

2016 Review of the NSW Board of Studies, Teaching and Educational Standards

Modernising the educational architecture of NSW

RESPONSE FROM THE MATHEMATICAL ASSOCIATION OF NSW

There are several issues identified by MANSW that run across the four high level discussion questions raised in the Review's *Issues Paper*. Therefore this response to the 2016 Review of BOSTES is organised into four sections:

- A. About the Mathematical Association of NSW
- B. Findings from the MANSW Survey relevant to this current review
- C. Summary of issues impacting upon the achievement of quality mathematics education for all.
- D. MANSW response to the Review's four high-level questions
- E. Summary list of recommendations to the Review.

A. About the Mathematical Association of NSW

The Mathematical Association of New South Wales (MANSW) is a professional association of mathematics educators that is dedicated to improving the quality of mathematics education and learning throughout New South Wales. The association celebrated its centenary in 2010.

MANSW is an endorsed Professional Learning Provider at Proficient Teacher level with the Board of Studies, Teaching and Educational Standards NSW (BOSTES). In 2015, MANSW gained recognition as a professional learning provider with the ACT Teacher Quality Institute.

MANSW membership covers mathematics educators from pre-school through to tertiary level. The association provides support for teachers of mathematics from Kindergarten to Year 12 in both government and non-government schools. MANSW encourages participation from tertiary educators in mathematics and mathematics education to share their skills and expertise. The association is a not-for-profit organisation. The activities of the association are managed by a voluntary executive committee and a number of volunteer sub-committees supported by employed staff comprising an Executive Officer, a part-time secondary professional learning officer, a part-time Project Officer, a full-time K-8 professional learning consultant (from the beginning of 2016) and the full-time equivalent of two administrative officers.

The association provides:

- professional learning courses and conferences for teachers
- quality resources for teachers and students
- opportunities for the exchange of ideas,
- activities to enrich student learning,
- a representative voice for mathematics educators.

The association supports teachers through its website, journals, newsletters, conferences and professional learning courses many of which are held in regional centres across NSW.

The Mathematical Association of NSW has a proud history of involvement with and contribution to the work of BOSTES (and its predecessor boards) particularly in the areas of development, implementation and evaluation of syllabuses, support materials, external examinations and teacher professional learning. The founder of MANSW over 100 years ago, Horatio S Carslaw, was by virtue of his position (Professor of Mathematics at The University of Sydney), responsible for the Junior and Senior Public Examinations in mathematics and was a prominent member of the Board of Examiners formed to conduct the Intermediate and Leaving Certificate Examinations. As president of the Mathematical Association from 1911 until 1934 he is remembered especially for his invitation to teachers to discuss the mathematics papers of the public examinations, a practice not undertaken in other subject areas until many years later.

The MANSW Executive Committee meets twice a year with the President and various officers of the NSW Board of Studies, Teaching and Educational Standards NSW (BOSTES). MANSW played a key role in lobbying for (and the subsequent development in 2015 of) a Reference Sheet for use in the Mathematics, Extension 1 and Extension 2 HSC examinations to replace the list of 'standard integrals' which had been used since the late 1970s. In 2015 MANSW prepared a comprehensive submission to BOSTES regarding the development of the BOSTES Writing Briefs for the development of new Stage 6 mathematics syllabuses.

B. Findings from the MANSW Survey relevant to this current review

During December 2013, the Mathematical Association of New South Wales (MANSW) conducted an online survey of secondary mathematics teachers across NSW. The survey focused on student participation in senior mathematics courses, student access to qualified mathematics teachers and teacher views on the NSW Stage 6 Mathematics Syllabuses. The survey was completed by 1084 teachers from regional and metropolitan schools, representing an estimated 18% of NSW secondary mathematics teachers. The full report of the findings and recommendations arising from the survey can be downloaded from <http://www.mansw.nsw.edu.au/resources/public-resources/2013-secondary-mathematics-teacher-survey-report>.

- **The participation rate of students from rural schools in the HSC Mathematics calculus based courses (Mathematics, Extension 1 and Extension 2) is less than half that of students in metropolitan Sydney schools.**
 - For Mathematics Extension 2, the figures are 2% in regional schools and 11% in Sydney metropolitan schools
 - For Mathematics Extension 1, the figures are 7% in regional schools and 17% in Sydney metropolitan schools
 - For Mathematics (2 Unit), the figures are 15% in regional schools and 21% in Sydney metropolitan schools.
- **The NSW education system produces approximately 3 000 fewer calculus-trained students per year than it did in 2001.** This represents a drop of 13% over 12 years. The majority of the decline in calculus-trained students is in the Mathematics (2 Unit) only cohort, with a decline of 18% since 2001. Student enrolment in Extension 1 and Extension 2 have been more stable over the period. (Based on analysis of NSW Board of Studies data).
- 51% of respondents to the MANSW survey believe that **a substantial number of mathematically able students in their school are selecting a senior mathematics course below their capability.** Only 34% disagreed. The most frequent reasons given by respondents for students choosing a mathematics course below their capability were:
 - A desire to optimise HSC 'Band 6' and ATAR results,
 - The level of difficulty and time demands of Mathematics (2 Unit),
 - Students are attracted to other HSC courses.
- Over the last four decades, there has been an ongoing **shortage of qualified secondary mathematics teachers.** There have been measures during this time to retrain primary teachers and secondary teachers from other subjects as secondary mathematics teachers, but this has not made a significant impact on the shortage. As a result, high schools are calling upon out-of-field teachers to teach some mathematics lessons. An out-of-field teacher is a qualified primary teacher (K-6) or high school teacher who is teaching mathematics without formal qualification to teach high school mathematics. MANSW believes that every mathematics lesson for Years 7 to 12 should be delivered by a qualified mathematics teacher. However, this is not always possible.

As such, MANSW believes that a reasonable expectation is that at least 80% of Year 7 to 10 lessons should be taught by qualified secondary mathematics teachers (i.e. typically 4 out of 5 classes in a Year cohort). Anything less than this should be considered unacceptable. Sadly the survey found:

 - In the Sydney metropolitan region, 30% of respondents reported a Year 7 figure below the MANSW minimum expectation
 - In regional areas 51% of respondents reported a Year 7 figure below the MANSW minimum expectation.
 - In regional areas 37% of respondents reported a Year 9 figure below the MANSW minimum expectation.
- 53% of respondents to the MANSW survey agreed there should be an option for out-of-field teachers to be retrained so that they are qualified to teach Mathematics 7 to 10. Only 16% of respondents disagreed.

C. Summary of issues impacting upon the achievement of quality mathematics education for all that underpin MANSW response to Review's key questions

The following issues need to be addressed if NSW is to achieve higher quality teaching and improved educational outcomes for all students.

- Shortage of qualified secondary mathematics teachers and the related number of mathematics classes being taught by out-of-field teachers (especially pronounced in regional NSW)
- Lower participation and learning outcomes of students in regional NSW
- The content of available university courses for retraining primary and secondary teachers of other subjects to become mathematics teachers focuses on increasing mathematics knowledge of participants and greater focus should be given to pedagogy and developing mathematical understanding and skills related to syllabus content in Years 7-10
- Perceived lack of confidence and competence of primary teachers in teaching mathematics
- Students not choosing the more challenging HSC Mathematics courses although these provide a better foundation for tertiary and vocational study and career options especially in the STEM (science, technology, engineering and mathematics) field.
- BOSTES could better utilise and tap into the experience and expertise of professional teacher associations. Historically BOSTES has utilised the expertise of the professional teacher associations mainly in relation to the development and evaluation of syllabus and teacher standards but has not utilised this valuable resource in other areas such as teacher professional learning. MANSW has proven that it can provide high quality services to teachers and students across NSW that are valued by the profession and are offered at very reasonable prices. With resourcing and other support from BOSTES more could be achieved by the association.

In response to the above issues, MANSW has expanded its services to members as described below.

- MANSW has employed from the beginning of this year, a full-time K-8 Professional Learning Consultant with a background of primary teaching and consultancy experience.
- To supplement the long standing 3-day annual conference, the MANSW conference program has expanded to include a middle years K-8 conference and three regional cluster conferences (Wollongong, Dubbo and Port Macquarie).
- MANSW runs face-to-face professional learning courses for primary and secondary teachers across Sydney and in more than fourteen regional centres such as Ballina, Coffs Harbour, Wauchope, Newcastle, Gosford, Armidale, Bathurst, Dubbo, Broken Hill, Wagga Wagga, Albury, Cooma, Mittagong, Kiama and Nowra. In 2015, more than 2800 teachers attended one or more of the 62 MANSW accredited professional learning events offered. Video-conferencing has enabled teachers throughout NSW to participate in courses held in both metropolitan Sydney and regional venues.
- More than 500 teachers attended the MANSW organised HSC Feedback Day in February this year. MANSW is delighted that the BOSTES president has indicated that the BOSTES will assist MANSW next year in streaming the day online to regional teachers.

- The K-8 Conference held on Saturday 2nd April attracted 200 participants including exhibitors, presenters, teachers and student teachers.
- MANSW professional officers provide consultancy support to teachers in their school anywhere in the state. In December 2015, MANSW supported (cost-free) the Northern Border Senior Access Program to assist four very remote schools with mainly indigenous students.
- The long-standing program of HSC Lectures for Year 12 students in Sydney was expanded in 2014 to also run in regional venues. Students attended 1, 2 or 3 days of lectures in places such as Albury, Bathurst, Cooma, Dubbo, Kew, Leeton, Moruya, Murwillumbah, Nowra, Orange, Quirindi, Terranora and Wagga Wagga.
- The popular long-standing MANSW Talented Students Day aimed at Year 12 Extension 2 students has been expanded so that in 2016 it will cater for both Extension 1 and Extension 2 students. Almost 500 students and teachers have registered to attend this event.
- In 2015 MANSW brought the *mathsINSPIRATION UK* show to Sydney. The show aimed at upper secondary students comprises three interactive theatre presentations that highlight the mathematics that underpin various careers and technologies used in everyday life (eg mobile phones). Last year the event was held in two Sydney venues. It was reported on ABC current affairs radio and on the 7pm and 6am ABC TV news. Arrangements are well underway for another visit to NSW in August 2016 with venues booked in Parramatta, Chatswood and Newcastle. Over 3000 students will attend.
- The MANSW Facebook page has been particularly successful as a forum for teachers to network, discuss teaching and learning and raise matters of concern.
- MANSW has developed cost-free online professional learning communities in the form of Edmodo pages, on which teachers are able to share ideas and resources. This is greatly appreciated by teachers particularly those in small and remote schools. The HSC General Mathematics Edmodo page has over 1300 participants while the 2 Unit Mathematics Edmodo page has attracted over 700 teachers.
- In response to students not choosing appropriate Stage 6 courses, in 2015 MANSW published a brochure and online videos to assist students and parents to make a more informed choice of mathematics course for Stage 6. These are published on our website: www.mansw.nsw.edu.au/resources/public-resources/mathematics-2-unit-or-mathematics-general

MANSW believes that as a professional association it is in a unique position to work both with and through BOSTES to achieve not only the association's objectives but also the Board's goals of providing high quality professional learning courses and resources for teachers and high quality learning experiences for students.

This is in keeping with the Outcome and Action 16.4 in *Great Teaching Inspired Learning a blueprint for action* -

The profession will be supported to inform and provide registered teacher professional learning.

Teacher professional bodies will be supported and utilised as high quality and effective providers of teacher professional learning. Systems for the exchange of information will be established across the associations, school authorities and the Institute to help associations provide professional learning that meets school and system priorities, as well as to inform school authorities of teacher-driven demands for professional learning.

D. MANSW Response to the Review's four high level questions

1. Have the opportunities of the amalgamation been fully realised?

1.1 Shortage of qualified Mathematics Teachers

Through school registration processes, BOSTES has an opportunity to regularly monitor the employment of qualified mathematics teachers in both government and non-government secondary schools across NSW. Also BOSTES could monitor the percentage of lessons/hours of mathematics learning that are being taken by teachers qualified in other subjects. Unlike the HSC and NAPLAN these figures are not readily available to the public or parents choosing schools. We are not arguing that these figures should be made available to the press, but to school principals, school authorities and BOSTES, who could find these figures informative when determining action to improve student learning outcomes in their jurisdiction. For BOSTES it could influence the development of syllabus support resources and give an insight as to whether a school has the necessary teacher expertise to implement syllabuses.

Being responsible for the accreditation of teacher education courses as well as for teacher accreditation there is an opportunity for BOSTES to review the existing university courses designed to retrain teachers of other subjects to become mathematics teachers. In order to formally retrain, out-of-field teachers are currently required to complete advanced university mathematics subjects (for example, solving differential equations), when their immediate need is pedagogical support for teaching mathematics to Year 7 and 8 students.

Recommendation 1.1a

As part of the school registration process, BOSTES collect data from schools on the percentage of mathematics lessons/hours taught by teachers who do not have formal mathematics teacher qualifications.

Recommendation 1.1 b

BOSTES undertake a review of the systems currently in place for qualified teachers to retrain as qualified secondary mathematics teachers with a view to approving two different types of university courses and related teacher accreditation:

- **Type A is for teachers who want to be qualified as a teacher of Mathematics 7 to 10. The focus of this course should be on strategies for teaching mathematical concepts, especially to students who experience difficulty in Stages 3, 4 and 5.**
- **Type B is for teachers who want to be fully qualified 7 to 12 mathematics teachers.**

1.2 Influence of HSC examinations and NAPLAN testing on schools' syllabus implementation and student assessment

MANSW supports the concept that there are potential benefits in bringing together responsibilities for curriculum, student assessment/credentialing, accreditation of initial teacher education university courses, teacher licensing and school registration under the BOSTES umbrella but there are dangers related to the relative balance between the components and what is perceived to be the real driving force within the organisation and for that matter schools.

Historically the requirements underpinning the School Certificate and the Higher School Certificate and more recently NAPLAN have had a substantial influence on the way in which schools have implemented syllabuses and conducted internal school assessment of student learning, particularly in mathematics. For the HSC, internal school assessments ideally assess those syllabus outcomes not easily assessed by pen-and-paper external examinations with strict time limits. At the moment there is no compulsion to do so in mathematics, unlike other subjects. In relation to mathematics, the structure and nature of the external exam has been and is still the model adopted by schools not just in Years 11 and 12 but in the years below. Few opportunities are offered to students for open-book tests, or tests with no time limits or for students to be assessed on project work and open-ended investigations.

Allied to this, is the problem of 'teaching to the test'. Given time pressure, the focus of schools' teaching and learning programs is those elements of the syllabus that lend themselves to pen-and-

paper tests with the recall of knowledge and routine processes. There is little opportunity for students' to apply their mathematical understanding and skills in real world/life contexts or to problems where the mathematics needs to be teased out and the situation analysed.

Thus the syllabus intentions are diverted - children learn to jump through hoops, see no immediate purpose to their mathematics learning and regard mathematics as drill-and-practice. Many do not develop perseverance nor experience the excitement of puzzling / reasoning / experimenting / investigating; nor do they enjoy their mathematics learning or regard themselves as successful 'doers' and users of mathematics.

In mathematics syllabuses the outcomes related to mathematical content that are easily assessed in pen-and-paper tests dominate and the other elements of the syllabus are neglected and disregarded. This is in stark contrast to the Rationale in the Mathematics K-10 Syllabus -

*The ability to make informed decisions and to interpret and apply mathematics in a variety of contexts is an essential component of students' preparation for life in the 21st century. To participate fully in society, students need to develop the capacity to critically evaluate ideas and arguments that involve mathematical concepts or that are presented in mathematical form. ... Students learn to apply their mathematical knowledge, skills and understanding in a broad range of contexts beyond the mathematics classroom, including in such core learning areas as science, geography, history and English. The study of mathematics provides opportunities for students to appreciate the elegance and power of mathematical reasoning and to apply mathematical understanding creatively and efficiently. The study of the subject enables students to develop a positive self-concept as learners of mathematics, obtain enjoyment from mathematics, and **become self-motivated learners through inquiry and active participation in challenging and engaging experiences.***

BOSTES has the opportunity to strengthen the requirements on universities in relation to the number of hours devoted to the teaching and learning of mathematics in pre-service courses for primary teachers. Similarly BOSTES could specify the number of hours required in practicums to be devoted to mathematics teaching.

Several primary schools utilise team planning and teaching whereby a teacher with identified expertise in mathematics teaching works with and supports the professional development of their colleagues. Being responsible for the accreditation of university teacher education courses and also teacher registration provides an opportunity for BOSTES to encourage the development and employment of specialist primary mathematics teachers. This would require BOSTES to oversee the development of appropriate undergraduate and postgraduate university teacher education courses and the introduction in NSW of a new category for primary teacher registration/licence.

In conclusion, it could be argued that external tests such as NAPLAN and HSC Examinations are having a negative impact on the delivery of high quality teaching/learning programs and diminish student learning outcomes by focussing attention on lower order thinking and skills that are readily tested by timed pen-and-paper examinations in which 21st Century technologies are banned.

Recommendation 1.2a

BOSTES include in HSC mathematics examinations more questions that require students to demonstrate and explain their thinking.

Recommendation 1.2b

BOSTES provide financial and other support to student activities conducted by professional teacher associations that encourage and support schools to implement the 'intent' of the syllabus through open-ended investigations and project work.

For example The Young Scientist Awards organised by The Science Teachers Association NSW; and the following activities organised by MANSW - Maths Extension 1 & 2 Day (formerly the Talented Students' Day), the Investigating with Mathematics competition and MathsINSPIRATION.

Recommendation 1.2c

BOSTES investigate the feasibility of including student project work as a compulsory assessment component in internal school assessments in Mathematics Stages 3 - 6.

Recommendation 1.2d

In relation to initial teacher education BOSTES specify the total number of hours (or the relative proportion of time) in the pre-service course and in the practicum that should be focussed on the teaching and learning of mathematics.

Recommendation 1.2e

BOSTES support the development of university teacher education courses to underpin the BOSTES introduction of a new category of teacher accreditation, namely specialist primary mathematics teachers.

1.3 Opportunities for teacher professional development through HSC Examination marking and syllabus development

The amalgamation of the Board of Studies and the Institute of Teachers should mean that there is a greater link between HSC marking and teacher accreditation. Teachers report that marking HSC examinations has contributed to their professional growth and increased their awareness of common student errors and misunderstandings that can be addressed through teaching. Teachers report that it is difficult if not impossible to be appointed to the HSC marking team. BOSTES could explore how more teachers could be involved in the HSC marking process especially through the recent expansion of on-line marking. For example, by employing twice the number of markers, marking time could be greatly reduced.

At the time of the development of syllabus and/or support documents, the opportunity exists for BOSTES to organise accredited professional learning courses on syllabus and support document writing thus providing an opportunity for teachers to contribute to the writing as part of the requirements for accreditation at Highly Accomplished and Lead level.

Recommendation 1.3a

BOSTES explore opportunities for linking teacher involvement with HSC marking and syllabus development with teacher accreditation especially for those teachers working towards Highly Accomplished and/or Lead status.

Recommendation 1.3b

BOSTES increase the number of markers to provide an opportunity for more teachers to participate in the process.

2. Are roles and responsibilities clear and appropriate?

2.1 The responsibility of BOSTES in channelling financial resources into the development of the teaching profession.

The role of BOSTES in teacher accreditation/licensing is clear and BOSTES will soon be collecting \$100 per year from every teacher in the state. What is not clear is the Board's responsibility in channelling some of this money back into the teaching profession. Surely not all the \$100 per teacher collected will be utilised in maintaining teacher registration records.

Since the introduction of NSWIT, the costs to volunteer not-for-profit teacher associations such as MANSW in mounting a professional learning event have increased due to the additional administrative work required to initially upload course details onto the NSWIT/BOSTES website and then teacher attendance data after the completion of the course. The uploading of teacher attendance data is particularly tedious and time-consuming.

The provision of professional learning courses at the Highly Accomplished and Lead levels is presenting a financial challenge for MANSW to provide at the moment given the low demand at this time from teachers. We anticipate this demand will grow when all teachers come under the BOSTES Accreditation process. Financial support from BOSTES to the associations would enable MANSW to develop and run courses at the Highly Accomplished and Lead levels even though participant numbers may be low and a reasonable course fee would not be sufficient to cover costs involved.

Of particular concern and worthy of additional support from BOSTES to the profession is the provision of on-going professional support to teachers in non-metropolitan NSW. MANSW would very much appreciate financial support from BOSTES in our various activities designed to support students in regional areas who are undertaking the higher levels of mathematics. This could take the form of online lessons available cost-free to students and teachers in all schools, created by MANSW with financial support from BOSTES.

Recommendation 2.1a

BOSTES each year assign a specified proportion of moneys collected through teacher registration/licence fee back into the teaching profession via grants to the professional teachers associations to provide professional learning support for teachers.

This professional learning support could be related to face-to-face and online professional learning activities, professional support resources including eJournals, maintenance of online professional learning communities through which teachers are able to share ideas and resources.

Recommendation 2.1b

BOSTES provide financial support to the professional teachers association to provide learning support to students in regional NSW undertaking higher level courses in mathematics.

3. Are processes and practices as effective and efficient as possible?

3.1 Teacher Accreditation

As outlined above in 2.1, the uploading of teacher attendance data at the completion of a registered professional learning course is particularly tedious and time-consuming for MANSW as a professional learning provider operating in a not-for-profit environment. Currently we are required to enter each teacher attendance record separately. There is no computerised process for transferring a spreadsheet containing the required data on all course attendees to BOSTES. With the extension of the teacher accreditation process to all teachers in the near future, a more efficient process is needed.

Recommendation 3.1

BOSTES implement a process whereby a file of course attendance data collated by a professional learning provider can be electronically transferred to BOSTES.

MANSW has received anecdotal reports from members that the accreditation processes they went through as a New Scheme teacher were arduous and the time involved was unduly lengthy, particularly if they were an experienced teacher from overseas or interstate. We are not in a position to verify these reports and trust that this matter will be more fully addressed by others responding to this review.

Similarly we have been told that teachers applying for Highly Accomplished and Lead accreditation are not provided the opportunity to resubmit if their application is not successful. There appears to be a need for BOSTES to provide feedback to applicants on early drafts of their submission to ensure that they fully understand and meet BOSTES requirements. The support provided appears to vary from school to school. The purpose and benefits of pursuing accreditation at the Highly Accomplished

and Lead levels need to be specified, otherwise teachers may not see the need to undertake what is often viewed as an arduous process.

3.2 Maintenance of teacher accreditation

There appears to be no requirement for primary teachers to ensure that their professional learning over the five year period addresses each curriculum area. There is the possibility that the professional learning undertaken by the teacher plays to their interests and strengths rather than addressing curriculum areas where they are lacking either confidence and/or competence.

Given that the Board's NAPLAN data highlights student learning outcomes in literacy and numeracy, this assists schools identify priorities for school strategic planning and associated staff professional learning. Given the central place of numeracy in the primary school curriculum and the reported low levels of teacher confidence and competence in mathematics, it can be argued that there should be a requirement on all primary teachers in maintaining their teacher accreditation to demonstrate that in addressing the national teaching standards they have specifically undertaken BOSTES registered courses and teacher identified professional development related to numeracy and/or mathematics for a significant proportion of the required hours. This will build on the requirement that preservice teachers pass a numeracy test prior to their final practicum.

As literacy and numeracy are every teacher's responsibility in secondary schools, (not just the responsibility of English and mathematics teachers), a similar argument could be put that secondary teachers of all subject areas should be required to demonstrate in each five year cycle they have undertaken QTC accredited courses related to developing students' literacy and numeracy skills within their particular subject area.

Recommendation 3.2

BOSTES strengthen the requirements for the maintenance of primary teacher accreditation at the proficient level by mandating a minimum of 25% of the required hours to be undertaken over the cycle (for both BOSTES registered and teacher identified professional development) be related to mathematics teaching.

3.3 Proportion of BOSTES work directly related to primary school education

Primary teachers generally are responsible for all curriculum areas in contrast to secondary schools where there are subject specialists. Thus it might be argued that some BOSTES procedures such as the maintenance of teacher accreditation (discussed above) may be more appropriate for a secondary setting than a primary school setting. This raises the question as to the on-going support from BOSTES to primary teachers and the relative number of professional staff employed by BOSTES who have primary school experience.

Historically the examinations and curriculum branches including subject inspectors appear to have been drawn mainly from secondary subject areas. The primary years are critical in providing a foundation for further learning and primary teachers are required to have expertise across all the subject areas and knowledge of all the primary syllabuses.

There may be a perception that BOSTES activities are focussed on and driven by the HSC. How much of BOSTES work is directly relate to primary education? Are decisions made related to the award of the Higher School Certificate and this then percolates down into curriculum development in Stage 6 and then down to curriculum development and assessment in years 7 to 10 and then the primary years. Or alternatively, is curriculum development and assessment focussed on providing sound foundations for further learning?

The Mathematics K-10 syllabus acknowledges that

students learn at different rates and in different ways, so that there will be students who have not achieved the outcomes for the stage(s) prior to that identified with their stage of schooling. For example, some students will achieve Stage 3 outcomes during Year 5, while the majority will achieve them by the end of Year 6. Other students might not develop the same knowledge, skills and understanding until Year 7 or later.

Do the current BOSTES syllabuses provide a seamless learning experience for students as they progress from Kindergarten through primary to junior secondary school and to Stage 6? How does the Stage structure in syllabuses help or hinder a student's transition into high school? Does the Syllabus structure encourage schools to provide additional instruction time and/or teacher support for students who learn at a slower rate especially during the primary years? This issue is discussed further below in section 3.5 of this response.

Recommendation 3.3

The review ascertain the relative support and related work undertaken by BOSTES to directly support teaching and learning in the early childhood and primary years.

3.4 Syllabus Development - Representation on BOSTES Curriculum Committee

MANSW appreciates the opportunity to nominate a representative to be a member of the BOSTES Curriculum Committee undertaking the development of mathematics syllabuses. The process of inviting individuals and associations to comment on Syllabus Writing Briefs and Draft Syllabuses is also valued by our members.

With the provision of new syllabuses on-line, there is an opportunity for the syllabuses to be updated more frequently to reflect changes in available technology and emerging research or social issues that may be relevant to the syllabus.

The current Stage 6 Mathematics syllabuses for Mathematics, Extension 1 and Extension 2 were published in 1982 (and were very similar to the 2, 3 and 4 unit courses introduced under the Wyndham Scheme). Over thirty years is a long time. Syllabuses should be reviewed more frequently to ensure they are still relevant and meeting community expectations. This should be a transparent process with clearly published timelines.

Recommendation 3.4a

BOSTES make minor revision to on-line syllabus documents in an on-going manner where appropriate.

Recommendation 3.4b

BOSTES formally review and revise syllabuses in accord with a published timeline at least once every five years through consultation with teachers and stakeholder groups.

3.5 Syllabus Structure

The current Board practice of having a uniform structure and framework for syllabus documents irrespective of the subject is not the most effective way of ensuring that the contents of the syllabus are in tune with the needs of the reader.

This is particularly relevant in relation to the current primary mathematics syllabus. Due to the special nature of the mathematics discipline combined with the reported low level of confidence and competence of many primary teachers the layout, content and limited discussion of key pedagogical issues does not promote teachers' understandings and ability to deliver mathematics lessons that truly engage students and promote learning. As discussed above, mathematics teaching and learning becomes focussed on the transmission of skills (drill and practice) rather than the development of deep understandings and reasoning capabilities.

The provision of a second expanded version of the syllabus with integrated support would help teachers implement the syllabus as intended. The expanded version could include more explanation and include video clips, student work samples and ideas for achieving outcomes related to working mathematically.

In the current on-line version of the primary mathematics syllabus, it is difficult to view as a whole the progression of skills and understandings in a particular content area from Early Stage 1 through to Stage 3 without having to click back and forward. The aims, rationale and Working Mathematically are not obvious.

It is interesting to note that pre-service teachers are now required to pass a numeracy test. This should be complemented by an expanded version of the syllabus designed to assist those teachers lacking confidence in their own mathematical understandings.

At the secondary level, an expanded version of the syllabus would greatly assist beginning teachers and out-of-field teachers especially in Years 7 to 10.

Recommendation 3.5a

BOSTES supplement the on-line version of the current mathematics K-10 syllabus by the addition of the facility to view the progression of skills and understandings for each content area.

Recommendation 3.5b

BOSTES develop two versions of mathematics K-10 syllabus - one a concise electronic document (similar to existing formats) and the second expanded version providing more explanation of the underlying key ideas being developed and the links to other areas of mathematics together with suggested activities to actively engage students. This could be achieved through embedded electronic links to further explanations including videos, exemplars, and illustrations of working mathematically.

3.6 Press coverage of HSC Band 6 Statistics released by BOSTES

As described in section B above, there has been a significant drop in the number of students studying the calculus-based HSC courses that provide the foundation for tertiary studies and careers in the STEM field. Many able students are selecting a Stage 6 mathematics course below their capability.

A contributing factor to this decline is the manner in which the HSC statistics released by BOSTES are reported in the media where the underlying assumption is that a Band 6 in all subjects are equivalent. A Band 6 in Mathematics General 2 is counted as equivalent to the highest band in Mathematics Extension 2, Mathematics Extension 1 and Mathematics (2 Unit). As a result in order to maximise the number of Band 6 results a school achieves, students are being entered into Mathematics General 2 or no mathematics at all rather than the (2 Unit) Mathematics calculus course.

Stage 6 mathematics is a hierarchical subject having five courses including two extension courses. Common scaling for the HSC examinations in the mathematics courses would allow the comparison of achievement between students studying mathematics in different courses. Although the use of a common scale is used for English (another hierarchical Stage 6 subject with five courses), this is currently not applied to the mathematics HSC examinations.

Recommendation 3.6

For the HSC examinations in mathematics, BOSTES apply a common scale allowing the reliable comparison of achievement between students in different mathematics courses.

4. Are effective governance arrangements in place?

4.1 Membership of the Board

Given the roles and responsibilities of BOSTES it is surprising that professional teachers associations such as MANSW are not represented on the Board and other BOSTES committees.

The Professional Teachers Council NSW (PTCNSW) is the umbrella body in NSW representing professional teacher associations such as MANSW. If it is not feasible for MANSW to be represented on the Board, perhaps it would be more appropriate for all the professional teacher associations to be represented on the BOSTES board through PTCNSW. Other key stakeholders have formal representation including the various unions, teacher employer groups, principals, parent bodies and universities. The three appointed members who are teachers are nominees of the unions. We are not

arguing against the unions being represented, but in recognition of the significant contribution of volunteer members of the professional teachers associations across NSW to the work of BOSTES, it is only fitting that they have the opportunity to nominate both a primary and a secondary member of the BOSTES board. Perhaps as there are three union teacher representatives, and three parent representatives, there could be three nominees of the professional teacher associations through PTCNSW.

Recommendation 4.1a

The Professional Teachers Council of NSW have three representatives on the governing board of BOSTES.

Recommendation 4.1b

The Professional Teachers Council of NSW be invited to nominate one or more representatives to serve on each BOSTES committee.

E Summary list of recommendations to the Review

Recommendation 1.1a

As part of the school registration process, BOSTES collect data from schools on the percentage of mathematics lessons/hours taught by teachers who do not have formal mathematics teacher qualifications.

Recommendation 1.1 b

BOSTES undertake a review of the systems currently in place for qualified teachers to retrain as qualified secondary mathematics teachers with a view to approving two different types of university courses and related teacher accreditation:

- Type A is for teachers who want to be qualified as a teacher of Mathematics 7 to 10. The focus of this course should be on strategies for teaching mathematical concepts, especially to students who experience difficulty in Stages 3, 4 and 5.
- Type B is for teachers who want to be fully qualified 7 to 12 mathematics teachers.

Recommendation 1.2a

BOSTES include in HSC mathematics examinations more questions that require students to demonstrate and explain their thinking.

Recommendation 1.2b

BOSTES provide financial and other support to student activities conducted by professional teacher associations that encourage and support schools to implement the 'intent' of the syllabus through open-ended investigations and project work.

Recommendation 1.2c

BOSTES investigate the feasibility of including student project work as a compulsory assessment component in internal school assessments in Mathematics Stages 3 - 6.

Recommendation 1.2d

In relation to initial teacher education BOSTES specify the total number of hours (or the relative proportion of time) in the pre-service course and in the practicum that should be focussed on the teaching and learning of mathematics.

Recommendation 1.2e

BOSTES support the development of university teacher education courses to underpin the BOSTES introduction of a new category of teacher accreditation, namely specialist primary mathematics teachers.

Recommendation 1.3a

BOSTES explore opportunities for linking teacher involvement with HSC marking and syllabus development with teacher accreditation especially for those teachers working towards Highly Accomplished and/or Lead status.

Recommendation 1.3b

BOSTES increase the number of markers to provide an opportunity for more teachers to participate in the process.

Recommendation 2.1a

BOSTES each year assign a specified proportion of moneys collected through teacher registration/licence fee back into the teaching profession via grants to the professional teachers associations to provide professional learning support for teachers.

Recommendation 2.1b

BOSTES provide financial support to the professional teachers association to provide learning support to students in regional NSW undertaking higher level courses in mathematics.

Recommendation 3.1

BOSTES implement a process whereby a file of course attendance data collated by a professional learning provider can be electronically transferred to BOSTES.

Recommendation 3.2

BOSTES strengthen the requirements for the maintenance of primary teacher accreditation at the proficient level by mandating a minimum of 25% of the required hours to be undertaken over the cycle (for both BOSTES registered and teacher identified professional development) be related to mathematics teaching.

Recommendation 3.3

The review ascertain the relative support and related work undertaken by BOSTES to directly support teaching and learning in the early childhood and primary years.

Recommendation 3.4a

BOSTES make minor revision to on-line syllabus documents in an on-going manner where appropriate.

Recommendation 3.4b

BOSTES formally review and revise syllabuses in accord with a published timeline at least once every five years through consultation with teachers and stakeholder groups.

Recommendation 3.5a

BOSTES supplement the on-line version of the current mathematics K-10 syllabus by the addition of the facility to view the progression of skills and understandings for each content area.

Recommendation 3.5b

BOSTES develop two versions of the mathematics K-10 syllabus - one a concise electronic document (similar to existing formats) and the second expanded version providing more explanation of the underlying key ideas being developed and the links to other areas of mathematics together with suggested activities to actively engage students.

This could be achieved through embedded electronic links to further explanations including videos, exemplars, and illustrations of working mathematically.

Recommendation 3.6

For the HSC examinations in mathematics, BOSTES apply a common scale allowing the reliable comparison of achievement between students in different mathematics courses.

Recommendation 4.1a

The Professional Teachers Council of NSW have three representatives on the governing board of BOSTES.

Recommendation 4.1b

The Professional Teachers Council of NSW be invited to nominate one or more representatives to serve on each BOSTES committee.