

The Mathematical Association of Victoria (The MAV), Submission to the Review of School to Work Transition

The Mathematical Association of Victoria (The MAV)

The Mathematical Association of Victoria is an innovative membership driven association. Through its programs and services, The MAV promotes the importance of mathematics to society. Our Association has over 1400 members from all sectors of education including individuals, schools, universities and other institutions. The MAV reaches up to 17000 people through its newsletter. The MAV has been an active not-for-profit professional Association for more than 100 years.

The MAV supports its members by working with experts including leading academics, education consultants, exemplary classroom teachers, the Victorian Department of Education, The Victorian Curriculum and Assessment Authority (VCAA) and industry partners to provide professional learning, resources and advocacy in the interests of members and the wider community. This highly respected, proactive professional association fosters the promotion of mathematics education.

Core Statement: Valuing mathematics in society

Mission Statement: The MAV is a membership driven association which provides a voice, leadership and professional support for mathematical education.

The MAV is an Affiliate of the Australian Association of Mathematics Teachers (AAMT).

www.mav.vic.edu.au

The MAV also supports the AAMT submission to this inquiry.

Introduction

As the workplace changes in a future where new jobs will be invented and other jobs will either disappear or be changed due to automation and other societal effects, it is essential that a close eye is kept on the factors that are required for a successful transition from school to work. The MAV in its work sees the effects of good mathematics teaching, learning and the impact this has on students moving to the workforce.

Mathematics is applied in most, if not all fields of employment, and is a crucial skill required for both university and workplace success. Student ability in and experience of mathematics education at school affects student career choices. The often-negative views of mathematics as a subject by society and factors like not having mathematics as a compulsory core subject at higher levels of schooling as compulsory, often lead students to avoid mathematics and therefore set themselves at a disadvantage from those who fully engage in mathematics at these levels in school.

Yet all students end up in workforce roles that require mathematics. It is therefore important that students are engaging with mathematics whilst studying it. The MAV has experienced while delivering its own programs to students, that students who work with industry in a contextual learning environment change their views on the importance of mathematics and their future career choices. The MAV recently ran a recent 'Girls in STEM' day¹ supported by industry partners, and the following are just some of the responses that were received by students:

'I found Mathematics difficult and couldn't really see why it was important in the long run. I was so wrong!'

'I have a real passion for science and would love to become a Geologist, so attending this event allowed me to see what kind of careers I can do in the scientific field.'

'Be prepared to give things a go, don't worry if you do not know what you want to do in a career, take time to find the thing that you are passionate about but keep on with your STEM studies.'

'The variety of careers, and understanding that Engineering is not just a few types, but many and varied. Use of Maths is important in those careers.'

(Source: MAV feedback survey 2017)

The MAV believes that making links from school to industry is highly important as students progress through their schooling. It allows them to make the connection from what they are learning at school to the world of work. More importantly it demonstrates that not just special programs like this Girls in STEM day are required, but how student are engaged in mathematics at school everyday is important. Alongside mathematical ability students need to see the uses, applications and contexts within which mathematics is used. Thus making the mathematics targeted and relevant to the students, and preparing them for the workforce better.

In applying such approaches, it is also important to also teach the skills required for the future, including communication, negotiation, team work, problem solving and critical and creative thinking. The work of The MAV supports the Victorian Department of Education and Training Education State Targets, including for example 'Learning for Life: By 2025 25 per cent more Year 10 students will have developed excellent critical and creative thinking skills'. These skills are crucial to workforce success.

There is an economic cost to not having students well prepared for work.

¹ For more information about The MAV's recent Girls in STEM day, see here:
<http://www.mav.vic.edu.au/student-activities/girls-in-stem.html>

1. Measurements of gain in school and how this contributes to supporting students to prepare for post-school education and training

Measurement of gain in schooling traditionally and currently culminates in exam based assessment with the exam often balanced against some school assessed course work component (such as in the VCE in Victoria). Such systems result in a score that is used to assess ability, but it is not believed that such scores duly demonstrate the gain that students make in school. Students develop a host of skills, subject and curriculum based, but also in other areas including problem solving and thinking skills, which underpin quality mathematical thinking.

A score based assessment does not support employers knowing what skills a student has that are applicable in the workplace.

The most recent report from the Foundation for Young Australians, *The New Work Smarts, Thriving in the new work order*² released in July 2017 indicates that:

- Today's 15-year-olds will likely navigate 17 changes in employer across 5 different careers.
- Automation is going to impact what we do in every job, in every occupation.
- The skills required for early-career jobs have already changed. With advances in technology, many jobs have traded some of their more tedious, manual tasks with tasks that people enjoy doing most, such as working with others and thinking creatively.

The New Work Smarts report describes the type of skills required as 'enterprise skills', although over the years they have had many names such as 21st Century skills. These enterprise skills are described as transferable skills including problem solving, communication, teamwork and creativity. These skills are vitally important to develop in students, and to measure or demonstrate 'gain', in order for students to be successful at work and employers to see what they are capable of.

A progressive mathematics classroom will develop such skills, while at the same time teaching mathematics curriculum based concepts. The MAV works with many schools in various ways, including but not limited to:

- its Maths Active Accredited Schools program³
- at its Annual Conference with over 1400 mathematics education professionals⁴
- by working directly with schools through consulting programs to enhance educational and numeracy outcomes,⁵ and

² Downloadable from <http://www.fya.org.au/report/the-new-work-smarts/>

³ For more information on mathematics Active Schools program see here: <http://www.mav.vic.edu.au/membership/maths-active-schools-2.html>

⁴ For more information on The MAV Annual conference see here <http://www.mav.vic.edu.au/conference/mav17-conference.html>

⁵ For more information on The MAV consulting program see here <http://www.mav.vic.edu.au/professional-development/in-school-consulting.html>

- using Special Partnership Program funding from the Victorian Department of Education and Training to support disadvantaged schools, including low SES (Socio Economic Status) schools, and regional schools including those with Indigenous students.

Through this work The MAV contributes to developing new approaches and best practice in this area and helping schools improve. Many schools are in dire need of support to transition their teaching and learning of mathematics to use approaches that ensure students are prepared for the future workforce.

In relation to preparing students for the workforce and ensuring gain in the required skills, an issue has been identified by many teachers, first year university lecturers, TAFE teachers and the Council of The MAV. The most popular subject in Victoria, Further Mathematics, (studied by approximately 30,000 students each year) allows calculators and student notebooks for all assessments which means that students can complete the course and achieve a high standard without basic number skill knowledge, which in turn results in many schools allowing their students to do all their Maths at secondary school with calculators. Hence, students are not using and consolidating a large part of the skills and knowledge set expected by industry, throughout their entire secondary schooling. The MAV recommends that all Year 11 and 12 subjects have both calculator and calculator-free assessments, to ensure students leave school with the basic number skill set desired by industry and tertiary institutions as identified in Tackling the School-Industry Mathematics Divide [Project Report Summary], p.1)⁶

The MAV have already mentioned its work above with Industry at the Girls in STEM day. The MAV also runs a mathematics camp program funded by the Victorian Department of Education and Training under the Strategic Partnership Program (2015 to 2017). The mathematics camp brings together high potential rural and regional students to experience what a career in some of the most exciting organisations in the STEM industry look like.

Students work in small groups to find a possible solution to a project problem. They receive daily mentoring by mathematicians and industry representatives. Students develop their project presentation and solution as a team, developing 21st century skills including communication, problem solving and creative and critical thinking. The open-ended projects stretch the application of mathematics past students' usual experience and challenge them to come up with innovative solutions. The week culminates in students presenting their project findings in the presence of the industry partners, invited guests and parents.

All participants visit each industry partner's facilities, and are exposed to mathematicians and STEM-based career opportunities providing motivation for future studies. In addition, they will undertake experiential activities, including Made by Maths App walks, visits to universities and presentations from professionals and academics with connections to mathematics.

⁶ Download here

http://www.aamt.edu.au/content/download/31676/446921/file/quantitative_skills_summary_v2.pdf

These programs linking with Industry have demonstrated the value that comes from schools working with industry, to directly demonstrate to students how the mathematics they learn in school can be applied to the workplace, in real world contexts. The type of feedback received includes:

2016 Student feedback: 76% of student respondents replied definitely and 19% replied yes to the survey question: "I felt the camp provided me with information that would assist me in making future career choices"

A number of parents have given us feedback since the camp letting us know their child's career decision has changed or been re-focused. They are more motivated at school.

(Source: MAV feedback survey 2016)

The MAV believes that schools need to change how they approach the teaching of mathematics, and other subjects to use similar contextual approaches through the curriculum, and then measure the various gains that relate to the skills required for the workplace including areas of numeracy.

With the current interest in STEM, industry is looking for partnerships to deliver STEM based programs. The MAV has found that the time is right for this and is exploring how to have impact in this area through further events and industry partnerships. Such programs can develop students in preparation for the workforce.

The Victorian Department of Education and Training alongside VET courses and certification, also offers a VCAL (Victorian Certificate of Applied Learning). The MAV recently consulted on the re-development of the curriculum for the Numeracy component of this course, and believe it takes a strong approach to ensuring students are developing relevant workplace skills in numeracy and mathematics. This is achieved in VCAL through contextualized learning of mathematics, within industry based contexts and ones that are specifically related wherever possible to student interests. As stated by the Victorian DET, *'The Victorian Certificate of Applied Learning (VCAL) is a hands-on option for students in Years 11 and 12. The VCAL gives you practical work-related experience, as well as literacy and numeracy skills and the opportunity to build personal skills that are important for life and work.'*⁷

The VCAL course is a unique opportunity for the whole of Australia to learn from this initiative that is all about preparing students for school to work transition. The courses measure the 'gain' students make, and preparedness for the workplace. The program includes information for employers taking VCAL students into the workplace, to support school to work transition.⁸

⁷ VCAL <http://www.vcaa.vic.edu.au/Pages/vcal/index.aspx>

⁸ VCAL Employer support: <http://www.vcaa.vic.edu.au/Pages/vcal/employers/index.aspx>

2. Opportunities to better inform and support students in relation to post-school education and training, including use of employment outcomes of students who undertake school-based vocational education or post-school tertiary pathways.

The MAV's work in linking with industry has had positive impacts in relation to the experience and information that students get around the real world of work. The MAV supports the work of AMSI (Australian Mathematical Sciences Institute) who also produce materials for showcasing and raising awareness of careers in mathematics.⁹ The MAV is now well placed to begin producing such materials subject to funding opportunities. It is vital part of the work required to not just demonstrate to students the opportunities available in mathematics related fields, but STEM generally.

The MAV encourages and recommends investment in this area, to help ensure parents and students are better informed of the opportunities in career areas that are the future of our economy.

The MAV also encourages greater accountability of universities and tertiary institutions to demonstrate that students offered places in courses have the requisite mathematical knowledge and skills to participate in the learning for their particular course. In Victoria, Mathematics is no longer a prerequisite subject for entry into University courses, even those subjects requiring substantial mathematical knowledge. Students are often advised on subject selection at school to maximise their ATAR score, at the expense of being prepared to undertake the mathematics required for success in many courses.

An MAV Council member who supports students at a university with mathematics across various courses, has found that up to 50% of students are failing some courses and/or subjects in courses because they do not have basic or requisite maths skills. This situation is not only devastating for the students financially but also with respect to their mental health, as they cannot continue with the course of their choice. Some popular courses, such as Sports and Exercise Science, Education and Business fall into this category and the experience of first year lecturers at universities now demonstrates that it is rare for students to be able supplement their maths knowledge to the extent required by the tertiary courses concurrently. Therefore they cannot complete their course of choice, even when only a basic level of Mathematics is required. Students in this situation are not being prepared fully for success in their studies or work.

With respect to Mathematics Education, The MAV's work is crucial in ensuring that graduated teachers are up-skilled and develop their knowledge and ability to deliver the mathematics required for future success at both university and in their work with students. The MAV runs a program throughout the year on Saturdays for teachers of Year 7 to 10 Mathematics who do not themselves understand the mathematics required to be taught by them. This group of teachers

⁹ AMSI <http://choosemaths.org.au/>

usually includes out of field teachers and recent graduates. The MAV would like to expand this program including to primary school teachers ensuring that primary students get the best start possible. If teachers are not adequately prepared to teach the content, how can students be prepared appropriately for the workplace?

It was mentioned that many students do not get appropriate advice at school in subject selection in relation to the subject knowledge that is required for success at further levels of study or use in the workforce. Much of this advice to students and parents comes from the Careers Counsellors in schools. Better careers counselling in schools and better dissemination of required knowledge to careers teachers is required to ensure that students make the right choices for success, and develop the required skills for school to work transition, and not just focus on achieving their ATAR.

3. Other related matters that the Committee considers relevant.

Working in areas of disadvantage is very important in terms of providing equity and ensuring all Australians receive the same opportunity to be prepared for the workforce. Schools may be disadvantaged due to many factors and The MAV observes this through its work. Groups of disadvantage that The MAV work with include:

- Low SES schools.
- Aboriginal and Torres Strait Islander peoples and Koorie students.
- Regional and rural schools, who the MAV would like to support further. This is challenging work as the cost of servicing rural schools to provide the same access to professional learning and development and other services for teachers is significantly higher than for those in metropolitan areas. Higher costs are due to travel and accommodation, salaries of staff to deliver this work taking substantial amounts of time allocation, and the smaller number of attendees per event that the MAV runs. Reaching all schools across the state equitably is very difficult.
- Schools that have trouble accessing qualified and/or experienced mathematics teachers. The proportion of maths teachers that are not maths-trained is high. The Australian Council for Educational Research, *Out-of-field Teaching in Australian Secondary Schools Policy Insights report (Issue #6, June 2016)* demonstrates those out of field, and so lacking content and pedagogical content knowledge is between 30-40% for Year 7-10 teachers. Students in these setting are not developing the skills and mathematical knowledge required for success in the workplace, and are disadvantaged compared to students who do receive instruction from qualified and experienced teachers. Therefore, addressing teacher supply in this area is crucial if equitable access to education is going to be delivered.¹⁰
- The Australian Council for Educational Research, *Out-of-field Teaching in Australian Secondary Schools Policy Insights report (Issue #6, June 2016)* indicates that rural and regional school have more out-of-field teachers than metropolitan schools, and with lower access to support and services such as those The MAV provides, these schools are impacted severely, disadvantaging their students further in being prepared for the workforce compared to metropolitan schools.¹¹

Differential support is required to ensure that disadvantaged students leave school and transition to work with equal opportunities as their peers. The MAV's work towards increasing the skills of school students is vital in setting them up for post-school success.

¹⁰ The Australian Council for Educational Research, *Out-of-field Teaching in Australian Secondary Schools Policy Insights report (Issue #6, June 2016)*

<https://research.acer.edu.au/cgi/viewcontent.cgi?article=1005&context=policyinsights>, page 3

¹¹ The Australian Council for Educational Research, *Out-of-field Teaching in Australian Secondary Schools Policy Insights report (Issue #6, June 2016)*

<https://research.acer.edu.au/cgi/viewcontent.cgi?article=1005&context=policyinsights>, page 11

Other useful reports for this Inquiry:

1. This document from OECD in 2014 is a useful reference point for this Inquiry in relation to vocation skills development and assessment:
<https://www.oecd.org/edu/skills-beyond-school/Skills-Beyond-School-Synthesis-Report.pdf>
2. Pages 19-21 of this earlier OECD report gives a summary of Australia's circumstances.
<https://www.oecd.org/edu/skills-beyond-school/LearningForJobsPointersfor%20PolicyDevelopment.pdf>
3. Pages 23-28 of this recent, local review discusses issues around professional development of trainers.
https://www.ncver.edu.au/_data/assets/pdf_file/0023/83570/The-Australian-literacy-and-numeracy-workforce.pdf
4. The recent joint industries survey by AAMT and AIG will offer important points for consideration, of course: *Identifying and Supporting Quantitative Skills of 21st Century Workers*. Refer to the AAMT Submission.
http://www.aamt.edu.au/content/download/31676/446921/file/quantitative_skills_summary_v2.pdf

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