedures. I think it is also very important to note that in some cases panellists can be quite young in their careers as teachers. I have heard anecdotally instances of teachers who have been out only two years or so being on a panel and I think that is really quite inappropriate. They simply do not have enough experience. One of the problems with that is that it is getting increasingly difficult to get people to go on to panels. Part of that process, part of the problem, I believe, is there is insufficient reward for the work and quite often insufficient time allocated to it to do the job properly. I think that needs to be looked at quite seriously if we are going to have a good process of external moderation in operation. It is not something that you can cost-cut on.

A thorough review of the quality assurance processes currently in place should be undertaken as part of the QSA OP and tertiary entrance review processes. I know they have quality assurance processes in place, but I think we need to have a look at them and see if they are sufficiently rigorous and, if they are not, then processes that are sufficiently rigorous need to be funded. Everything costs money.

One of the greatest impediments to the effective application of the current system has been the failure to resource its use in schools. The growing demands on teachers' time makes the often very lengthy process of designing a work program and the assessment tasks that go with it unrealistic under the current provision of time. Governments have failed to fund schools to provide the staffing necessary to free up time for this work and for the very demanding work of assessing student work in tight time frames. In the independent sector, in some places you will get perhaps a maths-science teacher who might have four senior classes in one or both disciplines, or in a number of science-maths disciplines. With the nature of unitised work, it usually works out—or frequently works out—that all of those assessments could come due at least within a week of each other, perhaps two weeks of each other maximum, and having something like 100 long senior assessment papers to mark in a period of two or three weeks when you are not provided adequate time means that quite often you are doing things like working to two o'clock in the morning or, what I used to do, going to bed at 10, waking up at four and marking until seven when I had to be at work at 8.15. I do not believe that always gives the greatest clarity that needs to be brought to this work. Teachers do it with the best will in the world, but there are only so many hours in the day and it does come down to funding—what schools can afford to do in putting staff in front of students where your primary duty is. Also, of course, at those times the notion that you can do really detailed and adequate preparation is nonexistent. So if you are not experienced at what you do, you really struggle.

I think that really covers the important additional material that we perhaps wanted to provide to our submission. If you have any questions, we are happy to try to address them.

CHAIR: Thank you very much for that. Our time is terribly tight and I am sorry about that. I have just a very quick question. You made some very relevant comments about the panel. Do you have any alternative solution for those moderation panels?

Ms Dunn: No, I think the idea of professionals moderating each other's work is very useful. Certainly, in internal moderation processes it works very, very well in schools. I think the problem has been in being able to attract enough highly qualified teachers in all cases to fill the positions. I think there has been perhaps insufficient ongoing training and certainly insufficient induction into the processes. I think a really detailed set of written guidelines would be very helpful—'These are the rules and you must abide by them.'

CHAIR: Thank you. We probably have another two minutes. Desley, do you have a quick question?

Mrs SCOTT: Yes. I really would have liked your comments on more creativity and the authentic scientific practices and so on that you spoke about. We have already heard from the QUT that there has always been the complaint that students are not ready for university and so on. We are still hearing that. Is that because of the wide range of topics in the curricula? Is there some way that we can address that? Or is it something that will forever be because of the large jump from the high school curriculum into university?

Ms Dunn: I do not know that there is necessarily such a large jump from senior high school into first year university. I think some of it may well be a matter of perception. Academics in their disciplines are very passionate, quite often in quite discrete areas, whereas the senior secondary program tries to give students a fairly broad range of coverage so that they can get on with the job. I think even perhaps in something as specific as chemistry and physics, that may well be the same issue. But I think it goes back even longer than when I was a girl. There are reported comments from Plato, for example, that students in his day were not what they were 20 years ago. I think that it is something of a perennial issue of perception.

CHAIR: Thank you very much for your in-depth submissions and also for your comments this morning. I really do thank you both, Dr Giles and Ms Dunn, for the information that you have provided. We really do appreciate your time. Thank you.

AHERN, Mr Brad, Private capacity

ANDERSON, Ms Maureen, Private capacity

PERRY, Mr Leon, Private capacity.

CHAIR: Good morning. I would now like to welcome three teachers who have raised concerns about the current system for assessing senior mathematics, chemistry and physics in Queensland schools. We have 40 minutes for this session and we invite you each to make a short statement. Could you limit that to say, three minutes each, which I know is difficult, but that will ensure sufficient time for committee questions. Thank you.

Mr Perry: Thank you for giving us the opportunity. I was the head of science and subject master at Brisbane State High School for 40 years, during which time I had seen large changes in the school curriculum and so forth. You have my submission, which is quite detailed—possibly mildly offensive, but heartfelt. I would like to talk about just two aspects of my submission. The first one involves the unintended consequences of assessment for senior chemistry and physics.

The point about students entering university being disadvantaged and so on has been brought up here. I think it misses the point a little bit. Our students never really came back after their first set of semester exams and said, 'Gee, sir, you could have done a lot better by us.' Most of them were very grateful that they had done their course at our school. I think in some ways if you have extended experimental investigations the students are basically constructing their own knowledge and, when they enter university, if that has been a feature of the program they have gone through the university lecturers more or less have to deconstruct that knowledge and rebuild it—a little bit like army training, I suppose you could say.

But moving back to what I was going to say about the unintended consequences, there is an opportunity cost I think involved with the time and effort that teachers put into chemistry and physics assessment programs with the transition to the EEs and so forth and the use of letters rather than numbers.

I have noted over the 40 years or more that I was a teacher that the emphasis increasingly turned towards the assessment program that we had put in place. I could not see that as being what my primary role was. I felt that my primary role was to provide learning experiences for the students to construct courses that were very valuable for them and so on. The reason we have that emphasis or the reason people keep ringing up about university is that students who select physics and chemistry, by and large, select those subjects because they are prerequisites for university subjects. So they want to go to university. The number who do not want to go to university who actually do chemistry and physics would be extremely small.

From my own personal experiences I doubt that any of the students that we taught—maybe one per cent to five per cent—did not intend to use that subject knowledge and so on when they moved on to university or to use it as a prerequisite subject. No-one selects chemistry and physics because they need to have a break from other subjects. It is tough work and it is very mathematical work, which is another reason I do not particularly like the use of letters in place of marks because when they move to university there are marks involved. I can appreciate that if you have criteria you can talk to students about that, but that does not exclude the use of marks. They can still be involved.

In fact, I think what is involved here is Occam's razor principle. If you have two different ways of arriving at the same sort of result—in other words, the ranking of students according to ability and so forth and performance—the simpler way is the preferred method of use, and marking is a lot simpler. It is not any less—I am searching for a word here—effective than using the letters. I think the use of letters is rather coarse grained. They are more subjective than using marks. It is one of the principles of science that if there are two competing theories or ways of doing things the simpler one is the preferred method.

Another aspect is that there is a conflict between the assessment methods that we use and the actual nature of science itself. I understand the reason behind extended experimental investigations. I put as much effort into making those work as any other element of the assessment program. But there is a degree of self-discovery involved in the extended experimental investigations, even the extended responses. And I think it is a time-consuming and inefficient way for students to gain knowledge.

One reason for that inefficiency is that students are building and consolidating their knowledge, understanding and skills as they actually work through those, where ideally that should have occurred before. If consolidation does not occur prior to that EEI, students are looking at it with an unpractised eye. The best example I can give of that is when you get an X-ray or a ultrasound scan done. When we look at it we can see various features on it. It is easier enough to identify a fracture, but with the practised eye of a doctor or a radiologist they can point out other things to you and then I think to myself: how do you know that or how can you interpret that? It is because they have had the practice behind it. They know where the various organs and so forth lie and they know how they are going to show up in the X-ray.

CHAIR: Mr Perry, I am going to have to ask you to round up your final comments.

Mr Perry: I think, in summation, during my teaching career, time spent by students on finding knowledge to carry out assessment tasks in chemistry and physics has grown at the expense of supported learning and the gaining of key information and skills. It is my belief that the end result of the continuation of this process will not be in the best interests of students.

CHAIR: Thank you, Mr Perry.

Mr Ahern: Thank you very much for the opportunity to speak to my report today. I had a teaching career of 44 years. I have spent 30 years as a subject master of science and HOD of science—28 of those years were at Beaudesert State High School and Kelvin Grove State College. I am going to start with a brief summary of my report and then move on to a discussion of different things that I want to say.

The first term of reference for the report was ensuring assessment processes are supported by teachers. I believe that a high proportion of chemistry and physics teachers do not support the present assessment procedures but nonetheless continue on with their pretty onerous duties and professional responsibilities. Maureen later on is going to present an analysis which I have seen of submissions to the inquiry, and she is going to talk about support for this claim.

The second term of reference was student participation levels. It is quite apparent when you are looking at the QSA data that was tabled on 7 March that there has been a flatlining or a general decline in student uptake of the subjects under consideration by the committee. I retired from teaching in 2010 because I felt that I could not in clear conscience teach chemistry under the assessment regime of the new syllabus. I did not like doing that. I was invited to teach chemistry at QASMT under the IB system in 2011. Since then I have retired again because of illness. In my more recent experiences as a tutor, I have taught some very bright and hardworking students, all of whom failed to achieve A level in chemistry and physics at exit. In fact at one private school, a school that my tutee was attending, not one student in the grade 12 cohort achieved a VHA level in chemistry.

I commonly find when I am teaching students how to do their EEIs that I have to teach tutorial students that basic knowledge right from scratch for class tests as well as for extended assignments. They have the task instructions and the PowerPoint in their hands, but they do not have the knowledge in their heads and their level of participation is in question. You could talk about the students who take the suicide six. Have you heard of the suicide six? It is urban language for taking English, maths B, maths C, physics, chemistry and biology. Not many students take all six these days. They know that it is folly. It is too much to try. Some students would like to do that though.

The third term of reference is the ability of assessment processes to support valid and reliable judgements. I believe that validity and reliability of assessment processes are questionable on many aspects. There are high levels of subjectivity in the grading. It is a bit like grading English essays. The comparability of results between different schools and different districts is often in question. The ownership of projects and assignment work is in question commonly because many students are known to recruit the help of older siblings, parents and paid tutors to assist them. It is not known what proportion of students actually receive substantial help, or for that matter it is not known how many students are unable to afford that sort of help.

This grading system with the five letter grades, A to E scale, is the norm today, but this is a coarse grained scale and there is a loss of accuracy in the assessment and therefore a loss of validity. In sections 4 and 5 of my submission, which is published on the inquiry website, I presented an account of how a QSA preferred assessment model evolved, as shown by my studying the past publications of the board and the QSA. My submission states how the authority at first investigated the nature of quality assessment and subsequently, over a long period of time, developed a theory, and that was the term that was actually used. Interestingly, a QSA commissioned study from 2006

confirmed that this system was indeed a ‘theory’ in development and the study identified issues with the theory which were highly problematic. The author of this review was none other than the Queensland Director of ACER, the Australian Council for Educational Research—which is the largest independent educational research body in the country—Dr Gabrielle Matters. Her main conclusion was that the validity and reliability of the model was in doubt.

Also in 2006 international studies reported why minimal guidance during instruction does not work. However, the QSA, in spite of these facts, continued with the trial pilot syllabi and then the new syllabus versions. It is my belief that the authority in doing this has put in place an experiment on to Queensland students and teachers which has been at great cost to all the stakeholders—the students, the parents the teachers—and even possibly to the detriment of the success of this state and its economy. I am hitting pretty hard here.

Nowadays, highly robust international research from 2010 has shown a strong link between two important educational variables. All of the leading nations in economic success, as measured by national productivity, also use external exit exams for maths and science. We should realise and recognise the fact that the knowledge is part of the economic capital of the nation. Whether it has been a well-intentioned experiment or not, the current assessment system fails many important tests.

CHAIR: I will have to ask you to wind up very shortly.

Mr Ahern: I figured that might happen. There are symptoms of a system that is sick. There is overanalysis. There is overcomplexity. There is a lack of clear goal posts for the students and for the teachers. Every school has a different program. There are no two schools with exactly the same programs. It is much like what the primary school system experienced and now that has been straightened out because of the direction that the national curriculum and NAPLAN has given. There is burnout. There is illness. There are resignations. There are plenty of claims that there are low knowledge levels at exit, but chemistry students at my schools never complained about not being prepared for university.

If I could I will just present a few recommendations to conclude. My first recommendation is that the use of numerical marks must be reinstated so that internal school assessment is capable of grading students using accurate data rather than letter grades so you can see the results more clearly. The use of numerical marking will eventually bring Queensland up to date with the rest of the world. It is absolutely essential to contemporary assessment methods that we allow teachers to place marks on papers. My second recommendation is that it is necessary to apply this to the long science assignments too. Since the criteria describing the standards have already been developed, it is necessary to superimpose marks on those marking rubrics.

The third recommendation I make is that there is a need to make clearer goal posts in senior science and maths, and the way of doing that is to have state-wide common external exams which should be reintroduced as soon as possible to create a level playing field. Finally, there is a need to re-establish subject knowledge, subject processes and procedures of the sciences to be at the forefront of the assessment. During my long career as a subject master in science HOD, I have had numerous teachers in my department whose knowledge base was lacking. Not every teacher you get to teach senior physics has done physics at uni. You can only imagine the damage that can be done to classes in that scenario.

We have to realise that knowledge is a commodity that our international competitors will actually spy to get. Advances in knowledge are things that precede the growth of the economy and advances in knowledge will generate the critical advances for the future of the state of Queensland.

CHAIR: Thank you, Mr Ahern. You had some very relevant comments there. Ms Anderson, we welcome your comments.

Ms Anderson: Thank you for the opportunity. I would like to hand out some data analysis.

CHAIR: Is the committee happy for this to be tabled? Yes, thank you.

Ms Anderson: I have been teaching for about 30 years in many areas across Queensland including remote areas. I want to make it clear today that I am speaking, I believe, on behalf of teachers. I have made an effort to look at all of the submissions so that I was not just giving my opinion. I would like you to look at the top corner—teachers on a full teaching load. They are the ones I want to address today. Ninety-five per cent are in favour of change, and that is change from

the current system. Of the teachers on a full teaching load, as I went through the submissions, you can see the ones that want change. Of the teachers who tended to favour the current system, 53 per cent were on a partial teaching load, which were HODs. They are on less than half the teaching load compared to teachers on a full teaching load, and they are the ones I would like to look at today.

As I went through all of the submissions, lots of teachers were saying that the workload was too much. Often teachers in a school are the only ones directly involved with the curriculum. They have been delegated the role of writing the work programs, designing EEs and ERTs, and all of the time they were saying that they were overworked. I am finding it quite demoralising as I look to the institutions. As you can see, education establishments including the QSA itself are against the change to the current system and 75 per cent are in favour of it. When I read their comments, without fail they are basically saying that teachers need to undergo more professional development. We are not saying that we do not know the system. We are saying that we cannot cope with that and teaching as well. To teach effectively you need to clear your mind. We are finding that the assessment is overtaking the time that we have to teach. I will give you some examples from some of the submissions. The QUT states—

The concerns of teachers should not surprise given that most secondary chemistry and physics teachers have not had science research careers ...

Griffith University states—

... it is crucial to the success of rollout of change that adequate professional learning is made available ...

The University of the Sunshine Coast states—

Ongoing professional development for teachers in understanding and enhancing their expertise ...

We are not saying we do not know how to do the system; we are saying that we cannot teach effectively with this onerous assessment regime. That is what has been said throughout the submissions.

I have also taught in remote areas in Central Queensland where those teachers do not have HODs and they are not within driving distance of panel meetings. They are on their own and they are often teaching more than one senior subject. I know that a lot of teachers are not coping with one senior subject. To expect those teachers without any mentors to be able to implement programmes is very difficult.

If you look at the graphs you will see that a lot of teachers do support an outside body writing an external work program and possibly assessment as well. I think we would be able to help those teachers in the country because at the moment, with every school writing their own work program it is very difficult to transfer your resources to another school because they may not match.

The other thing I found from going through the submissions was the third term of reference about reliability and validity. I found that a lot of people gave their opinions. I have seen no proof that it is valid in that we know it is the student's work. I think science teachers will react more strongly to that as they look for the evidence because science works on the principle that you can never prove; you disprove it. For example, as Karl Popper, the father of science, says, you can make a statement like exams are valid. For example, all swans are white. You do not go and prove all swans are white. You do not look for reasons why you think they are valid. You disprove it and look for the black swan. There are many black swans with assignments. They are saying that students are cheating with assignments: there is one. If you have an external exam, you do not have that type of problem. There are no black swans to be introduced.

As I went through and looked for reliability and validity, I just found opinions. I just found more and more white swans. Many people are mentioning the black swans but they are not sure that it is the student's own work. So I have to agree with Mr Ahern when he said that external exams would reduce the test for validity as well as help teachers in remote areas.

As you can see, 95 per cent of teachers would like change but do not believe more ongoing professional development is the answer. We would like to get back to doing what we became teachers for, and that is to teach our subject. I do take a bit of offence that I just need more training and I will be better in the classroom. I was an industrial chemist and I did do research before I went into teaching. I do have the full subject knowledge. I find that focusing on assessment as opposed to teaching takes away from my first love, which is my subject. I find that with science you need to test knowledge explicitly, not implicitly like you would in English or you would in essays. That is why I think the present system which is all criteria based is not allowing for a lot of practice.

I do not believe the assessment regime is sustainable. I do believe I am speaking for teachers when I say that they are overworked and we cannot find any solution to it. Teachers do not have any power within the system. I think the only weapon they have is to leave the system, and from the reports that I have seen and the statistics I have seen that is exactly what they are doing.

When looking at the parents and the students, 94 per cent of parents are for change. When I look at the education academics, 75 per cent are against change, whereas 13 per cent of maths and science academics are against change. I find it very disappointing that there was no chemistry representative on the syllabus from the universities when the syllabus was written for chemistry but there were education academics. So I am not surprised they are saying that there is a disconnect. I do have some students who are doing PhDs in chemistry come back to tell me that they were very well prepared for university. I am not finding that students are coming back and saying they are not prepared, but I have always taught from an academic perspective. I have taught from where I know because I believe that chemistry is an academic subject.

CHAIR: Thank you all for those very in-depth and very meaningful comments that you have made and amongst them some very disturbing comments as well. Do we have any questions from the committee members?

Mr BENNETT: Good morning. Ms Anderson, I would like you to elaborate more on your submission about the workload issue. Over the many months of this inquiry it is interesting that we have heard about the impact on teachers and particularly the HODs, and I note your comment on that particularly. Are we to understand that in summary we are seeing a complete change, a reversal, on the workload of teachers in preparing the current QSA syllabus and outcomes? Is your proposal that there could be a potential saving in allowing you to get back to what you see is your core business as an educator?

Ms Anderson: Definitely. If you can convince a teacher that something will help students, they will do it and they will do it without complaint. I have never found an exception to that. What we are finding is that we are not helping the students. This new syllabus I do not think helps the students.

CHAIR: Ms Anderson, you made a comment about statistics and teachers leaving. Are you able to enlarge more on that? Would you have any further details on that?

Ms Anderson: The statistics I have read is that most teachers leave teaching within five years. I think it was from QTU articles that I read the maths-science shortage is worse in Queensland than other states. I do not have the exact figures with me today.

Mr BENNETT: Ms Anderson, I note your comments about the discrimination against boys and their capacity to carry on into tertiary. Could you expand on that for me, because it has been a consistent message that we have heard throughout these inquiries?

Ms Anderson: Teaching chemistry, I often come across boys who are exceptionally good at maths and science but when it comes to writing they have never been as good. I do believe that having an emphasis on the literary parts of science does discriminate against boys. The girls tend to take to it much easier for some reason. The other thing I have noticed is that when I first started teaching, boys could take some pride in attempting to write well. Now I think in boys' heads they have decided it is a girly thing to write assignments. We are dealing with adolescents and so sometimes they do not see why they would want to become 'more girly', in their own words. I personally believe—this is my opinion—boys just need to be told. Once you can tell a boy their boundaries they are quite happy. I have often found they are far more suited to doing exams. You just say, 'This is what you do,' and for some reason they just tend to accept that and get on with it. With assignments it just does not fit their mentality. I do not understand them when they get older either but ...

CHAIR: Thank you, Ms Anderson. I have a question for Mr Perry. You conclude that when teachers converse with students and parents over student assessments most parents do not grasp the syllabus vocabulary and they encounter difficulty with the complex application of the criteria. How should parents be educated on this? Do you have further comments on this area?

Mr Perry: I think that parents are busy enough as it is. The role of a parent I think exceeds that of a teacher. As a teacher I struggle with all of the work I had to do. I became increasingly bitter with the changes in assessment because it took me away from my family. You would experience the same in your roles, too, as you spend a lot of time away from your family. I think vocabulary is power. If you do not understand the vocabulary that is used in syllabuses and so forth, you are at a disadvantage. My trouble was in trying to converse with parents about the progress of their children

most of them automatically went back to marks because that is what they felt comfortable with, but my greatest difficulty was if a parent was a professional or a parent was an academic or at our school. A fair number of students have parents who are research scientists, professors and so on—not that the children knew that because no child knows what the parent actually does—and I would be stunned with some of the comments they would make about the range of abilities of students that came before them in university. The reason there is a range is because, as I think was mentioned by Maureen, each school invents its own curriculum suited for its purpose. In some ways the QSA uses the principle that the school has to make the utmost use of its resources and so on. When the QSA provides sample work programs and so forth, I have never received one that applies to a large school situation such as ours at Brisbane State High, where we dealt with hundreds of students doing physics, chemistry and biology. The numbers were huge.

Getting back to your original question, when conversing with the parents we are using descriptors, and those descriptors can be vague and can be interpreted differently by different individuals based upon their background. There is something not clean and neat about educating parents in the way the system is. I think that is because there is an artificial complexity to it, as though the complexity somehow validates the system.

I made reference to the Occam's razor principle. To me, a lot of what we do in science is decided by people who have—I do not mean to be elitist here—vocational degrees in education with some major teaching area such as chemistry or physics. And that is what happens with teachers coming through. I was trained to be an industrial chemist. I also have majors in maths and in econometrics, because in my second degree I have a large element of economics, systems analysis, linear programs and so on. I find it very difficult to accept that complexity means a better result. Parents cannot grasp the vocabulary of the terms, and I do not see that they need to undergo some education program for that. The system is too complicated.

Mr BOOTHMAN: Brad, I certainly understand that you are very passionate about the result here today. I simply thank you for that. You made three recommendations to rectify what you consider to be the failings of the system. Can you elaborate about the reintroduction of an external examination system and where the balance would be between external and internal assessment components?

Mr Ahern: What I suggested, I think, in my recommendation is that the external exam to be reintroduced should count between 50 and 60 per cent of the total assessment for exit and that the balance should be derived from internal assessment. There were a couple of years in the 1970s, in between the abolition of the senior exam and the introduction of the new system, where school assessment contributed to and was added to the mark of the senior exam. I figured that that sort of thing could still apply. That would mean that in the in-school assessment you would still be able to have assignments and reports as well as tests and that there would be a balance that would be quite achievable out of that.

Mr LATTER: My question to Ms Anderson is in a similar vein. Ms Anderson, I note your comments with regard to maths and science being explicit subjects as opposed to implicit. What are your views in relation to getting an appropriate balance between a qualitative and quantitative assessment for some subjects as opposed to others?

Ms Anderson: If you are testing a process such as writing an essay the criteria would work very well, but in that you are testing knowledge implicitly. With science they need to study and have that knowledge explicitly in the way that we test it. You cannot assume that students have learned the concepts—it is a conceptual discipline—from an assignment. Science is essentially counterintuitive. If you go for discovery learning or you go for your intuition with your learning, you are probably not going to get there. If science was common sense, we would not need to teach science. It is an experimental discipline whereby you need to be guided to what the concepts actually are. That is why I mention that explicitly you need to know that students actually understand those concepts. Regurgitating them in an assignment and just using that knowledge on that literary level does not indicate a mastery in the subject. It is a bit like learning your tables or learning the skills of a musician: they need to get the basic skills of the mastery of the concept before they can go and apply them in assignments. Have I answered your question?

Mr LATTER: Thank you. If I may elaborate just a touch more, certainly I understand the explicit nature of science. I guess what I am asking is: if you have a QSA assessment model across all subjects within the curriculum but you are proposing to have a numerical based assessment for

certain subjects, how do you tie the two together? Do they give you a beneficial outcome in terms of being able to assess the student's overall learning outcome, if you will? Do you have anything you would like to add with regard to how you might see that it would be feasible to have a model of assessment for particular subjects and an alternative model for the balance?

Ms Anderson: I think that is possibly one of the major problems we have at the moment. I think the social science model has been imposed on science. I do not think one model is going to work. Mathematics is the language of science. Newton told us that. I have been told in my submissions to the panel in the past that I am being too mathematical with chemistry. I think we do need that quantitative measure when it comes to the testing of the knowledge, and I do not believe that you cannot be complex with that because you can ask complex questions. I think in answer to your question I am saying that one model is not going to fit all subjects; they are different. I think a lot of our problems come from having that model imposed on us. We do need numerical marking.

CHAIR: Thank you. I am afraid our time has come to an end. I thank you very much, Mr Perry, Mr Ahern and Ms Anderson, for the really genuine information that you have given us this morning. We really appreciate your time.

Proceedings suspended from 10.23 am to 10.43 am

BARRA, Mr Michael, Private capacity

FINDLAY, Mr Andrew, Private capacity

HARTWIG, Mr Mal, Private capacity

MEAGHER, Mr Chris, Private capacity

CHAIR: The hearing of the Education and Innovation Committee is now resumed. I would like to welcome a group of teachers who are, I understand, broadly in favour of the current assessment system for senior maths, physics and chemistry: Mr Michael Barra, Mr Mal Hartwig, Mr Andrew Findlay and Mr Chris Meagher. We have 40 minutes for this session. We have invited you each to make a short opening statement. Could you limit that to three minutes each, please, to ensure sufficient time for committee questions. Mr Hartwig, I will ask you to start off, thank you.

Mr Hartwig: Thank you. My name is Mal Hartwig. I am currently head of maths at Grace Lutheran College. Up until last year I was chief examiner for external maths B with the QSA. In a previous life I was also a review officer with the QSA for maths A, B and C. I have read many of the submissions to this inquiry. The negativity and criticism I see as simply frustration and a cry for help. So much so that some people think that the current model should be replaced with an external exam. I would say that the reasons that Queensland moved away from external exams still exist. In my opinion, the main reason for this frustration is because the professional development offered by the QSA does not meet the needs of schools. The current professional development offered is basically a one-size-fits-all. It is also slanted towards the preferences—I am talking here about mathematics—of the presenter rather than what the school wants. I believe one of the best examples of that was in the method of setting assessment items or instruments that was given at the public briefing by preparing, say, B and C standard type questions. To me it appears that the inventors of this method are more concerned with defending the method rather than working with schools to ensure that their school's method is compliant with the syllabus requirements. I also believe that is abundantly achievable, too.

Another source of frustration I see is that teachers believe that they are not being listened to. In fact, the only forum that they usually have is when they attend professional development opportunities. Here, however, the presenter sticks to the predetermined delivery and very little discussion about a need from a school ever seems to be held. Many teachers attend the professional development session so they can meet, discuss and share ideas and sometimes resources with other colleagues who attend. These teachers would then rate the session as being successful in meeting their needs because of this rather than any content that the presenter has actually given.

I have two more points. Another aspect of not being listened to is that teachers also regard the QSA as being out of touch and QSA does not do anything to rectify this. Let me give you an example. Teachers and heads of department hold cluster meetings within their local area. This typically occurs once a semester. I am one of the leaders of those in the Sunshine Coast south division where we represent 27 private and state schools. Invitations for a QSA representative to attend these is always refused and I had the instance, after issuing such an invitation, of QSA expecting to be paid for its representative to come to a meeting and hear firsthand the concerns that the schools were having. I believe officers of QSA themselves need professional development and attendance at meetings such as this would provide some of this, as well as relieving some of the anger and frustration that is felt towards the QSA.

One more point I want to raise is the QSA statement which says, 'Teacher judgments using numbers, letters or other symbols must explicitly identify the standards demonstrated and how the qualities in the student responses match the standards described in the syllabus.' I used a numerical system—you can call it marks or points—to set what I would consider balanced papers for last year's external maths B exam and the years before and previous years. Since 2000 I have been the chief examiner of either maths B, C or A. This allowed me to assess each topic according to the contribution it made to the syllabus—for example, introduction to functions 35 hours, optimisation 25 and so on—and to also include a balance of the attributes of each criterion within each item and then have the makings of a marking scheme. Marking then was relatively easy and the agreement between markers on one-third of cross marking was 100 per cent last year. Once the

marking and ranking was done, for me it was a relatively simple process to then match each candidate's work against the syllabus descriptors and assign levels of achievement. In my view the QSA should work with schools who wish to use a numerical system such as marks to ensure that teacher judgments are being made which identify syllabus standards. Thank you.

CHAIR: Thank you, Mr Hartwig, for those comments. Mr Findlay?

Mr Findlay: Good morning. My name is Andrew Findlay and I am a teacher of senior chemistry and mathematics in a large metropolitan high school here in Brisbane. Although I work for the department and the QSA, and I am also a parent of school aged children who will soon be the subject of these very processes that we are talking about, I want to stress that these views are my own personal views and do not really take into account things that I have been told and so on from my elders, I guess. I wanted to actually start off by drawing on some of the things that Maureen was saying in her last address because I feel that I am perhaps one of the rare beasts who is a non-HOD that teaches three or four senior science subjects. I still manage to be able to coach my son's soccer team, assist with my other son's AFL team, and that takes three afternoons a week, so I still have a life as well.

I wanted to talk mainly on the three issues that the inquiry is set up on and that is the participation levels in these subjects, whether the assessment practices are supported by teachers and then, finally, whether the assessments or the processes are valid and reliable judgments about the students' work. As a scientist it seemed appropriate to me to treat this as a hypothesis and look for evidence to support or reject it and so I started with my own school. I expected that there would be some sort of decline, given that this is what we are being repeatedly told. However, when I looked at the evidence it seemed pretty clear to me that there had been a general upward trend in the number of students taking chemistry each year and that trend has risen quite significantly since 2010. Our current cohort of year 11 students is the highest it has been since the implementation of the 2007 syllabus. Further research identified numerous reports demonstrating that the uptake of advanced senior maths and science subjects in other countries around the world and in other states in Australia has been falling. So it is not an isolated phenomenon if it is actually happening here in Queensland in any case.

What about the typical year 10 student who is considering chemistry as a subject? What questions do they typically ask in their decision making process? It usually starts with am I good at science? Do I like chemistry? Will it be important for the career that I plan to take? And, mostly and very tellingly, they ask the question who is going to be the teacher of that subject? So it is an essential part of the process. I cannot state it categorically but I am quite certain that very few students consider the syllabus or the assessment plan when they are making their decision to do chemistry or, for that matter, physics or maths. I can only conclude that there is very little evidence to support the tenet that syllabus or the assessment have resulted in lower participation rates around Queensland.

What about the assessment practices used in chemistry? Do I support them? Absolutely, and so do many of my colleagues, and for very good reason. A well designed and supported extended experimental investigation is an extremely effective means of assessing what students are capable of doing. It facilitates deep knowledge and understanding of the topic and provides teachers with a wealth of information about the scientific capabilities of the student rather than a straight narrow definition of what is considered to be the mathematical processing of the science. There are wow moments, too. There are nearly always gasps of surprise when a student sees that final drop of sample convert an inky blackness into a clear colourless solution during an iodometric titration. This experience can never be replicated by reading about it in a book or answering it in an external examination.

John Hattie is widely recognised around world for his work in identifying the most important influences on student achievement. He calls it his effect sizes studies. One of the factors with the most or at least the highest influence is feedback and Hattie reported an example of feedback is giving students' assessment criteria high quality feedback against explicit criteria. Other highly influential determinants include peer tutoring, students' motivation to learn and having clearly defined goals about their learning progress. EEI tasks have allowed gifted students to provide responses at levels far higher than I have witnessed before the implementation of this syllabus. This is possibly due to the open ended nature of the task, but I accept that the majority of the reason for it is that the students have motivation to learn in an engaging task and the ability to be able to work as part of a team.

The move from an instruction model to an investigation allows me to step back and observe the students during the learning process. They get to take control of their learning. As an observer I have far more insight into what the students are capable of doing and their individual understanding of a particular topic, far more than if I were simply to assess a question on an exam. Do these tasks result in stress? Some. However, they do get four to five weeks to implement that task, to get feedback, to understand the process and understand the background knowledge behind it and I think that it is fair to say that there will be considerably less stress in that system than there would be if you are taking an external exam on one day which is going to determine your outcomes over two years.

I also support the use of supervised exams and the variety of criteria used in this state. The range of skills being assessed is more in keeping with the skills required by scientists in authentic employment situations rather than pure knowledge measured by an external exam.

CHAIR: Mr Findlay, I will have to ask you to wind up.

Mr Findlay: All right. I will get to the crux of it then. I think Queensland has a system which is quite different from other educational jurisdictions, but its methods are supported by research and when our syllabus is delivered by professionals who understand the strengths of it, Queensland is a really good place to gain a scientific education. Thank you.

CHAIR: Thank you, Mr Findlay. Could I call on Mr Michael Barra, please?

Mr Barra: Thank you, Madam Chair, and members of the committee. My name is Michael Barra. I am here representing myself. I had worked in Queensland schools for 30 years and in the last four years I have been working as an education officer, mathematics, with Brisbane Catholic Education. So I bring to this inquiry, really, my work primarily as a classroom teacher and head of a mathematics department but also some knowledge that I have gleaned over the last four years from my readings in the work that I am presently doing and also from the work of the teachers that I work with.

I made it quite clear in my submission that teachers are always assessing student learning and I think it is very important that we recognise that the terms of reference for this inquiry are really about assessment of student learning because teachers make judgements on a day-to-day basis about what is best learning for the students under their care. I think that for all teachers as professionals that is the core of our work and no matter what education assessment processes and practices we have in place I believe we need to centre all of our decisions about learning, teaching and assessment on the students. It is because of that pillar or that premise from which I base my submission that I think it is in the best interests of students that the assessment of learning practices that we presently have in Queensland is advantageous to students and is something that should be cherished and further developed. I will acknowledge that there is some room for improvement and I may, given time, get to that. I do want to say that I do position student learning as paramount to the assessment processes that we have and it is not about ranking students for further study. I do wish to make that distinction quite clear.

With that in mind, as part of my submission and reflecting work from research and the work of Hattie that Mr Findlay referred to, making learning intentions and success criteria clear and explicit to students is something that this assessment of learning program and processes in the school that I was at enabled us to do and I have submitted to the inquiry a typical criteria sheet that would very clearly, if that was given to students prior to assessment—and I am talking here, in fact, with all assessment but the example given is prior to an end of term exam—that makes very clear to students what their expectations are and that could guide their revision, that could guide their learning and they could look at focusing on where they need to work towards those goals. As a consequence of then providing feedback to students we in our school made it our business to ensure that students understood where they could improve on their learning and this was used to also inform teacher practice. That first point of keeping students' interest at the core of our ongoing deliberations I want to stress again is paramount.

Aligned with that I think we have to have a system that is manageable and workable for our teachers. It is probably in this realm that I think that teachers are perhaps looking for some guided modelled assessment tasks; they are looking for better advice about how to interpret the standards in mathematics; and they are probably looking at more creative ways of assessing. I think teachers of mathematics have recognised that mathematics learning and teaching is more about a regurgitation of knowledge and skills; it is about their application. Our current system allows teachers to design assessment tasks to reflect that creativity, to reflect what the focus of learning has been.

That being the second pillar, I do acknowledge that in some instances, because of practices that have been chosen to be used in their school, teachers may have made unnecessary workload. So I would like to put to the inquiry that we do really need to consider the intent of the syllabuses and then the practices that have evolved in some schools that may have made our system unworkable. With any assessment system I think we need consistency about student judgement; and, again in this area, perhaps some work needs to be done to support teachers in ensuring that consistent judgements are being made across Queensland to ensure that transparency, that consistency, that equity is acknowledged and recognised.

CHAIR: Mr Meagher?

Mr Meagher: I am the head of department of science at Beenleigh State High School. Before I was a teacher I worked as a civil engineer in Queensland for 11 years. I have taught physics, maths A and maths B in my teaching career. I am going to talk today about the role of communication, knowledge and investigation in science. I am also going to touch briefly on the role of marks and about participation levels.

My first argument is about the role of EEs. I am a passionate believer that we should retain them. They have an important place in giving our students an understanding of how science works. We constantly say to our students that science is a body of knowledge, a way of thinking and investigating, and a way of communicating ideas. I am sure that if we had spoken to the students we had in the public gallery this morning, they would have heard their teachers talking about those three elements of science.

I am concerned that critics of the current system argue that we should go back to a narrow exam base, which would primarily assess students in the knowledge part of those three criteria. So if we say there are three areas of science—knowledge, investigating and communicating—my concern is that exams place too much focus on knowledge and not enough focus on the other two elements of science. It is argued that mathematically gifted students and boys in particular are underperforming in the current regime as they cannot cope with the literacy demands of EEs and ERTs. I do not agree. I believe that in order for the same boys to gain good OP scores and gain university entrance, they need to succeed in English as well, which obviously has high literacy demands. But further than that, I think that communication in science and technology, in those fields, is more important now than ever. When I worked as an engineer one of the key skills that engineers seem to be able to do was, yes, undertake the calculations and have a good strong mathematical basis. But they also needed to communicate with clients; they needed to be able to write reports; they needed to have good communication skills. I think that that is true if you look at any complex scientific or engineering issue in today's society. The ability to convey complex information and communicate technical issues to laypeople is more important than ever. Whether the issue be immunisation, water fluoridation, environmental issues, flooding et cetera, all those issues require good scientific communication. I think we can start doing that at the high school level. I think we undervalue our students if we say, 'You'll have to do two years of maths because that is all you are capable of and then you will have to learn that communication stuff at university.'

I think it is a mistake to go back to a purely knowledge based system. My understanding is that in the USA they have a fairly narrow knowledge based curriculum, and I do not want to go that way. There is a great website which I and other physics teachers use called One Minute Physics. It contains a presentation that I recommend you look at, which is an open letter to the president of the USA regarding physics education. In there the presenter makes the point that the current knowledge based system in the USA only examines physics that was done up til 1865. So all the modern physics, all the contemporary physics, is not really studied under the curriculum because the argument is that 'to properly understand that, you need a college level mathematical ability and we don't think that you students will really understand these complex issues. So we're going to give you two years of solid maths, solid knowledge'. I think that is a mistake because you obviously miss out on all the great and fundamental physics and scientific applications that have been done in the last 150 years.

Just finishing up on communication, the sections in an EEI that I give to my students in terms of the aim, the hypothesis, the method and all those parts of the scientific report structure, are the same structure that I used when I wrote my honours thesis in engineering. I think it is not too early to start giving them that knowledge because we undervalue if we do not do that. I am aware of time.

On marks, just very briefly, I do have some sympathy with the arguments put forward by the critics of this system. I am somewhat ambivalent about marks. I think that whether you use marks or criteria to assess the types of assessment we have at the moment, you would get pretty similar

results. I think a positive outcome of this whole process has been that the QSA have specifically said and made very clear that you can use marks on the condition that they adhere to the criteria sheets that are used. I do think that most schools are now at the stage where they have established assessment items written with the criteria, but I think some more flexibility is okay. If we had said to everybody, 'You have to go back to marks,' I think that in itself would create more work for teachers.

On the third point about participation levels and skills at university, personally, anecdotally, I have not seen much change in the numbers of students taking senior sciences. I do think that science teachers today are competing against a much broader field of subjects than we were when I was at school, say. So there is a big range of stuff that the kids want to get involved in. We just have to somehow try to emphasise the engaging, the challenging and exciting parts of our subjects. One of the issues that has been discussed is participation levels at university and the skills of students who are entering scientific and mathematical courses. I make the point that the universities themselves may have to examine their processes, because I know that maths C has been removed as a prerequisite for many engineering courses for a number of years. I understand that the people who are making the criticisms about the lecturers are not necessarily the ones who are making the decisions about what the prerequisites are, but the university system must take some of the responsibility and say, 'If we have lowered our requirements for entry, we can't really point the fingers at schools and say, "You guys aren't really teaching maths as well."'

CHAIR: I have a quick question. You did mention the use of marks and you also made the comment that there has been an explicit statement from QSA, which there has, that marks can be used. Is that only a recent announcement from QSA or is it something that maybe has not come out in the open before?

Mr Meagher: Again, I am speaking from my own experience. I believe it has always been there. In schools there is a lot of rumours and sometimes misunderstanding. Someone will go to a workshop and hear a QSA officer make a comment and they will come back and say, 'The QSA has said we can't do this,' or, 'The QSA said we have to do that.' I guess my feeling is that the QSA tolerate marks. They do not really like them; they prefer schools not to use marks, but they are allowed. Other panellists may have a different view on that.

Mr BENNETT: Mr Findlay, if I can I will try to flush out some more comments on the arguments about the objectives, particularly academics as opposed to the preparation of students. Can you briefly give us some more information about the arguments in your closing statement of your presentation please?

Mr Findlay: I assume you are referring to whether students are prepared for university?

Mr BENNETT: Yes, and also in the closing remarks in your presentation you did make three recommendations in that particular space.

Mr Findlay: What I said was that the system is quite different from other states and other education systems. But I think that it is a good place to become an educated science citizen. I base that on the evidence of what I am seeing. We are able to assess I think very validly what we are trying to assess. We do it quite reliably. I think the assessment criteria do provide a useful framework for providing assessment and feedback to students. As I mentioned in my submission to the inquiry, there is a large amount of external information that supports that. We have our NAPLAN results; we have ACER tests which the school uses; we have our OP results; we have the QCS test results in terms of practice and in terms of the actual one; we have students who do university subjects while still at school and the results in those are nothing less than outstanding.

Mr LATTER: I should note for the record that relatively recently, Mr Meagher, I was in attendance at your school and had the pleasure of seeing your facilities and hearing about some of the exciting programs that you have there. Mr Meagher, I would ask you, on the back of some of the observations made by Mr Findlay with regard to student attendance, what your observations have been in that space. Do you concur with assertions that student attendance is diminishing, or is your experience otherwise for senior science and physics?

Mr Meagher: Sorry, you are talking about student enrolment or student participation in senior science subjects? My view is that I agree with Mr Findlay that the numbers have been generally consistent over the last 10 years or so that I have been teaching. I have worked at two schools. My last school was an inner city Brisbane school, and we certainly had stronger numbers in senior physics and chemistry than we do at my current school but that is something that is improving with time. Overall, my opinion is that if we went to a solely exam based system or an external exam that we could have the opposite effect where we may discourage students from entering senior sciences. That is one of my concerns. I would agree with Mr Findlay.

Mrs SCOTT: Just listening to the number of speakers we have had this morning and the fact that there is a certain basis of knowledge in these sciences, maths and so on, would it be possible to have those basics taught earlier on, say, in the first half of a year, and then an examination as to how well they understand those and from then on see the application of that knowledge so that then you go to assessment? How do we actually address the issues on both sides of the argument?

Mr Findlay: I will take that point up because in my first term of year 12 we do learn about the chemistry of a range of complex subjects in the context of a swimming pool elective. So students will learn about reduction in oxidation, acid base, equilibrium. Then at the start of the second term they get their extended experimental investigation, which draws on all the knowledge that they have been learning in term 1. I think there is a push to try to get as much of the mathematical knowledge and as much of the important knowledge that we deem necessary to be done as early as possible so that we can allow for the development of other skills later on within each of those courses. So, yes, I think it is very important to try to make sure that students do not attempt these things without a good knowledge base, because that is a sure recipe for failure.

Mr Barra: If I could add to that. I think from some of the research on learning we are probably moving away from that linear development of how we perceive learning does occur. Students learn in very different ways. So even starting with, if you like, basic skills or a sort of common basis of knowledge does not mean that students could not acquire knowledge in different contexts and in different ways other than just being exposed to it initially. It is probably more the context that they are engaging in which gives the opportunity for them to learn about some of those contexts and concepts.

CHAIR: I would like to throw a question to Mr Hartwig, if I may. In your submission you support the current school based, externally moderated model of assessment of senior mathematics. Why do you think that a switch to external examinations is not the solution for the issues and difficulties of mathematics?

Mr Hartwig: If I could just simply go back to when I did senior. There was an external exam in 1967. That was the year that the physics paper was so hard that there was a public outcry and the mark had to be changed. When I walked out of that exam, I would have thought I had failed badly, probably got about 30 per cent—because it was mark based at that stage—but I ended up with a 6 and then it was upgraded. The problems that occur in external exams is that if it happens at the end of two years, it is a massive disaster for the whole student. Can you just ask the question again?

CHAIR: Why do you think external exams are not a good idea?

Mr Hartwig: To completely throw it out I think is a bad idea. I do not have a real problem with a component of it, and the QCS test is probably similar to what an external exam is. The current external exams that I have been setting were for those students or candidates who were adults, who were in the Army who had left, and so they need to cover the whole course.

In mathematics, communication and being able to write reports and being able to investigate is an important skill that they need to have, just as in science. It is probably not quite as heavily weighted as chemistry and physics, but it is certainly a skill that needs to be developed, and an external exam will not cover those skills.

CHAIR: Just a question basically for the panel if you wish to make any comment. It has been put to me that some students are unaware of the weighting of different assessment tools across the two years and whether there are areas that they could put more focus on than other areas. Would you be prepared to make a comment on that, or is that an incorrect supposition?

Mr Hartwig: The weighting in the maths—and I am talking here about maths—there are at least five pieces of assessment that need to be done. Most schools will usually do six per year. Two of those will be alternative tasks, either extended modelling and problem solving tasks, or a report or an investigation. Quite often they will take one to three weeks in time. The examinations, when they turn up, they are more like six or seven weeks worth of time. So the amount of curriculum that is covered in the mathematics alternative assessments generally is considerably less than what is covered in the examinations.

However, when the overall achievement, the summative grade, is applied to the students, the assignments are equally weighted. I do have a problem with that; that if you are covering one to three weeks worth of work it carries the same grade, A, B or C as does exam A, B or C, covering six or seven weeks of work, and I believe that marks would help sort that out as well in maths.

Mr BENNETT: Gentlemen, can I just talk about some of the comments that we have been hearing about. I note Mr Findlay's response about keeping his life with his sons. Congratulations. But is anyone willing to further comment about your colleagues and the expectations, the stress on teachers and the claims seen this morning about more time, more resources and more personal development being needed to make this current system successful?

Mr Meagher: Following discussion, the issue of the length of the assignment seems to have been a contentious one that has been raised by teachers and others in the debate. Maybe I am looking at it in a fairly simplified way, but I think that this is something that could be controlled at the school level in terms of stricter enforcement of word lengths. I certainly have seen students go to great lengths with their EEs and write very large reports. Anecdotally from the comments I am reading, my understanding is that some private schools have a very, very competitive system where students are writing extremely long reports.

I think that this sort of thing could be managed better at the school level, and again maybe I am being naïve here, but I think it could be managed better at the school level by stricter enforcement of word limits and saying, 'We are only going to mark the first 1,500 words. That is the limit that is recommended by the QSA for year 12 EEs. If you write beyond that, we will not be assessing it.' Because I think there is a definite skill in being able to write in a brief manner.

So I understand there is a lot of angst out there amongst teachers in getting their heads around how the criteria work and how the assessment works. I take on board some of the comments in the submission by the Science Teachers Association of Queensland—and I think it was alluded to in the previous round of speakers—that teachers who have panel experience or who are at head-of-department level seem to have more skill or are able to apply the criteria with greater ease than teachers who are starting, and perhaps it does go to the issue of professional development or in-school development or mentoring, trying to get that system working better so that we can try to relieve some of that stress and anxiety for beginning teachers.

CHAIR: Thank you so much for that. I am afraid our time has come to an end. Thank you very much to all of you, and I would thank you for your time and your participation this morning.

KLENOWSKI, Professor Val, Queensland University of Technology

MacGILLIVRAY, Professor Helen, Queensland University of Technology

WRIGHT, Dr Tony, School of Education, University of Queensland

WYATT-SMITH, Professor Claire, Griffith University

CHAIR: We welcome you to the hearing this morning. We have allocated 40 minutes to this session, and I would like to invite each of you to make a short statement before the committee members ask you questions. Could you try to limit that to about three minutes each, please, to ensure that there is time for questions.

I would call on Dr Wright first.

Mr Wright: I brought a sort of cheat sheet of main points. Could I table it so that it can be given to you.

CHAIR: We will table that document.

Mr Wright: Thank you for the opportunity to come here and talk to you today. I am talking about two different submissions: the main one is the School of Education submission; and I have a role in the Science Teachers Association, and we have made a submission there also. On that sheet I have given you the numbers 224 and 246, so the first three points are about the School of Education submission.

The first issue that I want to bring up is that issue about the criterion and standards assessment and just point out that it has been very effectively used and is a very well-established method of assessment in Queensland.

I think that it is about judging quality rather than quantity, and there is an element of the quantity thing in the other approaches. I just wanted to point out that, as I understand it, most of the universities now use a criterion standards based assessment. Certainly UQ has done it for I think around 20 years or so. The system works extremely well and does what it is supposed to do, so I do not think that is an issue.

What I think is an issue is that—and I think it is supported by most teachers—there is also constant need of support for teachers for that, and I think that is a thing that has been commented about in detail. Doing very good assessment is a very skilful job, and so there needs to be support to help teachers—particularly new teachers coming in, or moving subjects or whatever—develop that quality.

The second issue I wanted to raise was the issue about student participation. I have been tracking that gently in the QSA statistics for some time, and I do not believe that there is a strong decline in any way as has been suggested. I think that in part that is because of the current system, which I believe gives the students a very much more engaging experience than the more didactic approach to science of traditional criteria. That is a minor issue from my point of view.

The next one, which is probably the major one, is the issue about whether current assessment processes provide valid assessment. I am very firmly convinced that that is very often true, and there are very good examples. I think one of the most important reasons for that validity is the issue that it allows a much broader range of learning outcomes to be assessed than can be assessed by external examination, so that is a really important issue.

In the 10 years or so I have been supporting teachers, I have spent half my time training teachers in preservice courses in chemistry and physics and maths and I work with them and with teachers in the classroom and the senior teachers especially very often report that the assessment that they get out of some of these methods, particularly the extended experimental investigation, the quality of the learning of the chemistry and physics is much higher, they believe, than is generated by the traditional approach. So I think there is a quality issue there.

I would now like to turn for the next couple of minutes to the Science Teachers Association submission. I am the treasurer and secretary of the association at the moment and the executive decided to do a survey of teachers to provide data for you. So we did that during March. We got about 220 teachers responding across all the sectors. I did the analysis of the data and it showed very strongly that the teacher group is divided into two. There are two extremes, if you like, of teachers who are extremely for the current system and those who are strongly against. There is a much smaller group of teachers who are ambivalent—in the middle. I think we can ascribe that to

the way the system has developed, because there were trial pilots done of these new syllabuses and that gave a number of the teachers, particularly the enthusiastic ones, the chance to spend multiple years learning the system. After the implementation, the amount of support has been really quite low and that is often the group who I think is unhappy with the system.

CHAIR: I will have to ask you to wind up.

Dr Wright: Thank you. I just have one point left to go. All the groups were unanimous—almost unanimous—in saying that the major problem they perceive is the lack of support they get. I think it is to do with resources and to do with professional learning. That is the message I would like to leave you with. Thank you.

CHAIR: Thank you, Dr Wright. Could I invite Professor Klenowski to give her comments?

Prof. Klenowski: Thank you very much. I really welcome the opportunity to talk to my written submission. I understand that you have a copy of the submission and that I have three minutes in which to put my support for the current system. Firstly, I would like to provide an assessment perspective. My own background is that I am a research professor and I have studied assessment and researched assessment for the past 20 years. I have been very privileged to have an international profile and have been asked on more than one occasion to provide keynote presentations on the Queensland system, because it is unique.

Firstly, let me put into perspective the recent changes over the past decade. In the last decade of the last century, there was a shift in focus from a concern solely on the measurement of learning to a focus on the quality of that learning. So we have seen this change of emphasis from a norm referenced system to a criterion based system. Such developments have parallel research in learning and improved insights that we have into how and when students learn best. People have referred to the importance of feedback as an important component of assessment, that is, that we need to link our feedback to the qualities, or the criteria that are used to assess student learning.

More recently, nationally, we have moved to an Australian curriculum and we have also moved to achievement standards. These achievement standards now focus on the qualities of the learning. So it is really important that teachers understand how standards are used and why we have moved to a standards based system. The reasons for this relate to the fact that the 21st century is very complex. We need to be able to solve problems that we had not really imagined previously. So what it is that we are looking at now is not just content knowledge, but skills and attitudes—attitudes like perseverance, persistence and resilience—in order to be able to problem solve and to really understand the complexities of the knowledge.

While I understand the need for students to have the content knowledge of physics, maths and chemistry, they also need to apply that knowledge and that is why the introduction of the extended experimental investigation has come about. So as we have had a change in the curriculum, so, too, have we had this change in assessment—to not just focus on content, to not just give numbers, but to really focus on skills and attitudes. With that change comes a change in assessment. So we now have a standards based assessment system.

I have completed a lot of research into how teachers make judgements. I would like to table this recent publication that I have coordinated. It is a special issue on moderation, practice and teacher judgement. It is not just Australian contributors; there are contributors from around the world.

CHAIR: Permission to table, committee members? Yes, permission is granted to table.

Prof. Klenowski: Thanks very much. That particular publication reveals the complexity in terms of judgement practice. It is not a straightforward process of giving work a mark out of 10—not when you have particular assignments or, as in the EEs where you have to look at the knowledge that is being applied to analyse problems and to solve problems. What happens in judgement practice is that we have to use trade-offs. We have to look at what are the advantages, what are the disadvantages, what is the quality of the argument that is being presented. Therefore, it is important that we use standards that reveal those qualities in order to give that feedback.

I know that my time is limited, but I just really want to emphasise the importance of the recognition internationally of the Queensland system and that it is recognised as being more valid and also more reliable, because it is in moderation practice where there is trust in teachers' professional judgement and it is teachers who give feedback to one another in terms of their interpretations and use of those standards.

In terms of moderation, yes, there is a need for standards, there is a need for teacher judgement, but there is also a need for exemplars. Those exemplars help to guide and direct judgement practice. Judgement practice is not something that can be regulated. Thank you very much. I will end on that note.

CHAIR: Thank you, professor. I now call on Professor Helen MacGillivray from QUT.

Prof. MacGillivray: Thank you and good morning. As you will see from my submission, I am involved with the International Statistical Institute, the International Association for Statistical Education and a number of national and international bodies. My submission was very much a personal one, but it is based on working with thousands of students across a number of disciplines, particularly at first year or introductory level, and also with school students in enrichment and extension programs and hundreds of teachers in teachers' workshops. I have also been involved with the Queensland Studies Authority in a number of ways since the mid 1990s. I went into that, I would say, as a sceptic. I am a statistician, so I am trained to be a sceptic. I would just make a few points to add to my submission, but they are in support of the current system at the senior level. I would prefer to say that my comments are very much for the maths, because, of course, that is where my experience is, but I would imagine that what I have seen in maths also applies to science. I have been teaching engineering students and science students and students in other disciplines for 40 years at both the University of Queensland and QUT and I have also worked at other universities. I have also been very much involved in the last decade in learning support in mathematics and statistics across disciplines.

Assessment at the university level has different challenges from the school level, apart from the fact that the students who I have been teaching have been in classes ranging from anything from 10 to 600, with an awful lot ranging 200, 300, 400, 500, 600, particularly engineering students and they are not necessarily doing the subjects because they like them. So the challenge is to engage the students. What I have learned over the years has come from working with students, listening to them, observing them. You might be interested to know that since the middle 1990s I have introduced in classes of up to 600 free choice—that is, choice of topic, projects for engineers and science students in classes of up to 500. I do not have the time to say how they work, but what I will say is that I have learned over the years that what is needed is an integrated package of assessment and learning experiences that is developmental and constructive. What the Queensland system does is that allows for the assessment package that, in a nutshell, includes the traditional style of exams and projects and assignments and the type of assessment that is both developmental—allows for formative assessment and summation assessment.

Let us come to the issue of marks, because I know the source of this inquiry. I know the starting of it. It does not matter what you use—letters, marks, or whatever you use—they must stand for your criteria and standards. One of the wonderful aspects of the Queensland system of school based centrally moderated assessment is the focus on student work and—I said one; there is more than one—development of a community of practice among teachers, which I have found fantastic and I do not see in states that rely on central exams.

Teachers work with their students for two years. That allows them to make the judgements, but whatever they present to regional panels and then state panels there must be evidence of their judgements. I can assure you, from being on state panels for both maths B and maths C, that that evidence is there. You may want to ask me questions. I would like to finish there and hand over to the fourth person.

CHAIR: Thank you very much for that. I would like to particularly welcome Professor Claire Wyatt-Smith from Griffith University. We have invited all of our witnesses to give a presentation of about three minutes. I would certainly invite you to do the same, Professor.

Prof. Wyatt-Smith: Thank you very much. In terms of categorising who I am, I am both an insider and an outsider of the system. That is to say, I taught in the system and was a head of department in a large school English department for 10 years. In that role I was both a panel member and further on I became state panel chair of English. So I have intimate first-hand knowledge of the workings of the panel systems. I date it back to the 1980s. I have more than 30 years of experience in educational research and policy advice within this country and, most recently, the Republic of Ireland. Once again, that makes the point that, in fact, the Queensland system of externally moderated standards referenced assessment acts as a lighthouse, we could say, to other countries looking for quality assessment.

I want to say in regard to that that the panel may wish to look to the latest OECD report in regard to international assessment trends and the recognition, as Professor Klenowski has said, of the need for rethinking the evidence base we are collecting in school assessment and the conditions for those assessments and the types of tasks, recognising that examinations can make a contribution, but that indeed the demands of the 21st century—with its recognition of the need for creativity, innovation, working in teams—requires a broad range of evidence types of student learning. Having said that, I would like to make three other points, and once again I am drawing on being the insider in the system itself and the outsider as researcher. I have to say that with research, I would like to publicly recognise the Queensland Studies Authority for being an industry partner in a national competitive grant which focused, as has been referenced earlier, to the working of standards in judgement.

However, there are some sustainability issues facing the system, I believe. Indeed, that we are having this inquiry points to the need for addressing the sustainability of a system that, in its current iteration, is some 30 years old but school based assessment dating back four decades. The sustainability issues pertain to the generational distance between the system in its first instantiation when there was high-level engagement of the profession in the working of standards and the strong engagement in moderation, and the building of community of knowledge. In my opinion, there has been a weakening in understandings about the underpinning principles and, therefore, key understandings or central tenets of the system. One of those is, indeed, in relation to the nature and function of standards in arriving at judgements, hence the concern with marks. I believe the issue of marks is a distractor. The key point here is we are talking about quality and judgement of quality against externally stated specified standards. I would suggest the sustainability, the generational distance from the system in its original formulation, is one key issue.

The next phase of the system, I would suggest, in addressing that distance is relating to the intersection of discipline, knowledge and judgements, because we all know that arriving at judgements in mathematics is different from arriving at judgements in, say, English. That intersection has not been worked at to date at system level and there has been a dominance of what has been called the exit achievement standards matrix. I think that is also underpinning or driving some of the discussions that are happening. Once again, I think the two things come together: a weakening in understandings about the nature and function of standards in quality assessment practice and, in particular, how in fact the underpinning of the judgement has to be markers of quality.

I would like to say that the system, going back to the lighthouse idea, is the best chance we have for educating high-quality learners in Australia in the 21st century. That is a very strong statement. It actually means that if we have well prepared professionals—and I would have to say that universities need to take seriously the preparation of teachers for understanding these central tenets of the system and it is not done well currently in Australia in this regard. In fact, we are looking at the potential of the standards to lift performance of students in this system in a way that cannot be achieved in any other system internationally.

CHAIR: Thank you most sincerely for those comments. Some very relevant details and information have come out this morning and I appreciate that. I would like to throw a question to the whole panel initially. Are there any aspects of the current system that you would see as problematic and, if so, could you explain what and why? Would anyone care to comment on that?

Prof. MacGillivray: I think that it is important not to think that a system is static, in a sense supporting what you say. We must always support the teachers and we must always keep on reaffirming what the aims of the system are. The fact that it does reflect the best in educational research and in experience at the chalk face from people like me and what a modern society wants, and is also in tune with the way that universities have moved with their assessment, particularly in these areas. I think the challenge is to remember that any system must be constantly nurtured and respected and is a living system.

Dr Wright: I might add something to that that has been worrying me for some time. I think it is directly apposite. For me, the issue is about how we help teachers develop professionally. It is a sort of professionalisation. One looks at fields like medicine, for example, and you do a preparatory undergraduate degree or whatever and then go out and work as a professional guided in hospitals for a long time before you are allowed to go out and actually do the business. I think at the moment we have a problem in that we train the teachers, give them a teacher registration and there is not a decent system of providing support for them, developing the skills that are the things that we have been talking about mostly today, because they are very much more sophisticated than were used by teachers, I believe, in previous generations.

Mr BENNETT: The issue of the expense of external exams has been tossed around and, of course, the cost issues have been raised here again this morning. Could I ask your opinion about the economies of scale, considering the work that teachers have to do in the prep of these examinations. Perhaps, Professor Klenowski, this might be in your area with your assessment background. Would you be willing to make a comment?

Prof. Klenowski: I think with any change there is going to be a period where teachers are going to experience an increase in their workload, given that they have to now understand that we have moved to a standards reference system. But I think after that initial period where they have become familiar with, and also as has already been stated in terms of those communities of practice that have developed, that it is through those conversations that they have that that particular professional development and learning is continued and they are able to benefit from those conversations. In terms of cost, I did make reference in my submission to a report that was completed for the World Bank. In that particular document, there is a reference to—and I have not got the figures in front of me, so I cannot speak to it—that examinations are more costly than the current system. It does require—and I think that this is actually in answer to the previous question—a need for resources and for time and for professional development of teachers to maintain and sustain their understanding of the changes that take place. Teacher judgement and judgement is an area where there is a need for further research to understand how judgements are made.

Mrs SCOTT: I am interested in the comment of how well we are recognised internationally, the uniqueness of our system and so on. We hear constantly in the media that—I cannot remember if it is Sweden or another country—

Prof. Klenowski: Norway.

Mrs SCOTT: Norway—about its education system and then here in Australia we will hear constantly that New South Wales has a higher standard and so on. If you go to ANU or somewhere, with our Queensland graduates doing postgraduate work or those who are going to do their first degree, et cetera, are they showing that they are up with the best of them, basically?

Prof. MacGillivray: As the person here who has been teaching engineers and science students now for many years, I can answer your last question first and say, yes. I have not seen any differences. I do not know on what basis New South Wales makes those claims, to be quite honest. I have not seen any evidence that I would go along with. Certainly I have also been very much involved with interacting with employers in placing maths and stats graduates and in interacting with engineering graduates when they come back, as they always do, to ask for help with those notes that I gave them. The Queensland graduates in maths and stats certainly take their place anywhere in Australia and anywhere in the world—very much so.

Just to add to that, last year there was a delegation from South Africa representing their quality association—I am afraid I do not know the proper name for it—and the chair of that was a professor of statistics from Cape Town who is very well respected around the world. The standard of statistics research and maths research in South Africa is actually very good because of their traditions from both the English background and the Dutch background. They visited ACARA, they visited other states and they came to Queensland and—to quote the delegation—they were 'blown away' by the Queensland system. They were so impressed. They came to Queensland after they had been to other states. I actually arranged for the chair to spend an afternoon with the research branch of the Queensland Studies Authority—the ones who look after the moderation and the production of the tertiary entrance—because they were so interested in the details. I myself have been involved in the core skills scrutineer area and I am impressed every year with the work that goes into developing the core skills test which really does place the emphasis on the core skills that are across the curriculum. So I would like to assure you.

CHAIR: Thank you so much for that. We have come to the end of our timeslot, but we really appreciate all of that information and I thank you most sincerely for your time and your input this morning, as well as submissions.

ADAMS, Professor Peter, University of Queensland

DEAN, Mr Matthew, Private capacity

GROTOWSKI, Professor Joseph, University of Queensland

CHAIR: We are now coming towards the end of our hearing, but this is our final session this morning. I welcome three academics from the mathematics discipline. Dr Peter Adams and Professor Joseph Grotowski, both from UQ's School of Mathematics, speak to a joint submission. We have allocated 30 minutes for this session and I invite you to each make a short statement before committee members ask you any questions. We ask if you could try to limit that to three minutes each please to ensure that there is time for questions from the committee. We might start with Dr Matthew Dean.

Dr Dean: Thank you for taking an interest in this subject. I believe it is very important. May I please begin by tabling some documents.

CHAIR: The committee is happy to have those documents tabled.

Dr Dean: I understand that normally it is good manners for an academic in one discipline to not criticise other disciplines. However, today I feel like the stakes are too important for good manners and I will be speaking bluntly from my own personal opinion. I will hand around a summary of the submissions which have gone in showing 80 per cent of submissions do want marks, tests and state exams in preference to the present system and also some notes that I will be speaking from today and another relevant article. The main point I want to make to you is about academics. Not all academics are the same. In particular education academics: I have a picture of a typical university anywhere in the Western world. A university might consist of 40 different disciplines—law, medicine, engineering and so on. Education is one of those disciplines. In the diagram I have just handed out, it is marked in orange.

Education departments are very different from the mathematical disciplines. In mathematics, physics, chemistry and engineering we do mathematics. We do 10 years of mathematics after school, so we know school mathematics back to front. When we research we publish mathematics. Education disciplines, on the other hand, write opinion essays rather than do mathematics. Their level of mathematical knowledge may only be one or two years beyond high school level. It is these people who have introduced tables of paragraphs instead of marks, written essays into mathematics and our social moderation. QSA's 51 paragraphs for maths B are a cobweb of irrelevance thrown over school mathematics by education theorists. As you can see from the handout, 80 per cent to 90 per cent of teachers are very upset with this system and there is an enormous disconnect between the education theorists and the teachers practising at the coalface. As I read through the submissions I see teacher after teacher very upset with what is going on and then I come across an education academic saying, 'There's no problems at all. Maybe the teachers just need more training.' I find this remarkable and arrogant. Education theory is anti knowledge. In 1918 one of the initiators of inquiry based learning made this statement at the bottom of the page—

Knowledge is changing so fast that no specific subject matter should be required in the curriculum.

Can you imagine where we would be now if no specific knowledge was learned 100 years ago?

My principal motivation is for concern of students. I have seen students performing badly. What I have seen of first-year students as I have been lecturing is that they have been exposed to the relevant mathematics topics but they cannot do them, and that is demoralising for students. Imagine if someone said, 'Oh, the times table. I know about them, but I don't know them.' There is an enormous difference. Inquiry based learning from the constructive education theorists discourages repetition and memorisation. We do not. We want students to learn knowledge. On one of the pages I listed a table characterising the difference between mathematics and the education theorists' version of mathematics. There are some stark contrasts, most notably repetition is discouraged and memorisation is discouraged. It is not good enough. What would you want from your son or daughter? Would you want them to say, 'I can do it,' or, 'I can't do it but I know someone can'? There are so many differences between education, maths and—

CHAIR: I will ask you to round up because time is short.

Dr Dean: Okay; thank you. My final comment is please limit the destructive influence of this 'education' in Queensland. Only parliament can do this. The QSA or the education department, left to themselves, would have proceeded on as usual. May I, with respect, please point out that so far you have heard from many people in this process who support the system and yet there are 80 per

cent of teachers and the general public who want change. Please make sure you listen to plenty of these people including Dr Stephen Norton, Anita Bailey, Brian Joy, Tempe Harvey and many others. Thank you.

CHAIR: Thank you, Dr Dean. I now invite Professor Joseph Grotowski to address the committee.

Prof. Grotowski: Thanks very much, Madam Chair and committee members, for the opportunity to talk today. As you know from my submission, I am the Head of the Mathematics Discipline at UQ and I made a joint submission with Professor Peter Adams, who is the Associate Dean (Academic) in the Faculty of Science. We basically concentrated on two points particularly aligned to one of the terms of reference—that is, the ability of assessment processes to support valid and reliable judgements of student outcomes. Both of us have long experience in teaching tertiary mathematics, not just to mathematicians but to economists, to scientists in general, to business students and to all sorts of students in service courses and specialised courses as well. At UQ we are familiar with the exit criteria and UQ requires a sound achievement in maths B for entry to a lot of courses, and we very much engaged ourselves with the details of the curriculum in recent months. We went to a number of meetings organised by the QSA preliminary to this inquiry and we stated that we were happy with the mathematical content of the curriculum. So if you look at the heading's subject matter and look at the bullet points there, if you come to university and if you have a mastery of those subject points then you are in good shape for university mathematics.

What we also see is a large and increasingly larger cohort of students coming in with a Sound Achievement in maths B who do not have sufficient mastery of these mathematical techniques and content. We are not talking about students whom we want to go on to do a PhD. We are talking about students who are going to become engineers, who are going to be building our bridges; we are talking about biology students as well. They simply do not have the mathematic content and skills at a sufficient level, so there is a disconnect happening here. They have a sound achievement. The mathematical content of the curricula is sound, so what is missing? The only conclusion is that something in the assessment is not picking up that these students do not have the mastery of the content that they need.

We feel very strongly—and I think it is based on the evidence of what we see with first-year students—that the primary aim of maths courses, such as maths B and maths C, has to be to develop students' mathematical content knowledge and skills. Communication is vital. But it is in there. It is in the maths already. If you can construct a mathematical argument, if you can convince somebody that you can do a particular problem, then you have demonstrated precision. You have demonstrated logic. You have demonstrated conciseness, clarity and accuracy. It does not have to be in a real-life context for you to be able to demonstrate those skills.

The other point that I wanted to touch on briefly was the issue of marks. So you have repeatedly read and heard no doubt that there is a disconnect between QSA's stated position that it is permitted to use numerical marks for grades and what teachers experience and perceive—that it is effectively for them seen as something that they are not permitted to do either at the panel level or by the QSA. So this obviously needs to be addressed and we need a very clear ruling on that as to whether they are permitted and in what way they are permitted.

From our point of view, we use them all the time and we do criterion based assessment with marks. Going into one of our courses we will tell the students, 'You have this much on assignments, this much on your mid-semester exam, this much on your final exam.' When they come and look at their mid-semester exam and they see that they got 67 out of 100 and ask, 'Where did I lose the marks on this question?' we can say, 'You did not do this. You did not do that. You did not argue clearly. You failed this basic skill here.' So we can definitely map our marks on to criteria.

In summary, from our submission, we have students entering tertiary study with weak mathematical skills despite the fact that they are getting an SA or better in maths B. This is not down to the subject, the mathematical content of the syllabus; it is down to the assessment. The lengthy written work is taking too much time and too much effort for the teachers. Numerical marking schemes can and do pick out the criteria for assessment very well, and we believe that they should be supported and encouraged. Thank you for your time.

CHAIR: Thank you. Professor Adams, would you like to add to that?

Prof. Adams: Thank you, committee. I would like to concur with everything my colleague said. I would make the point that unusually I think for witnesses to this committee hearing we are talking from the perspective of people who see the outcomes of the current system. We recognise of course that the secondary education system is designed to prepare graduating students for a

range of careers and life choices. We would argue fairly strongly that mathematics C in particular but also to a significant extent mathematics B are to prepare students for tertiary study, be it in mathematics or in an area that uses that. My colleague highlighted some of them.

Despite what the theory may be and the outstanding job that teachers are doing—there are no complaints about teachers—it is demonstrably the case that students in many cases are not coming in with any great ability to perform what the content of the syllabus says that they should be able to do. Of course there are outstanding students coming through Queensland schools, as good as anywhere in the world. But there appears to be an increasing cohort who are not well prepared for what we would reasonably expect—and I stress ‘reasonably expect’—them to be able to demonstrate. I interact closely or less closely with around 2,000 first-year university students each year and they have all done mathematics B and a significant number of them have done mathematics C. At one o’clock I am going to go and stand in front of a class of 500 first-year science students—everyone who has done mathematics B—and I am going to reteach stuff that should have been covered in the curriculum. It is our strong perception that they are missing the content.

In first-year university courses that use mathematical knowledge we have a failure rate of around 30 per cent. These are students who have done this work and who have been given a pass in that work. We very strongly suggest that something about the assessment processes is not identifying whether these students can actually complete what is the core content of that area. Communication is important. We assess communication at university in mathematics. Part of that is the communication you do by doing mathematics and we also have more open-ended work, but none of that can be allowed to come at the expense of students being familiar with and being able to individually demonstrate that they have some level of competence and confidence with the core content. Thank you.

CHAIR: Thank you, gentlemen, for those very in-depth comments that you have made. Do we have some questions?

Mrs SCOTT: I have heard it said that it would be preferable that young students learn the basics of mathematics—numbers, tables and all of that sort of thing—before they are actually given a calculator, or nowadays a computer, and so on. So if we take it up to your level, you are saying that they need all of this basic knowledge before they then take on the EEL programs and that type of thing. So do we need part external examinations to make sure that the basics are there and then that they are able to apply those basics and thus overcome this? Where do we go with it? We are hearing a lot of different voices before our committee.

Prof. Adams: It is a very common view amongst mathematics departments and engineering departments around the world that students need to be able to demonstrate a level of competence at basic mathematical skills and that the current great use of calculators is not necessarily consistent with that. I note that in first-year university mathematics exams it is very common that only very basic calculators are allowed—so calculators at a much lower level of sophistication than are typically used in years 3 or 4 at schools. So, yes, we are voting with our actions that students need to be able to fulfil these basic activities. It is fairly clear that if you do not have a knowledge of basic English and language then you cannot write a great piece of work like Shakespeare did. So you need to have the basic knowledge.

I do not particularly have a view on external exams. I think my colleague Matt will probably talk to that. But I would suspect that there are a range of assessment approaches that could more accurately identify that students can do the content and have the skills that they need. External exams is one such approach but that is not my area of expertise.

Dr Dean: Regarding calculators, education theorists and inquiry based constructivist education theorists throw calculators at kids from grade 2 onwards. We do not. In high school there is a maths education lecturer in Queensland who promotes graphics calculator use and when the students get to first-year uni they are not able to draw graphs themselves which is a basic skill that they need.

In relation to external exams, yes, we definitely need some kind of external exams. The main reason I think is that assignments obviously are flawed assessment pieces and with tests it seems from what I hear from teachers that it is common for teachers to give the answers to the tests the day before so that their school performs and looks good at moderation. If we have an external exam for 50 per cent of the assessment, there would be some real study and real knowledge gain.

Mr BOOTHMAN: My question is to whomever wishes to answer it. It is to do with a submission made by one of your fellow professors. I will quote from that submission. It states—

It appears that the following are some issues that may have mistakenly been ascribed to senior Maths B and C and their assessment. These are some of the issues—some long-standing—that need investigation and attention.

I will highlight two of them. They are—

- significant decline of entry levels to university courses—

and this individual claims that that is certainly a problem in some regional universities, and—

- removal of Maths prerequisites for university courses needing the skills and knowledge of such courses

What is your point of view on that? I am very interested in hearing your point of view.

Prof. Adams: In my role as Associate Dean of the Faculty of Science I know a lot about entry requirements for my university, and we have also done a study about entry requirements for universities across the country. There is no doubt that across Australia having, for example, mathematics as a prerequisite for study in science is uncommon. In Queensland it is significantly more common than it is in any other state. So, as we said, for every student studying science or engineering or commerce at the University of Queensland, mathematics B has been forever a compulsory entry requirement and continues to be a compulsory entry requirement.

Around 13 or 15 years ago engineering scrapped mathematics C as an entry requirement, but students have to complete that on entry to the university if they have not already done it. I have read that submission. Certainly as far as the University of Queensland is concerned and the evidence that Professor Grotowski and I are presenting, that is not the case. That is in terms of subject completion for entry into the programs.

In terms of OPs for entry, OPs have moved around. I note that in recent years OPs for entry into UQ's degree programs have trended upwards, not downwards. If that person is comparing to 20 years ago, there is significant truth in the statement perhaps. But, in terms of more recently than that, there has been no reduction that I can observe in our university and I think that is reasonably common.

Mr BENNETT: Again, I am very interested in the subjects that you have raised this morning, particularly your statistics about failure rates in first year. I would like to encourage some more debate around the roles of schools in preparing for tertiary entry and of course giving you more opportunity to talk about what you see as the failures of your students being tertiary ready.

Prof. Adams: As I said, it would be a terrible job to be a school teacher because they have to satisfy so many masters. But I stress that in subjects like senior physics and chemistry and maths C, and to a significant extent but perhaps slightly less in maths B, I think they must be designed to prepare students for tertiary entry. We are seeing in many cases, not all—I have already said that we have outstanding graduates from our school system—but we are seeing an alarming number of cases which are very consistent with students just not having spent sufficient time doing the things that the syllabus asserts that they should be doing. Now I cannot demonstrate that that is because they are busily writing 10,000-word or 5,000-word or however long the essays are. But it is quite consistent with the assessment system at schools not requiring them to demonstrate proficiency in the core skills that most people would identify are a key part of that subject.

I said before that we assess communication in mathematics at the University of Queensland. It is also asserted as a graduate attribute for all of our science students. We would typically assess it in maybe a 10 or 15 per cent assignment, with criteria—with all the things that educational theory quite rightly says that we should have—but we never lose sight of the fact that the main game in town is to develop the students' mathematical skills and knowledge so that they can then go on and do the things in engineering or medicine which require those skills and knowledge.

Prof. Grotowski: I will just follow up on that briefly. My students, especially the first-year students, are sometimes taken aback when I say, 'Well, in order to master this, you are going to have to do a few of them.' They say, 'Oh, like two or three.' And I say, 'No, like 20 of them.' It seems to be something that they respect in other fields of human endeavour. For example, you do not expect to go out and play a round of golf without actually having spent a few hours at the driving range or playing a bit on the putting green. So in sport we seem to respect the need for practice of the basics, but the students do not seem to have a respect for that and do not seem to realise the fundamental importance of that for success in their tertiary studies.

Mrs SCOTT: Dr Dean, I have made a note that you talked about 51 paragraphs for maths B and you mentioned that they are like a cobweb being thrown over them. Do you want to flesh out a little bit more for us what you are referring to there?

Dr Dean: Thank you, yes. Mathematics does not need tables of paragraphs for assessment. It is right or it is wrong. That is what the man on the street will say about mathematics: it is right or it is wrong. And they are correct. For multistep problems there might be part marks awarded if they did part of it right and made a mistake. But we do not need tables of paragraphs. It is ridiculous. I hope that when we recover from this, in the museum we can have a plaque with those tables of paragraphs and record that there was a time in Queensland history when maths teachers were not allowed to use marks. Sorry, that is probably not the answer you were after.

CHAIR: Thank you for that, gentlemen. Our time has come to an end and I really do appreciate your input. I thank you very much for your submissions and as well for your time this morning. On behalf of the committee, I would like to thank all of the witnesses who have informed us today and to acknowledge the high level of public interest in this inquiry. I urge those with an interest in the work of the Queensland parliament's Education and Innovation Committee to subscribe to the committee's email subscription list via the Queensland parliament's website. I now declare this hearing closed.

Committee adjourned at 12.30 pm