

in alliance



in this issue

Engaging Girls in STEM

2013 Student Leadership Conference

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**In Alliance
Editorial Deadlines**

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Theme: *Mentoring and
developing women leaders in
our schools*

Articles and photographs should
be emailed to the Editor at
jbutler@agsa.org.au

From the President...

Robyn Kronenberg



This issue of *In Alliance* we look at some of the issues related to girls participation in STEM. Statistics show that girls' participation in the STEM areas is significantly greater for girls educated in girls' schools but even so the participation of girls in STEM in general is worryingly low. To quote from Kate Broadley's research article:

We need girls to follow the path of Nobel Prize winner Elizabeth Blackburn – the first Australian woman to win the prize – so that there are fewer 'firsts' for women in STEM. Engaging girls in STEM is vital and valuable, particularly for educators in girls' schools.

There are some great examples of what member schools are doing in this area and I hope that you enjoy reading this edition of *In Alliance*.

Our Student Leadership Conference held in January at Women's College at the University of Sydney was once again an outstanding success for the 160 student leaders who attended the week long program conducted by Rising Generations. Next year the SLC will again be conducted by Rising Generations but will be held at Bond University on the Gold Coast. This year Bond University joined the Alliance as a partner and part of their support is to host the SLC next year. Another initiative of this new partnership is our inaugural conference aimed at middle managers in our member schools, *Developing Today's Leaders for Tomorrow*, which will be hosted by Bond University from 30 to 31 May in conjunction with our sponsor CIRCLE. The broadening of our services through partnerships with our sponsors, World Challenge, CIRCLE and Bond University, is one way that the Executive is working to further benefit our members.

Ros Curtis, Principal of St Margaret's Anglican Girls' School, joined the Executive this year as the Queensland representative, replacing Amanda Bell, who has taken up the role of Principal of Women's College at the University of Sydney. The Executive is currently working on our strategic plan for the next three years and feedback received from the member survey last year will guide the directions to be taken. The presentation given to the Queensland branch last year by our researcher, Kate Broadley on her work for the Alliance was very well received and the Executive has consequently agreed to sponsor Kate's visit to other branch meetings. I hope you get a chance to hear Kate talk about her work and her findings on the education of girls in girls' schools.

This year the Annual General Meeting will be held at Bond University at 5:15pm on Thursday 30 May. All member schools are invited to send a delegate to this meeting which will be held during the middle managers conference. I will complete my term as President and Tasmanian Branch representative at the AGM and I thank all members of the Executive and Jan Butler for their commitment and support during my term as President.

Robyn Kronenberg



Robyn Kronenberg with speaker Mel Irons and Adriana Taylor MLC at the Hobart International Women's Day Breakfast

FOR YOUR DIARY
Visit the website for more details

30 May 2013	Alliance AGM, Bond University, Gold Coast, Qld
30-31 May 2013	Alliance Middle Managers' Conference, Bond University, Gold Coast, Qld
24-26 June 2013	NCGS 2013 Annual Conference, <i>Launching Future Leaders: Preparing Today's Girls to Shape Tomorrow's World</i> , Dana Hall School, Wellesley, MA, USA
15-19 January 2014	Alliance Student Leadership Conference, Bond University, Gold Coast, Qld
25-28 May 2014	Alliance Biennial Staff Conference, <i>Creative Girls, Creative Women</i> , Amora Hotel, Wellington, New Zealand

From the Editor...

Jan Butler



Today we are celebrating the 50th issue of this magazine, *In Alliance*. 22 years ago, the Alliance began in Victoria as *The Education of Girls in Girls' Schools Focus Group*, four years later became the Alliance of Girls' Schools Australasia and has gone from strength to strength, adding first New Zealand members and then Hong Kong, Singapore and recently members from the Philippines. We also have a South African member, and maintain valuable and warm relationships with similar organisations in South Africa, the UK and USA.

Pictured at right is a snapshot from the first issue of the magazine, in December 1995 which contained an interesting survey on Alienation and some comments about the image of women as portrayed in the media – suggesting not a lot has changed over the last 17 years. You can read the entire article by downloading Volume 1 from the Alliance website – click on Publications.

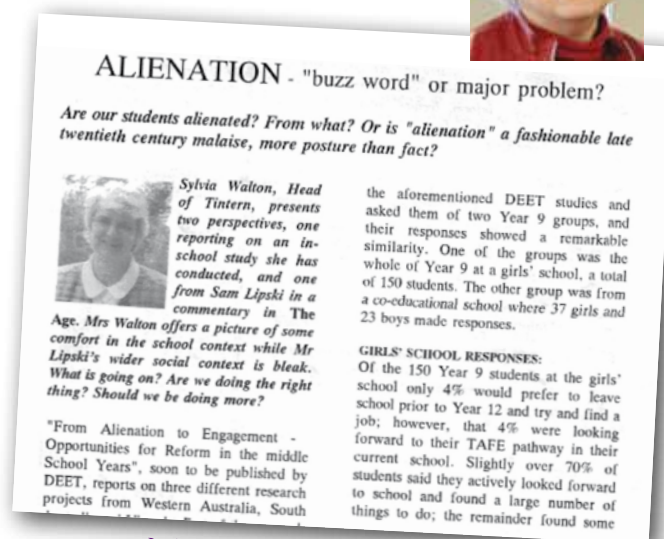
We now have three very supportive partners: World Challenge, CIRCLE and more recently Bond University. Thanks to their generous financial support, we have been able to reduce our fees for the 2013-2014 subscription year to \$980 plus GST, less than the original fees when the Alliance began. We can do this and still continue to improve the services we offer to our members, with the addition of a Middle Managers' Conference being hosted by Bond University in May.

We encourage you to seek out and support these valued partners in return.

The wonderful point of difference of the Alliance from similar organisations is that we are cross-sectoral and welcome membership from any school that educates girls only, regardless of whether it is a catholic, government or independent school.

The collegial network of heads, staff and students of Alliance schools is a welcoming, nurturing organisation, working to advocate for girls' education in girls' schools as the best way to prepare young women for their future as leaders and contributors in society and to support the educators of girls in Alliance schools. We are grateful to those early Executive members who had the foresight to begin the Alliance.

It is not always widely known that although the school holds the



In Alliance magazine, Issue 1, December 1995

membership of the Alliance, through the Head, every staff member of that school is also a member and is eligible for membership rates for Alliance conferences and events and for those of our affiliate organisations such as the National Coalition of Girls' Schools in the US.

This magazine serves as a forum for member schools to share their programs and successes with each other as well as to inform with the latest research on a given topic, summarised expertly by our Researcher, Kate Broadley, in our regular Research Review that you will find in the centre of the magazine. All members can access the magazines in PDF format on the website and we encourage you to make these available to members of your school communities.

In this issue we have a record number of articles contributed by Alliance member schools about how they are *Engaging Girls in Science, Technology, Engineering and Mathematics (STEM)*.

We hope you find it interesting reading.

Jan Butler

2013 marks the 10-year anniversary of World Challenge Australia! Originally founded in 1987 in the UK, no other company in the world has organised as many overseas expeditions for schools. World Challenge is not just an amazing trip to another country, but a developmental journey of self-discovery, friendship and life-long memories.



To celebrate, World Challenge is offering school leavers a unique opportunity to mark the end of their final studies with a journey of challenge, discovery, friendship and celebration. As a positive alternative to a typical 'schoolies' or 'school leavers' trip, students will spend 10-days living and working in a local community in Cambodia. This opportunity will give the students a chance to experience life in the developing world by engaging in a sustainable community project and immersing themselves in local culture, all while having the freedom to take ownership and shape their own experience.

To learn more about World Challenge please visit www.worldchallenge.com.au or phone us on 1300 728 568.

The mathematics of the transit of Venus

Betina Wrightson, Head of Mathematics, Abbotsleigh

The passage of Venus in front of the sun is among the rarest of astronomical events. It is rarer even than the return of Halley's Comet every 76 years. On 6 June 2012 people around the world turned their attention to the daytime sky to make sure they caught a glimpse of this natural phenomenon. Since this was only the seventh transit visible since astronomer Johannes Kepler first predicted it in the 17th Century and it is not to occur for another 105 years, the Mathematics Department at Abbotsleigh decided it was a special event that they too wanted to explore. Moreover, they decided it was a perfect way to demonstrate the practical application of mathematics to Year 10 students.

With the help of surveyors from the University of New South Wales, a day was designed by the Mathematics Department with many hands-on and theory-based activities designed for the students.

The activities that the students were involved in were many and varied. They included:

- Using the transit to measure astronomical units
- Angular measurements in astronomy
- Mapping activities involving the *miniCAD* and scale maps.
- Using surveying equipment (including laser distos and GPS) to map out the school lawn.
- The mathematics behind transits, brightness changes, star sizes and fading
- Planet periods and orbit distances
- Constructions of ellipses using the auxiliary circle.
- Construction of a scale model of the solar system
- Spreadsheet activities to calculate orbital distances and transit frequency
- Exploring the patterns of past transits using *Geogebra*.

The day and follow-up lessons were well received by the students. Like 17th Century astronomers, the girls were able to use actual transit of Venus information to calculate the distance between the Earth and the sun. They were able to translate the information with the help of trigonometry and make sense of the size of our solar system. As one student stated "It was also one of those events that sparked my curiosity about the universe and our place in it. It definitely will be one day I'll never forget."



Students also took turns peering at the sun through telescopes with special filters. Additionally they were also given solar-filter eyewear to view the transit when they had an opportunity.

Shouts of "I can see it" echoed throughout the school grounds as delighted students and staff were able to witness the transit first hand.

Seeding the next STEM generation

Nene Macwhirter, Deputy Principal and Head of Senior School, Lauriston Girls' School

Women have made great progress in education and the workplace during the past 50 years where we have seen that even in historically male fields such as business, law, and medicine, women have made impressive gains. In science, technology, engineering, and mathematics (STEM), however, women's progress has been slower. Why are so few women becoming scientists, mathematicians and engineers?

Here at Lauriston we have found it especially puzzling that the enormous interest in Health Sciences doesn't carry over into the physical and technological sciences – we have lots of Lauriston graduates training to be doctors, dentists and physiotherapists, for example, but very few physicists, engineers and software programmers. It is not simply a gender issue; there is wider social concern about the diminishing numbers of graduates in these areas at a time when technology is becoming increasingly important in all of our lives.

So what to do about this deficit?

“One of the largest gender differences in cognitive abilities is found in the area of spatial skills, with boys and men consistently outperforming girls and women. Spatial skills are important for success in engineering and other scientific fields.” (Hill, Corbett & Rose, 2010) Research highlighted in the recent AAUW (American Association of University Women) research report *Why so few?* documents that individuals' spatial skills consistently improve in a short time with a simple training course. If girls grow up in an environment that cultivates their success in science and maths with spatial skills training, they are more likely to develop their skills as well as their confidence and consider a future in a STEM related field.

Lauriston's Junior School (Years P – 6) has led the way in initiatives in these areas: Lauriston was the first school to trial Young Australian of the Year 2012, Marita Cheng's *Robogals* program which has now become an internationally acclaimed organisation for involving young girls and women in robotics and other applied sciences.

For the Preps, Year 1 and 2s, tinkering tables are provided to inspire and give confidence to budding scientific minds. The girls in Grade 4 have a technology day each year which is spent building and testing a variety of machines made from wood, metal and plastic, and they are encouraged to extend this interest with a 'tinkering lunchtime' once a month in our Junior Science room. Senior school science and maths teachers have also worked closely with the Junior school teachers over the last few years to develop curriculum and pedagogy in a range of science disciplines, as well as providing extension mathematics to talented primary students.

A STEM Teacher Learning Group

At Lauriston, we have voluntary Learning Groups for like minded teachers to join together to pursue an area of interest based on teaching and

learning. In 2012 we began a Learning Group focused on STEM, headed by our Head of Science Faculty, Di Wood, and our Head of Mathematics Faculty, Pauline Holland. The group brainstormed ways to raise awareness of STEM and to highlight STEM education and careers pathways by providing positive role models, as well as integrating knowledge and experiences from the wider Lauriston community. They soon identified the need to provide girls with opportunities to develop their spatial skills by encouraging them to play with construction toys and 3-D computer games, and to experience hands on application of planning, drafting, and mechanics.



STEM initiatives

In November 2012 the STEM Learning Group developed two days for students in Year 7 to envisage, plan and execute a practical model of their own creation. The model had to incorporate an electrical device, a mechanical device including both gears and levers, and hydraulic or pneumatic movement in a machine that could perform a task. In order to achieve the brief each part had to interact with another part.

Imaginations were fired via a presentation from Norm Stephens, a regular hands-on technology facilitator at the School. *Thoughtworks*, a community of passionate individuals whose purpose is to revolutionise software design, creation and delivery, while advocating for positive social change, sent six young people to direct a one hour session on working as a team and to carry out associated activities with the girls. Dr Bernadette Sinclair, from the Faculty of Science and Technology at Deakin University, judged the final presentations. Also facilitating the building phase off the project were two female engineering students, providing great role modelling to the girls.

Where to from here?

The STEM Learning Group is already planning ways in which last year's Year 7 experiences can be capitalised on in the girls' regular science and maths classes as well as outside the curriculum. Lauriston will also include a Year 10 STEM elective in the second half of this year, in addition to our Maths problem solving elective, which has a very good student take up. Consequently, more hands on curriculum is being developed including robotics, Ti inspire materials, and guest scientists and engineers from within and outside the Lauriston community. Hopefully we can turn around the question 'Why so few?' into 'Wow, look how many girls are taking up careers in Science, Technology, Engineering and Maths!'

Reference

Hill, C., Corbett, C., & Rose, A. (2010). *Why so few? Women in Science, Technology, Engineering and Mathematics*. Retrieved from: www.aauw.org

Engaging girls in STEM at Ascham School

Victoria Harper, Publications and Marketing Coordinator, Ascham School

Engineering may not be on the curriculum, but Ascham students have shown how their studies in Science and Maths have prepared them well for problem solving. In 2011 Ascham's Maths Engineering team's preparation for the annual Tournament of Minds Competition resulted in spectacular success. The team won the first division, district level at the Australian Catholic University, beating ten other schools by preparing a piece to 'Raise A Wairness'. As part of their work they built a crane (up to 100gm) out of only paper and glue which managed to lift 1.7kg! Subsequently the team won at the regional level after six weeks of preparation on their crane and exploring how it could be used to save an endangered species.

The girls from the team reported in Ascham's eNews:

In the engineering section we were required to create the crane that was to lift this species. The trick was that it was to be made purely out of paper and glue that was to hold a weight of as many grams as possible. After weeks of preparation and thinking, we managed to create a finished performance with set, costumes, a script and of course a finished crane. On the day our paper crane managed to lift a huge 1.7kg. We were all very excited to find out that our team was the overall winner of the day, which means we now continue to the next level.

They then went on to win the state final, outsmarting the top ten teams from across NSW. The team consisted of girls from Years 7, 8 and 9 whose critical thinking skills were guided by Science teacher Mitchell Thompson. In all stages of the competition the girls showed their ability to respond quickly to problems and to solve them with ingenuity. The teamwork skills gained and the rewarding experience of the process engaged them fully. Their excitement in their learning is well illustrated in their report for the school's newsletter:

On Sunday, seven girls from Years 7-9 arrived at UNSW at a ridiculously early hour, fuelled by high levels of excitement and anticipation. We began the day impatiently waiting in the main theatre, anxious for the day to begin. However, once we were off with our supplies and supervisor, the nerves began to kick in. With three hours of preparation awaiting us, tension was running high. Once we were into it, however, the challenge proved, well, challenging! We worked very hard for the whole time allowed, but not without a few pieces of caramel slice and a few harsh words between the team. Our challenge was to sort three valuable objects from rice without touching them (the Maths Engineering aspect.) We had to explain the significance of these objects, why they needed to be sorted and who the sorters were. After three frantic hours, we were able to see the work of every other Maths Engineering team in the state. We were very impressed with some performances and every team, from the 11 regions who made it to the state level, should be commended. However, in the



judge's opinion, our performance demonstrated the best solution to the challenge.

As the presentation commenced, nerves were high. After the announcement of the two teams who achieved 'Honours', we were disappointed and worried. When they announced the winner was Ascham, we could not have been more excited. So much hard work for the entire term had gone into TOM and we were thrilled with the result. We are looking forward to the Australian Pacific final next term in Hobart. We must thank Mr Thompson for his constant support throughout this process and for giving up his weekends for us, whether it be helping us prepare at school or arriving at a competition early on a Sunday morning. A huge thank you must go to the team, who has made all of this possible and a great experience: Xanthe and Lucca, for their engineering expertise, Coco and Portia for their speedy poetry writing, Antonia for her provision of amazing caramel slice, Victoria for her realistic costumes and Sophie for her organisational skills and keeping the whole team on task.

TOM has been a very rewarding experience for all of us. It has taught us great teamwork skills, how to think on our feet and how to resolve problems that arise. It has been a fantastic experience and one we will never forget.

The girls went on to represent NSW in the Australasian Pacific Final held in Hobart late in 2011.

The percentage of Ascham girls in senior years studying the higher levels of Science and Mathematics subjects is generally double the state average. Ascham's rigorous approach to learning coupled with the fun and achievement of co-curricular activities has led to a strong level of engagement in the STEM subjects.



Engaging girls in the narrative of STEM education

Clayton Kelly and Lakshmi Mohan, Clayfield College

“If you want to learn about nature, to appreciate nature, it is necessary to understand the language that she speaks in.” – Richard Feynman

STEM (Science, Technology, Engineering and Mathematics) education looks to interpret the language of nature and give students the ability to engage in its dialogue as future citizens. As such, immersing students in the ‘narrative’ of nature is a goal of STEM Education at Clayfield College; connecting them to the evolving story of science and society. Every student has their own story, and actively seeking ways to encourage this story makes STEM subjects accessible and engaging, aiding the transition between *knowing* and *telling* (Avraamidou & Osbourne, 2009).

A good narrative, much like an effective scientific method, incorporates key components such as purpose, events, agency, a narrator and a reader (Norris, Guilbert, Smith, Hakimelahi, & Phillips, 2005). In the senior sciences, opportunities to afford such components are sought out as contextual units are devised. Each unit begins with a ‘big question’ such as ‘Can a school be powered by students?’ in the hopes of connecting all learning experiences back to a central narrative as students find their answer to this question. Learning experiences such as thought experiments, excursions and project-based learning are designed to help facilitate such discussion.

The narrative of Science sees topics such as gravitation and radiation become an element within the story of energy, also showing how conflicting opinions and theories have become resolved through scientific history in the pursuit of understanding. Excursions are sourced to bring the student into the audience of this story such as night-time trips to the observatory, collecting data whilst on rollercoasters at Dreamworld or participating in the *Women in Physics* lectures organised by the Australian Institute of Physics. Each student brings unique personal, spiritual and cultural back-stories to the evolving story of the Universe, and helping students to resolve these through the shared narrative experience is a powerful tool for affording purpose and engagement in the classroom.

Of particular importance to girls in this narrative is to present opportunities for purpose and agency, and project-based learning is an effective vehicle to both. Every school student will need to be a part of the solution for the impending energy crisis, so specific topics are run for students to give them a working understanding of energy, efficiency and the future of fuel.

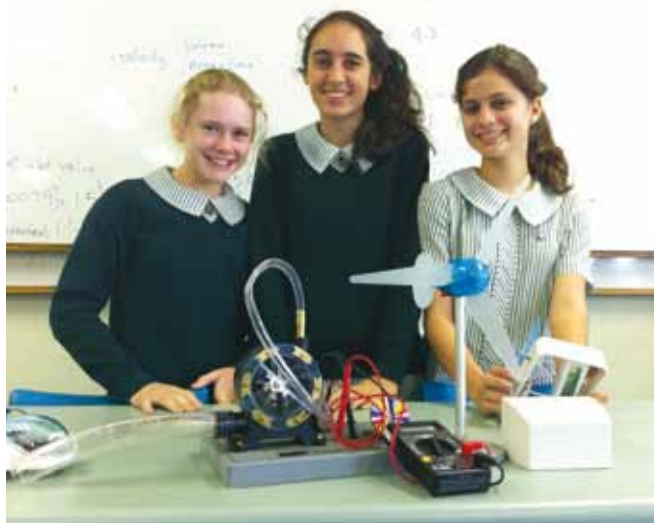


Chemistry is used as a link between the disciplines as students recognise the purpose that it serves in resolving fundamental environmental issues such as the pollution of our rivers, protection of valuable marine structures and the search for alternate fuels.

Open-ended projects related to fuels as well as other energy sources are offered and students are asked to make creative and innovative conclusions linking the past, present and future of our energy story as a local community. Awareness campaigns, reports to college leadership and personal pledges are made, extending students to take on a role as narrator in the story of energy and develop future strategies. Giving students ‘voice and choice’ as they prepare their projects helps to drive much-needed purpose and agency throughout the STEM education process.

The Bring Your Own Technology (BYOT) Program implemented at Clayfield College has also helped interpret the language of nature, calling on devices from the students’ own lives to assist them bridge the gap between knowing and telling. With the introduction of these new tools, emphasis is taken off computation in the classroom (much like it has been in industry), and shifted instead to utilising more robust skills such as translating a problem to a mathematical form and interpreting the result (Wolfram, 2004). Such a move gives more immersion to students within the dialogue of future problem solving, allowing them to recognise mathematics as a vital interpreter to facilitate this narrative.

Students at Clayfield College have appreciated the practical and project-based opportunities offered through this program, recognising and engaging with the purpose and agency it affords them. From unprecedented interest in extra-curricular STEM lectures and excursions to the pride students place in their publically-presented projects, there is a genuine buzz within the community as students engage in the STEM narrative. These benefits will hopefully translate across disciplines and into the future as students use the natural language they have developed to engage in innovative and creative strategies for future problems.



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Loreto girls reach for the stars in STEM

A group of Loreto College Marryatville students, representing one of only four schools in the world, has had the opportunity to share their ideas in addressing Australia's future water security in front of world leaders participating in the Rio+20 summit in Brazil. The opportunity was made possible as part of the SCEnaRios Water and Life pilot project - a partnership between Questacon - Australia's National Science and Technology Centre, Guangdong Science Centre, China and Science Centre Singapore.

As part of the project, the girls were involved in a series of international video conference forums with students from China, Singapore and Canberra to discuss issues, share ideas and aspirations around future water security. As well as dedicating their own time on Saturdays to take part in the video conferencing, the girls created their own project to address water security in Australia.

With South Australia's dependence on the Murray River, the girls' focus on the Murray's water scarcity issues involved a community approach as they created their own awareness and education campaign starting with the College's Primary Years' students.

The project is just one example of the way Loreto College Marryatville tailors its learning in STEM subjects, a traditionally male-oriented field, to how its girls learn best. This has led to many successes for its students including old scholar, Alyssa Fitzpatrick ('06) who was recently

announced as the 2013 Rhodes Scholar of South Australia. Alyssa recently completed a Bachelor of Medicine/Bachelor of Surgery and is currently undertaking an internship at the Royal Adelaide Hospital before travelling to Oxford University to complete her Masters in Global Health.

While there are many stand-out achievements, nurturing a love of learning in STEM at school is just the start on a journey to success. From Reception, early engagement cultivates a lifelong love of learning in STEM which is nurtured throughout the middle years and into the senior years. Loreto College Marryatville Principal, Mrs Rosalie Gleeson, said the key to ensuring retention in STEM is to encourage students to engage with these subjects.

"It's not only what you teach but how you teach that really makes a difference in truly engaging students," Mrs Gleeson said. "Research clearly points to the higher levels of success in STEM subjects in all girls' schools; however, at Loreto Marryatville we find it's the way the students are able to form their opinions and experiences of STEM every day that makes the biggest difference.

"As an IB World School, we take every opportunity for the girls to be hands-on and to also look for the creative applications of STEM, both within and beyond the classroom. Our focus is on developing inquiring, open-minded learners by providing opportunities to see, opportunities to do and opportunities to experience - all injected with a healthy dose of imagination and creativity."

"Our focus is on developing inquiring, open-minded learners by providing opportunities to see, opportunities to do and opportunities to experience - all injected with a healthy dose of imagination and creativity."



Briar Standing, Marketing Manager, Loreto College Marryatville

Loreto College Marryatville has launched its students into virtual reality space through performances in the Adelaide Fringe Festival, and welcomed the Maths Man - a comedian who combines stand-up comedy with Maths as well as using Mathematical applications in Art. In addition, the College has taken part in industry-led workshops such as interactive biotechnology workshops, welcomed industry-leading guest speakers and taken part in the CSIRO's *Lab on Legs* program for the junior primary students.

Beyond the opportunities to see, middle and senior students are given a multitude of in-classroom tasks. These include building and programming robots, producing short movies and designing multi-page websites, while junior students enjoy getting tactile with new technology as well as using an outdoor learning classroom to learn about forces of nature, conduct experiments and observe the outcomes each day.

When combined with the many co-curricular activities such as the SCEnaRios Water and Life pilot project or the Oliphant Science Awards, the program provides broad opportunities to assist the girls to understand, appreciate and be excited about the infinite possibilities within the STEM realm.

Mrs Gleeson feels the greatest gains in promoting women in STEM are made through embedding STEM into the everyday activities both inside and outside the classroom.

“One of the many, great aspects of an all-girls environment is that our students don't have to combat gender stereotypes. This not only provides opportunity but empowerment too; our girls are empowered to achieve and grow in an environment where possibilities are endless and they can reach their full potential.”



Nurturing STEM from an early age at Mentone Girls' Grammar

At Mentone Girls' Grammar School, we are working to positively influence our students and create a culture of engagement and excellence across the STEM areas of Science, Technology, Engineering and Mathematics.

In order to achieve this, we believe it is vital to nurture STEM inquiry from a very early age, which for us begins in our Early Learning Centre (ELC). Across our ELC and Junior School, we incorporate the fundamentals of the International Baccalaureate (IB) Primary Years Programme (PYP) with the scope and sequence of the Australian Curriculum. In this way we provide an engaging, relevant curriculum that uses an inquiry-based model of in-depth investigations, which is particularly relevant for the way in which girls learn. We also use our single campus model and the strong relationship we have between Junior and Senior Schools to ensure our junior students benefit from our dedicated facilities and the extensive knowledge of our specialist STEM teachers.

In our ELC, we engage our young learners with basic numeracy skills and scientific concepts through our play-based curriculum. We immerse students in experiences which enable them to question, collaborate, think critically, problem solve, communicate and discover new knowledge: the essential building blocks for developing inquiring minds. Students explore materials and events, ask questions, investigate, record and represent their work, reflecting on what they have done and what it means. This allows them to create new theories or ideas about how the world works.

Through this process, our highly skilled Early Years teachers observe the interests of the students and the STEM inquiry develops as a result of their questions. Using different aspects of the curriculum, we work to build our students' understanding of key concepts

"We provide an engaging, relevant curriculum that uses an inquiry-based model of in-depth investigations, which is particularly relevant for the way in which girls learn."

and answer their many questions about the world. For example, when using yeast to make pizza during a cooking lesson, we talk about what it does and how it works. We plant daffodil bulbs to understand how plants grow and put the cut flowers in coloured water to watch the petals change colour to help students understand the essential functions of roots and stems in plant growth. Other such explorations might include playing with magnets to discover the concepts of magnetism and opposing forces.

Our STEM journey continues as we further use inquiry as a tool for scientific understanding and at Year 3 this informs an important part of the curriculum. Students undertake their own research problem and conduct experiments to demonstrate scientific principles. For example, students undertook a study of microorganisms by designing experiments with single variables. They then developed a hygiene plan for the School which demonstrates our approach to encouraging real world applications of science. The PYP based inquiry into 'Sharing the Planet' further explores the responsibility of individuals, community and government for the conservation of species. In 2012, Year 3 students began a new inquiry to explore 'How the World Works'. Through this Unit, they explore how scientists generate new knowledge and build on existing knowledge. By exploring the physical sciences of Chemistry, Physics and Astronomy, students are able to understand and evaluate new scientific knowledge. At

the culmination of the unit, the girls present an experiment to demonstrate a key scientific principle that is used by professionals in their every day work. This learning expands into the EnviroKids program at Year 4, where students take a great interest in environmental issues and sustainability and where we make particular use of our unique beachfront location and our 'Classroom by the Bay'.

In Years 5 and 6, students explore key scientific concepts through formal science classes taught in our dedicated laboratories by expert teaching staff from our Senior School. Our Senior Head of Science has created a novel program of scientific inquiry for our

junior students called 'What If' that encourages students to explore and question their experiments and their results in such a way that prompts them to develop a genuine understanding of the scientific principles involved. The students also influence the curriculum through their own interests and questions, which then form the basis for further investigation and experimentation.

These specialist science classes are enhanced by classroom units based on the world of inventions, technology and simple machines. Students learn a new way of thinking and how to use technology safely. They study engineering principles, as well as design and construction concentrating on the development of fine motor skills, focus and concentration, and understanding the



Looking through a solar scope at the recent Transit of Venus



Winning entry (Artistic section) in the Junior section of the CANstruction Engineering competition held in Melbourne and the QR Code that they created.

Try it!



conceptual world. Through our Year 5 Invention Convention, students are required to create a simple machine which includes an explanation of their invention process from blueprints and prototypes to design and construction. They use pulleys, switches, levers and basic circuits to 'solve' or 'streamline' everyday household activities.

Further examples of real world applications of STEM include our Year 6 students running experiments on how to make yeast grow well (including using vitamin C) and then completing the journey by making bread. Year 7 students are undertaking tests on local waterways, including the beach, and putting their results online so that they can be shared and compared with students in other countries. Our Year 10 Astronomy students are also communicating regularly with Astronomy students in Vienna, Austria.

In Mathematics, we have explicit teaching of mathematical concepts every day across the Junior School, as well as a range of specialist numeracy programs, such as financial literacy, where students study many concepts from consumerism and product development, to profit and loss, and marketing.

In the Senior School, we continue our extensive STEM program with a range of offerings from Year 7 through to VCE. Subjects vary at different year levels from Human Physiology and Disease to Marine Studies, Accounting, Economics, Mathematics, Science, Chemistry, Biology and Physics, as well as technology based units such as Interactive Digital

Media, Food and Technology, and Visual Communication and Design. In our School, the numbers of students undertaking STEM subjects is a testament to the teaching and interest we have built in this area. Around 66% of our VCE cohort this year is taking at least one Mathematics subject, together with at least one other STEM-related subject. Over 40% of our 2012 cohort has also chosen STEM-related tertiary studies in myriad courses from Medicine, Emergency Health, Biomedical Science and Psychology to IT, Systems, Engineering, Game Design and Computer Science.

Our SAIL (Supporting Advanced & Independent Learners) program also provides extended STEM activities for advanced students who have a particular passion for these areas of inquiry. Students participate in challenges and competitions that accelerate their knowledge and learning. Activities range from the international CANstruction Engineering competition, to the Da Vinci Decathlon, ICAS International Science Competition, Mathematics Challenge for Young Australians, and The Siemens Science Experience.

At Mentone Girls' Grammar School, we engage our students in an inquiry-based STEM program that is age and stage appropriate and builds in complexity as students progress through the educational journey. By doing so, our aim is to 'stem' the significant attrition rate of young women from STEM related careers that exists worldwide.

Institutionalising STEM for girls at Miriam College

Dr Edizon A. Fermin, Principal, Miriam College

Miriam College, currently the only Alliance-member institution from the Philippines has recently adopted STEM as a new focus of its institutional strategic plan. With the strong belief that young women can excel in STEM in order to contribute to nation building and international development, it followed a four P's approach towards institutionalising this focus.

The four P's – program, people, processes and systems, and physical plant, form the pillars of the Miriam College institutional strategic plan for 2011–2016 under the helm of its President, Rosario O. Lapus. Through this planning approach, Miriam College aims to create a learning environment that enables its learners to embrace STEM in their everyday lives.

A central feature of the program development focus is the continuous effort to design or enhance programs to keep girls and young women curious, creative, and competitive. These programs include: the adoption of a thematic and activity-based curriculum at the Child Study Center, the provision of Skills Training in Developing and Enhancing Math, English and Science (STRIDES) in the Grade School, the introduction of the tablet PC as a learning device, and robotics in the High School. In order to sustain program development, partnerships were established with institutions promoting STEM for women such as the National Coalition for Girls' Schools (NCGS), Alliance of Girls' Schools Australasia (AGSA), Department of Science and Technology Science Education Institute (DOST-SEI), and a Philippine party list organisation called Agham (the Filipino term for science).

To address the people development focus for the STEM-oriented programs, the institution has rationalised its faculty development program to ensure that instructional managers, materials developers, and assessment specialists are provided with opportunities for intensive training. To date, the institution has already sent a number of STEM faculty members overseas to upgrade their competencies and to be updated concerning STEM directions in international education. School leaders also maximise learning sessions and meetings in order to create an integrated framework for communicating the school's STEM focus to the public.

A review of internal school processes and systems in support of STEM was also completed at all levels. Management of academic contact time, particularly regarding extended laboratory work, hands-on learning, and assessment of learning, has been significantly enhanced to support a renewed focus on STEM. While attending to the needs of learners with higher aptitude in STEM, the school sees to it that those who have special needs in terms of pacing, scope of study, and level of performance are

Welcome

The Alliance welcomes Miriam College as its newest member and the first from the Philippines. It was a special pleasure to have two girls and two staff members from Miriam College attending the Student Leadership Conference in Sydney in January 2013.



Teachers Nancy Roman and Maria Luella Tampico

also attended to. A system of identifying STEM scholars has also been developed in order to reward learners and ultimately, their parents who nurture their desire to excel in these fields.

Finally, much has been carried out by the school in terms of physical plant and resources development to support its STEM focus. We recently opened a Science Garden that serves as an open classroom for active learning and scientific explorations. At this special laboratory, students learn about the interaction of STEM fields through topics such as urban gardening, vermicomposting, and hydroponics.

In implementing the four P's towards STEM at an institutional level, Miriam College has identified five key principles. The institution hopes to encourage young Filipino women to become leaders in STEM.

1. Collaboration. Knowing that girls work best using their social skills, we will provide opportunities for collaboration and teamwork, encouraging them to share ideas and develop solutions together.
2. Encouragement. Raised expectations coupled with consistent praise and positive feedback for each thought-provoking question asked, for thinking out of the box, or for a problem successfully solved will go a long way in boosting a girl's confidence and performance in STEM.
3. Engagement. STEM subjects must be taught in the context of real life situations so girls can easily make the connection between what they learn in class and its application in the real world.
4. Creativity. Our students should be encouraged to approach projects using their own creativity, talents and learning styles.
5. Inspiration. Exposure to women role models who have made an impact in the fields of STEM not only inspires girls and young women but presents them with possibilities of who and what they can become in the future.

For more information on Miriam College's STEM initiatives, visit www.mc.edu.ph/STEM.aspx



Captains at the CUBE in Brisbane

Dr Deborah Priest, Head of Moreton Bay College



Recent research undertaken in England and America mirrors concerns in Australia regarding the low participation rates of girls in the tertiary study of physical sciences and technology (Archer et al., 2012; Barton et al., 2013; Fergusson, Oliver & Walter, 2012). The English study suggested that girls as young as 10 years of age develop identification patterns with science careers and suggested that educators should broaden girls' exposure to science careers in the early years of primary schooling (Archer et al., 2012). The authors of both the American and English studies argued that at this age girls associate science with cleverness and masculinity, all at a time when, developmentally, pubescent girls are beginning to identify with their own sense of femininity. They suggested that the dominance of male stereotypical role models of scientists portrayed in the media works against educators trying to feminise science in order to attract girls to take subjects such as Physics and Information Technology in their secondary phase of schooling (Archer et al., 2012; Barton et al., 2013).

Ferguson et al. (2012) suggested that girls may not be choosing to study science because of the disparity between how science is portrayed at school and how it is practised by adults in scientific careers and research. The authors suggested that engaging students in the contextual learning of science based on authentic activities, such as astrobiology, may improve girls' understandings of the nature and processes of science from an early age. The Queensland University of Technology (QUT) in Brisbane is working to address these issues with the completion of their latest Science, Technology, Engineering and Mathematics focus building called *The CUBE* that has been designed primarily for primary and secondary students in Queensland.

On Saturday 9 February 2012, the Moreton Bay Colleges and QUT hosted a College Captains' CUBE Experience followed by dinner with the Governor General and Patron in Chief of the Alliance of Girls' Schools, Her Excellency Ms Quentin Bryce, at Old Government House in Brisbane. Captains from Brisbane's leading independent schools were invited to have exclusive access to one of the world's largest digital interactive learning spaces dedicated to inspiring the next generation of scientists. Dr Deborah Priest, Head of Moreton Bay College (MBC) and co-host for the evening, reported that the Captains learned how the CUBE had been designed and built entirely by QUT graduate students and academics using world-first technology.

Rather than becoming a static display, Vice-Chancellor of QUT, Peter Coaldrake, later informed the Captains at dinner that a large suspended room in the CUBE is dedicated to young scientists wishing to create new interactive displays of research projects using the advanced digital technology that includes over 40 multi-touch screens and sound technology on the two-story electronic display boards. College Captains from across Brisbane were enthralled by the responsiveness of the three digital



displays. The Physics Playroom display allowed the Captains to investigate the nature of forces and sound and to manipulate virtual objects in different gravitational fields. The Flood Wall display tells the virtual and interactive story of the 2011 Brisbane floods showing how high flood levels reached across the city. The touch-screen technology allowed the Captains to move across the map and see how events unfolded day by day and how the residents of Brisbane were affected.

The third screen is equally impressive. The Virtual Reef screen provides a simulated underwater experience that invited the Captains to engage and learn about the unique ecosystem of the Great Barrier Reef. The real-world scale display has fish, mammals and sea creatures moving freely in an underwater world. The Captains particularly enjoyed the touchscreens that provided them with content based on the new National Science Curriculum. The CUBE will shortly have its official opening by Prime Minister Julia Gillard and will then be open to all primary and secondary students as well as to interested members of the public.

The exciting visit to the CUBE was followed by the formal dinner with the Governor General. Anwen Thomas, Vice-Captain of MBC, reminded guests and the other Captains of the protocols associated with having such an esteemed guest after which the official party were welcomed into the dining room of Old Parliament House. Following the main course, Professor Coaldrake spoke to the students about QUT's initiatives to promote science, technology, engineering and mathematics to young students. This interesting presentation was then followed by Hannah Russell, Captain of MBC, who introduced the Governor General and then engaged in a question and answer session with Her Excellency. The questions for the evening had been supplied by each of the schools prior to the event.

While the aim of the evening was to bring young student leaders together for networking and the sharing of leadership ideas for the upcoming year, no doubt a number of the Captains will have had their curiosity sparked and their interest in science and technology renewed.

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Engaging in Science at Ravenswood

Vicki Steer, Principal, Ravenswood School for Girls

One of the challenges of successful teaching is creating an engaging and stimulating learning environment, one which motivates students to pursue further learning. That challenge is no less evident in teaching science to girls. The promotion of science as an academic endeavor and then as a pathway to further education and a career is an ongoing responsibility of all teachers of science. However, students today are fortunate to have a variety of subject options at their disposal and subjects compete for the interests of a finite number of students. It is essential that science positions itself as a relevant, engaging and worthwhile course of study for students as it opens doors to ways of thinking and learning that benefit every student.

At Ravenswood we are responding to the challenge of engaging young women in science in a variety of ways. Many of these facets extend through the various year groups, while others are targeted to specific ages. Science teachers at Ravenswood are important role models to the students. A number of female teachers on staff come from various scientific backgrounds and willingly share their vocational experiences with the students. Connections with students are built over time; building relationships is based on common respect and the enjoyment of scientific pursuits.

Lessons are taught with considerable emphasis on practical experiences and the development of scientific skills. Students in Years 5 and 6 have timetabled science lessons in the senior school laboratories. The students excitedly look forward to these lessons, enjoying the active learning sessions in which they conduct 'real science' experiments using 'real science' equipment. The students wear laboratory coats and safety goggles and are taught to record their results and discuss the implications of the experiment in a scientific manner. Students are also encouraged to discuss the practical work and the relevant science with their parents, having been given the responsibility to teach their parents the science they have learnt in the laboratories.

A biennial Science Day event is organised for the Junior School; on this day all of the girls from K-6 participate in age appropriate experiments. For example, one of the experiences involves a challenge in which Year 5 girls design a parachute that will prevent an egg breaking when dropped from a first story balcony; this always produces innovative plans and tremendous excitement – for both successful and unsuccessful designs.

Students in the Middle School are given the opportunity to research female



scientists and their contributions to society. Female guest presenters are often brought into the school from a variety of science education organisations, providing exciting learning opportunities and role modeling women in science careers. An annual 'Scientia Day' is organised for Year 9 students, in which the girls participate in a range of activities, including forensic science, electronics and environmental chemistry. National Science Week is always celebrated, with a range of activities including guest speakers from a variety of areas of scientific endeavour.

Students in the secondary school have the opportunity to engage with discipline specific course work which helps staff to identify potential students who may elect to continue with subjects in their senior years. Secondary school students are offered opportunities to participate in various science and engineering challenges at universities, as well as participating in HSC specific courses at these institutions. These opportunities are educationally rich and stimulating, as well as providing an opportunity for students to experience life in a tertiary education environment.

An important point recognised by the school is the need for learning environments that encourage students to work scientifically. To that end, we have recently installed new high powered microscopes with digital cameras which project images onto computer monitors. Teachers have found the use of these monitors very successful, particularly the immediate identification of microscopic structures for student study. The images can be manipulated by the application of various 'stains', which emphasise specific structures of interest. Images can be captured, shared amongst the class and reviewed at a later date. These microscopes have proven to be very popular with the senior Biology students; their use has resulted in considerable discussion within the class.

With our continual commitment to creating best practice learning environments, the school has embarked on a program to completely refurbish the science laboratories, aiming to install state of the art facilities. Such an investment is a clear indication of the commitment to science education at Ravenswood, and is recognised as an important step in maintaining enthusiasm and interest in science.

The challenges facing Australia and the world in the 21st Century will require a new generation of scientists engaged in methodical, high-level thinking. At Ravenswood we are engaged in the serious work of inviting our girls to consider science a desirable, exciting and rewarding career pathway. Providing positive role models, a broad range of learning opportunities and an inspirational learning environment have all played a part in this approach at Ravenswood School for Girls.

Engaging girls in STEM at St Aidan's

David Madden, St Aidan's Anglican Girls' School

In Australia, about half of all professional occupations suffering skills shortages are in core STEM areas such as engineering, and the majority of the rest are in the associated field of health (West, 2012).

Yet, St Aidan's students continue to buck national trends of declining participation in elective science, technology, engineering and mathematics subjects, with roughly 13 percent of the 2012 senior cohort this year undertaking further study in science, engineering or architecture.

At St Aidan's, our approach towards science is firmly rooted in the curriculum. According to recent Australian research, good teachers rated as the single most important individuals in students' decisions to take STEM courses, ranking higher than the influence of peers or parents (Lyons et al., 2012). As such, students from Year 7 onwards are taught by dedicated science specialists, and experience a course that unapologetically prioritises interest, engagement, and building foundational skills.

From Year 8, students are then able to select science elective subjects in addition to their core science course. These semester-long electives are highly contextualised, exploring themes such as neuroscience, robotics, environmental science, space exploration, and mining.

Focusing on the development of students' experimental and research competencies also brings about opportunities for more adventurous projects, such as the production of a short *Mythbusters*-style video, or the use of forensic techniques to 'solve a crime'. The popularity of these courses is clearly evident: over half of the Year 9 and 10 cohorts regularly choose at least one science elective course each year, with a significant number of our students going on to study three or even four extra semesters of science before they reach Year 11.

In the senior phase of learning, St Aidan's eschews multi-disciplinary subjects such as Multi-Strand or Science 21, and instead offers the traditional sciences of biology, chemistry and physics. When our students choose a science at the senior level, it is because they intend to succeed in a rigorous, challenging course of learning, not as a 'soft' option.

St Aidan's also aims to make full use of the opportunities presented by Queensland's system of moderated school-based assessment. Less than half of the assessment in any of our senior sciences is conducted through testing, and assignment work is given a real-life context wherever possible. Examples of this may include an energy audit of the School, research into evidence of anthropogenic global warming, or a presentation of scientific concepts to younger students. The epitome of this approach is our Year 11 biology cheese-making project, which has seen St Aidan's win a number of ribbons at the Royal Brisbane Show for our delicious Brie and Camembert cheeses.

We also take time to celebrate the 'fun' of sciences, such as at our Open Day Science 'Magic' Show, a regular highlight for students, as well as the extravaganza of movies, activities, and competitions held annually at the School as part of Science Week.

Our key co-curricular program comes through the Australian Space Design Competition, bringing together students across year levels to solve a multi-disciplinary engineering challenge. St Aidan's students have gone on to represent Australia at the International Space Settlement Design Competition at the Johnson Space Centre in the United States, and on three occasions have scooped up first place.

Involvement in such a competition provides our students with a unique opportunity to work together with other schools on a significant project requiring high-level teamwork, creativity and integration of ideas, as well as the application of scientific and engineering principles learnt back home in the classroom. In 2012, St Aidan's girls worked as a part of a team to prepare a tender response to a major infrastructure project located on Venus, and develop operational plans to maintain the community and fulfill its business objectives. Given just 48 hours to fully understand the design brief and submit a 50-page proposal to a group of NASA engineers, the students walked away with the gold medal.

The crowning glory of the St Aidan's hands-on approach to science this year, the inaugural Aspiring Women in Science conference, will bring together top scientific researchers from the University of Queensland and major research institutions with current students aspiring to further study in science-related professions. Across the course of a weekend in May, participants will attend a series of workshops, discussions and participatory learning experiences, all related to various aspects of the science field.

Each of these curricular and co-curricular components fit together to create an effective, exciting, multi-faceted approach to science at St Aidan's, and in doing so seek to communicate a number of key messages to girls: it is normal to be interested in science; it is expected that, with work, you will be successful in science; and if you are interested in making a tangible difference in the world, study science. It is hoped that such an approach has produced a program that is as diverse and fascinating as the STEM disciplines themselves.

"...if you are interested in making a tangible difference in the world, study science."

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Engaging girls in STEM at Ruyton Girls' School

Why does melted cheese go stringy?

Why don't birds fall from their perches when sleeping?

Why don't penguins' feet freeze?

I found these questions in a column of an old copy of the magazine *New Scientist* titled 'Last Word', where readers can write in and ask questions, or respond to questions of other readers. But they may just as likely have originated in a Ruyton science room; these are the types of questions our students ask us every day, and are what science is really all about. We all have a natural curiosity to understand our world, and scientists are so often the people that provide the answers. Sometimes we may not know the answer to all the obscure questions we are asked, but will respond with something along the lines of "I'm not sure about that.....let's find out together". And so the students and the teacher embark on a journey of discovery together: an investigation into something real, something that actually matters to the students. We certainly need a body of scientific knowledge on which to base our investigation, but if the students know that in developing that knowledge they will be able to come closer to finding the answer to their question, they are prepared to put in the hard work and time to understand the scientific process or concept that underlies their question.

Ruyton Girls' School is an independent girls' school located in Kew, in the inner eastern suburbs of Melbourne. Celebrating its 135th year in 2013, Ruyton has a long tradition of providing opportunities for girls to pursue educational excellence and personal fulfilment, fostering the individuality of each student. While science and technology have long been an integral part of the learning program in the Senior School (Years 7-12), a number of initiatives in recent years have ensured that all girls at Ruyton are engaged in STEM.

"Much of the responsibility for a scientifically literate and ethical society lies with school science departments, as these are one of the few places where we can be certain that all young adults are given the opportunity to learn about science and its implications."

One of the great advantages of a P-12 School on one campus is the possibility for staff and students to move across the campus and for resources to be available to all learners. For a number of years, Year 6 students have undertaken a science program facilitated by specialist science teachers who predominantly work in the senior school. These classes take place in the Senior School Science laboratories with a focus on developing laboratory skills and an understanding of scientific method. All students prepare an entry for the student research section of the Science Talent Search (organised by Science Teachers Association of Victoria). This

program provides a wonderful transition for the girls as they prepare to enter the senior school. It is highly anticipated by girls as a point of difference in the Year 6 program, and as at least three quarters of our Year 7 cohort have been students in the Junior School, these girls can act as mentors in science for students new to Ruyton in Year 7. As a result far less time is spent in the Year 7 program mastering basic laboratory skills, and students are able to explore the Year 7 curriculum in greater depth and with a higher degree of sophistication. Year 6 classroom teachers also participate in the program, enabling them to build their confidence and professional capacity to teach science, and to link the learning in the science laboratory to their classroom programs.

The opening of a new building in early 2011 provided the opportunity for our younger students to also experience science in a laboratory on a regular basis. The basement level of the Carolyn Anderson Building has been designated as the Centre for Creativity, and incorporates music rooms, art rooms, open learning spaces and a purpose built science laboratory. Recognising that many primary teachers are not science trained and may lack confidence to deliver the science curriculum and fully utilise the laboratory space, the school made the decision to employ a primary Science and Technology specialist to again ensure all students were able to engage in and be inspired by STEM, and to build the capacity of the staff.



Cathryn Furey, Assistant Principal, Director of Learning, Ruyton Girls' School

All students from Prep to Year 5 have regular timetabled classes with the science teacher, and like in Year 6, the classroom teacher joins the students to learn alongside them. Using Primary Science Connections as a basis and incorporating the Australian Curriculum has enabled us to establish a stimulating, engaging program.

Another feature of the Science curriculum at Ruyton is the 'Ethics, Science and Society' program, which is the culmination of the core science curriculum in Year 10. As scientists continue to explore new frontiers, it is critical that we have a society that can make informed, ethical decisions about the pathway for the future. Responsible members of society also need to have an understanding of what ethics really is; so often our understanding of complex issues is influenced most significantly by the media or politics, two areas where ethical considerations are not always the primary concern. Much of the responsibility for a scientifically literate and ethical society lies with school science departments, as these are one of the few places where we can be certain that all young adults are given the opportunity to learn about science and its implications. In the Ruyton program students work with Dr Donna Cohen, a research scientist with extensive experience in the field of ethics, to explore what ethics is and how it applies to science. Students then prepare a drama performance to represent the different perspectives that might be taken by a range of stakeholders in an issue such as the use of preimplantation genetic diagnosis to determine the sex of a baby. The performance focuses on recognising the complexity of the issue and the 'grey' nature of the scenario rather than concluding whether or not there is a 'right or wrong' answer to the problem. The use of drama empowers students who may not have always experienced success in all areas of science to finish Year 10 with a sense of how science is relevant to them regardless of their future directions.

How do we measure the success of a science program? Is it by the engagement of students in the science classroom, the achievements of our students in national assessments, the number of students who choose to study science in VCE, or the number of students who go on to pursue careers in science related fields? Regardless of which of these one might consider more valid than another, there is no doubt that the Ruyton science program meets all of these criteria and more.



Leading the way with inventive thinking in STEM

Tanya Appleby, Deputy Principal: Teaching and Learning; Pascale Warnant, Head of Science; Piv Huot.

Leading means going first, and in going first, you can trust me, for I have tested the ice. I have lived. I now know something of the rewards as well as the trappings of growing toward adulthood and making a world for yourself. Although the going first is no guarantee of success (because the world is not without risks and dangers), in the pedagogical relationship, there is a more fundamental guarantee: No matter what, I am here. And you can count on me. (Van Manen, 1991).

Leading in learning, in the context of the Mercy Tradition at Our Lady of Mercy College is about celebrating the individual differences that make up our learning communities. In terms of teaching and learning, OLMC educators are applying a framework that uses technology to support a culture of inventive thinking that encourages students and teachers to pose critical questions, develop open-ended learning tasks and project based learning in the context of multi-disciplinary learning communities.

The shifting context of technology

OLMC has five ICT Integrators who work collaboratively with staff to give them the skills and confidence to use a range of technologies in their teaching and learning practice. The early access to foundational skills in the application of technology has been integral to enabling a culture of inventive thinking and action in the classroom. In establishing foundational skills sets, learners along with their teachers, have been more readily willing to move towards achieving a common goal.

Underpinned by the research of Professor Jeremy Roschelle (2010), educators have been working towards shifting their mindset from the functionality of technology to realigning their focus on how technology better enables student learning. This shift in teacher thinking is pivotal to the process of creating optimum environments that welcome project based learning, open-end tasks and inquiry.

The following diagram, adapted from Roschelle (2010), represents the cyclical and intrinsically connected nature of applying technology to enable equalised opportunities for all learners.



Developing a new mindset

There is no doubt that fostering an interest in Science, Technology, Engineering and Mathematics (STEM) begins in the classroom. The challenge for educators, students and their parents is in developing a mindset that values the interrogation of knowledge, the exploration of original ideas, the formulation of thesis and open-ended case studies from which student formulate their own thesis. It is less about the content and more about the process of learning that encourages authentic personalised experiences that lead to developing curiosity, creativity, problem-solving and critical thinking.

The Science Department at OLMC applied this new mindset to the Science Research Project in Stages 4 and 5 with overwhelming success. By replacing the traditional paper-based logs that students used to record the various parts of their investigations, new technologies were applied to encourage students to respond in different ways. By working with electronic blogs, students have been able to integrate photographs, images and videos of their experiments in action. The shift in paradigm from teacher-directed learning to student-driven learning has been most successful here. Harnessing the enthusiasm for student-driven projects has also given rise to the development of *Screencasts* that has involved script writing and other graphics used to record and showcase their works, providing students with a genuine audience for their work. Empowering students with the technological skills to voice and showcase their works

in multiple ways lies at the core of the STEM education process.

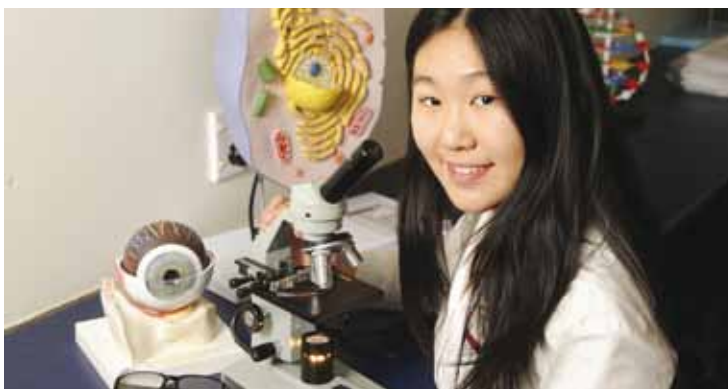
Similarly, the Mathematics Department has also explored new technologies as a means to driving student-based learning. In particular, girls at OLMC have been using *Geogebra* in Stage 5 to give them a hands-on experience in conceptualising gradients and to help them investigate the relationships between gradients. Other forms of technology such as *Geometer Sketchpad* have also proven most successful in encouraging students to explore quadrilateral characteristics at their own pace, thus giving students the opportunity to make and test conjectures. According to Wagner, as cited in Delaney (2012) "They have to learn to learn and to love to learn, and that's a total shift."

Harnessing opportunities in the future

Opportunity to reflect on the success of the STEM projects at OLMC has given rise to much consideration, particularly as teachers begin writing programs, Scope and Sequences for the new Australian Curriculum in NSW for 2014. It is hoped that with the learning that has already taken place at the College, and the growing enthusiasm of students for tasks, we will look to developing a greater number of cross-curricular projects harnessing inventive thinking across the school.

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STEM at St Cuthbert's College

Kelsey Davis, Communications Assistant, St Cuthbert's College

St Cuthbert's College is a place where girls can achieve anything they set their minds to. It is a place that encourages participation and celebrates success. Science, Technology, Engineering and Mathematics are among many areas that the girls achieve in. St Cuthbert's aims for well rounded students so every girl is encouraged to have an appreciation of and an involvement in all subjects.

2012's Prime Minister's Future Scientist Prize winner, Hannah Ng, explained that the College has an enthusiasm for science. Teachers and students alike create an atmosphere of excitement and Hannah commented that teachers cultivate a yearning to explore and learn more in all fields of STEM.

Dr Jan Giffney, Head of Science, mentored Hannah in many of her science projects and she explained that anyone can do science if they are interested in it. She finds it easy to encourage students in these areas because the students are highly motivated, making for a very positive atmosphere. Dr Giffney believes the important factor in teaching is to show girls at St Cuthbert's how science can be used in everyday life: the physics of a hockey strategy, the chemistry in simply cooking, the biology involved in gardening. It is not a matter of just learning science but using science, and science stretches right through to technology, engineering and mathematics.

Head of Mathematics, Ms Jo Palmer, agrees that success is not measured only by students wanting to pursue further study, but in how they use mathematics, integrated with other areas such as science, engineering and technology. Ms Palmer discussed that as you progress in the study of STEM topics they start to integrate naturally and eventually are all part of the same field.

The College offers extension and personalised learning programs that cover these areas and teachers are always encouraging students to enter external competitions. Annually, girls enter the International Young Physics Tournament, Science and Maths Olympiad Camps, Australian Competitions and the Engineering and Science Competition along with many more. St Cuthbert's also offers mentoring opportunities with university level lecturers and has a strong relationship with the Liggins Institute at the University of Auckland in particular.

Hannah loved her time at the College (leaving only last year after completing Year 13) and said that her teachers always encouraged her to take part in such competitions and extension programmes and were always willing to tutor, mentor, help out or just talk about each endeavour she and other students were involved in. The Liggins Institute and her opportunity to be involved with the University of Auckland allowed her to produce her novel theory that may provide solutions to global childhood myopia or short-sightedness. This theory enabled Hannah to win the prestigious Future Scientist Prize along with the Realise the Dream Supreme Award. She explained that none of this would have been possible without the support of the College and her teachers. Hannah offered a favourite Chinese proverb: "Weak people wait for opportunities, strong people create opportunities, wise people grab opportunities". St Cuthbert's teachers are extremely proud of Hannah and all of the students who leave the College to pursue their area of interest. We are also proud to see the rise in girls going on to study STEM topics at tertiary level.

Real-world research: a new pathway to STEM

Joanna Baker, Teacher of English, Melbourne Girls Grammar School

Lucky as I am to teach at a progressive, high-achieving girls' school in inner Melbourne, I often find myself sighing and shaking my head, at once disappointed and baffled, when I see the relatively tiny proportion of Year 12 girls who choose STEM courses at university. How can it be that of such a tremendously engaged and inquisitive cohort, so few wish to make a career in fields that will allow them to truly explore, experiment, and discover? To solve real-world problems? To shape the future – indeed, their own future?

This may seem a strange thing to be concerned about for an arts graduate and English teacher. Nonetheless, my passion for encouraging women to achieve excellence in their professional lives has led me to the belief that bringing more women into STEM is essential. This year I've been given the opportunity to develop a course that may – I hope – provide a new pathway into these fields.

The idea

The course, a semester-long elective aimed at Year 10 students, focuses on real-world research and writing. It is designed to be an inductive curriculum which will develop students' capability to design, implement and present academic research. Learning experiences are situated and networked, exposing students to communities of practice at a local, regional and global level through activities such as visits to research universities, as well as virtual interactions with research professionals. After an introduction to epistemology and ways of knowing across different disciplines, students will conduct their own research project on a topic or issue of their choosing.

The learning experiences are designed to incorporate:

- the social and dialogic elements of participation in a research community;
- movement across disciplines to gain new perspectives on familiar problems;
- the development of metacognition through regular reflections and class discussion;
- the exploration and critical analysis of relevant contemporary issues.

The learning goals

The knowledge and skills that are the focus for this course derive from Duschl and Grandy's three domains of science education: conceptual, epistemic and social/communicative (cited in Kelly, 2005). These domains

are not addressed separately, but rather integrated into the problem-based research project.

With this embedded, contextualised approach in mind, the following table outlines the goals of the course:

Knowledge and Understanding - Students will understand:

- the theories of epistemology which inform research processes, including related concepts and metalanguage.
- the traditional and emerging academic disciplines, and their respective research frameworks.
- the contemporary issues which drive research across disciplines (such as social inequality, crime, etc.).
- the difference between types of research (qualitative; quantitative; empirical; observational) and their respective applications.
- the ethical frameworks for research processes and academic integrity.
- a variety of approaches for synthesising and presenting research in multimodal and spoken contexts.

Skills and Processes - Students will be able to:

- discuss and critique the application of epistemological theories across disciplines.
- identify real world problems and areas for research.
- investigate, evaluate and summarise current research literature, and draw conclusions about 'gaps' in data or information.
- design a research project which incorporates appropriate methods of inquiry and data collection.
- implement their research proposal, closely monitoring and recording the process and making adjustments where necessary.
- evaluate and interpret various forms of data collected during research, and draw conclusions which address their core research questions.
- synthesise and distil information in a research report, using formal academic writing conventions, and present their conclusions in a short talk for their peers.

The potential outcomes

While the course is yet to be implemented, it is my hope that there will be various 'side-effects' as a result of participating in real-world research communities and engaging in the processes and practices of various disciplines.

Some of these potential outcomes include:

- *Improved scientific literacy*, helping students to engage critically



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with the issues and problems that science is working to solve. Problem-based inquiry is not a new phenomenon in education, but – as argued by Cindy, Duncan, and Clark (2007), it is increasingly being employed in science education as an effective way of enhancing students’ “understanding [of] the nature of scientific research and the practices involved” in science.

- *Enhanced understanding of scientific language*, empowering students to engage with various academic disciplines and, eventually, to make contributions in the areas that interest them. Importantly, however, this understanding is best developed through connected, purposeful, interactive experiences within the discipline itself (Kelly, 2007; Gee, 2005; Lave & Wenger, 2001).
- *A personal identification with STEM practitioners*, enabling students to see themselves as participants in a real-world community, and to (perhaps) start to imagine a future for themselves in STEM or other academic research fields.

Ultimately, I hope that students who experience this course can begin to see the connections between fields, and start to ask new questions about the world around them and the future that they may play a role in shaping.

“Learning is not merely a matter of acquiring knowledge, it is a matter of deciding what kind of person you are and want to be and engaging in those activities that make one a part of the relevant communities.” – Nancy Brickhouse (cited in Case, 2007)

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Women in Science @ Mater Christi College

Yvonne Sanders, Domain Leader – Science, Mater Christi College

The year is still young, but already there is a hive of sizzling activity to be found in the science corridors at Mater Christi College. With a strong focus on learning through exploration, our girls are encouraged to question, hypothesise, design and test, before arriving at conclusions that give the world a logical context. Our focus on collaborative learning provides an open, relevant and inclusive learning environment that encourages curiosity and engagement.

Even our most junior scientists have been cast straight into their lab coats, donning safety glasses and engaging in the intrigue of ‘elephant toothpaste’ and similar curious delights. Year 8 girls are exploring the inner-space of cells through discovery, investigating paramecium and amoeba, preparing slides for microscopic viewing.

Budding detectives can be found in neighboring laboratories, where Year 9 students engrossed in solving an intricately complex crime scene can be found dusting for fingerprints and gathering an assortment of evidence in our fabulous Forensic Frenzy.

Our senior school students have been equally busy, attending excursions to further extend a range of hands-on experiences in the sciences and supporting events such as our recent open day and evening. These Year 12 apprentice chemists eagerly plied their trade during the open evening to demonstrate the magic of titration under the tutelage of potions master, Ms Melissa MacEoin.

We’re proud of the great start our girls have made to this year in which our focus is inspirational women in science. Not only are we inspired by their curiosity, dedication and contributions to our world, we have taken up the invitation to be guided by their spirit of exploration and endeavor. We are raising the bar. And we have started by informing ourselves of their identities, trials, journeys and discoveries. We have considered what our world would be like if it were not for the contributions of the likes of Rosalind Franklin and Dr Fiona Wood. We have surrounded ourselves with their images and their work. We have created visual Fact Files displaying their images and recounting their work.

And that’s not all... these notable women in science, who we have been researching and wallpapering all around ourselves, will become the subject of a competition during Science Week later in the year.... Shhhhhhhh... don’t tell anyone!

Engaging girls in STEM at St Mary's College

Heather Omant, Head of Science, St Mary's College, Hobart

The St Mary's College Science faculty moved to our new *Women in Science Centre* in August 2011. The centre is a purpose built, cutting edge facility consisting of four bright, airy and well equipped laboratories and a preparation area. Students have responded very positively to their stimulating and inviting new surroundings with increased participation and successes in the sciences, building on the proud tradition of science education at the college.

The core aim of science education at St Mary's is encapsulated in the thoughts of Sister Majella Kelly, a past student, science graduate, teacher and Principal of the college. Girls can do anything that they put their minds to, she said, and at St Mary's College they are well prepared to take part in careers in science and technology. Methods of teaching science are now much more hands-on and technologically advanced. Nowadays there is an emphasis on relevance as students learn about the impact of science on society and its significance with issues relating to women.

As a K to 12 all girls' college we are passionate in our quest to encourage girls to develop a life-long love of learning in the sciences. Students in early childhood classes participate in science activities during Science Week with older mentors, and primary classes have regular timetabled lessons in the new laboratories. Secondary classes all study science, which is a core subject area in Grades 7 to 10. Grade 11 and 12 students have a wide and diverse subject choice, and a large proportion of our students study tertiary entrance subjects in the physical and biological sciences. Girls are supported to enter into science, engineering and technology studies and our past students have gone on to varied and successful careers, including in the medical, environmental, Antarctic, agricultural and physical sciences.

An important aim of the excellent science program at St Mary's College is to stimulate an interest in the world which encourages our students to think, observe, question and solve problems. In a study for the Girl Scouts of the USA, Eileen Sweeney, writes:

Girls are born problem solvers and, more than ever, they want to make a difference in their world, making them natural scientists and innovators. It's up to us to harness their talent and energy with hands-on experiences, real-world role models and a focus on the possibilities that science can make in their lives and the lives of others.

The study identified three keys for engaging girls in science and maths:

1. Make it real. Girls discover by doing, and experiential activities open girls' eyes to the ways science and maths affect their everyday lives.
2. Make it relevant. Programs that use real-world examples in a project-based format more effectively engage girls.
3. Make it possible. Relationships with role models and mentors, especially females, make a significant impact on girls' perceptions of their ability to excel in STEM careers.

We believe that successful science education engenders in our girls an excitement about the world around them and helps develop an enlightened and unbiased way of making decisions in their everyday lives. We provide many opportunities beyond the classroom such as mentoring by scientists, visiting speakers who are at the peak of their careers, relevant and interesting excursions and field trips, and encouraging all students to enter

in competitions particularly those related to the science inquiry process. St Mary's College students from all grades achieved outstanding success in the 2012 PICSE Science Fair, Tasmanian Science Talent Search, CSIRO CREST and BHP Billiton Science awards.

In an article for the Australian Education Review on engaging students in science for Australia's future Tytler (2007) argued for education 'for science in life', broadly conceived and designed to engage students at a personal level, rather than an education 'about science'. Tytler quotes the Victorian Middle Years Pedagogy Research and Development (MYPRAD) project which developed a framework to describe effective learning and teaching in the middle years. The first three of the MYPRAD components state:

1. Students are challenged to develop deeper levels of understanding: emphasising student questioning and exploration, and engagement with significant ideas and practices.
2. The learning environment is supportive and productive: emphasising a classroom environment where students feel able to express themselves, take responsibility for and occasionally take risks with their learning.

3. Teaching strategies cater for individuals' interests and learning needs: emphasising the monitoring and accommodation of diversity, and the encouragement of autonomy as learners.

These components form an integral part of the essential principles of science education at St Mary's College. The success and interest of our girls both in and out of the classroom and during and beyond their school years in the sciences attests to our success in engaging them in their learning. Our stimulating science program, along with state of the art facilities and highly qualified, hard-working and dedicated teachers encourages our students to be autonomous, deep thinking and responsible citizens.



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Engaging with STEM as a woman engineer

Madelaine Santini, 2010 Graduate of St Mary's Anglican Girls' School

At St Mary's, I studied physics, chemistry, maths, and maths specialist. These subjects gave me the basic tools to begin university as an engineering student – some of the more relevant points to the course being vector operations, differentiation and integration, projectile motion, truss analysis, and corrosion of materials. I was quite surprised at the extent to which my high school subjects were preparing me for the units I studied during my first year. Even things like bridge building with popsicle sticks in physics became useful when we had to work in groups to build popsicle stick bridges at uni! I still remember Year 8 Maths Camp – at that stage I hadn't been convinced that maths was for me, but after learning the basics of algebra and seeing how efficient it could be at solving problems, it captured my attention. I also fondly remember one science class where we saw some of the spectacular (while still safe) reactions of Group 1 and 2 metals with water.

It was after a science and engineering afternoon at UWA that I decided I'd study engineering. The mix of physical sciences with mathematics seemed to be a perfect fit for me, and I'd be lying if I said I wasn't also interested in the prospects of a good salary! However, I know that not all girls love maths and science as much as I do, and maybe this can turn them away from the STEM fields. While it's definitely a help to be knowledgeable in those subjects, engineering isn't all about that. At its core, engineering is about problem solving. This is what I now enjoy most about my course – not the opportunity to prove abstract formulae and do double integrations, but being able to work effectively in a team to come up with our best solution to a problem. Communication, leadership, initiative, and innovation are just as important to be a successful engineer as the ability to use a computer or calculator, but this isn't well understood. I believe that it's this lack of education about what engineering really is that limits the students choosing engineering to only those who have a passion for maths and science.

The existing gender ratio in the STEM fields is another possible reason that girls may choose other courses. Only about four girls in my year group chose to do engineering, so when I told someone what I wanted to study, the most common response was to inform me that I'd be surprised at how few other girls there were. To be honest, though, I was more surprised at

how little it had an effect on me. I had initially believed that I would find it difficult adjusting from attending an all-girls' school to lectures filled with 80 to 90% males, but it never really became important. In my first year, I got involved with a newly founded club at Curtin called Women in Engineering Curtin Division (WiECD), and this has helped me to meet other women studying engineering and science. We are a diverse bunch – some of us love pink and sparkly things, while others prefer to play paintball (and sometimes a combination of both). Jenny Cash, who graduated from St Mary's in 2009, is the current President, while I'm the Treasurer. Having a support network of girls who had gone or were currently going through the same course is important for many girls.

It's worth noting that the gender ratio varies greatly even within engineering. In chemical engineering, classes are probably around 30-40% females (as the degree proceeds, girls tend to drop out). Go to a mechanical engineering lecture though, and it'll fall to around 10%. Generally

the trend is slowly improving as more girls become aware of their own potentials as engineers through programs designed to engage girls in the STEM fields. One of these programs is Robogals, which was started up by Marita Cheng (Young Australian of the Year in 2012). I've been fortunate enough to meet Marita on a couple of occasions, and both she and the UWA Robogals chapter are passionate about getting more girls involved in the STEM fields. A core principle that Robogals works on is that giving relatable examples about engineering will help to interest girls. Rather than just showing them a cool robot and telling them they need to build a smaller one, they show them the robot, and might tell them that engineers are working on shrinking it so that it can be used to unblock heart valves. By giving it a real-life purpose, girls are more likely to be interested in not only completing the activity, but learning more about it.

My hope is that one day the gender ratio will be even enough so that these programs are no longer needed. Sam Carter from Stargate SG1 was, in part, the inspiration for one of my friends to study physics and engineering. I believe that once there are more positive role models in STEM fields for girls, they will be inspired to pursue their interests regardless of previous stereotypes of people in that field.

“I believe that it's this lack of education about what engineering really is that limits the students choosing engineering to only those who have a passion for maths and science.”



Madelaine (left) at Rio Tinto's Yandi Mine site



Madelaine (with another former St Mary's student, Jenny Cash ('09) at university

Programming and problem solving at St Peter's

Barbara Hender, Head of ICT, St Peter's Girls School

In February 2013, the Australian Curriculum Assessment and Reporting Authority (ACARA) released the Draft Australian Curriculum: Technologies paper which outlined the future direction and footprint for not only the learning of technology in schools, but the delivery of digital technology as a separate subject. This curriculum recognises that Australia "needs enterprising individuals who can make discerning decisions about the development and use of technologies" and that in creating solutions, they will "contribute to sustainable patterns of living for themselves and others".

A core tenet of the curriculum document requires students to acquire a deep knowledge and understanding of digital systems so that they can become developers of digital solutions. To be successful as a developer, one needs to learn programming skills and concepts. Programming allows for the development of high-order thinking skills and is characterised by its use of logic, algorithmic instructions and application to an environment.

The teaching of programming has evolved significantly from writing lines of code, to today's object-oriented and media-rich environments. The challenge, though, is how to engage girls in programming, considering that the idea of programming is often associated with a career option for boys and being a nerd.

At St Peter's Girls, we offer IT and a range of developmental programming experiences at Year 7, 8 and 9. All our programs use free educational software that are available in the school computer labs and able to be downloaded on home PCs.

At Year 7, students construct animations by programming objects using *Scratch* software. They learn computational ideas whilst learning to think creatively and reason systemically. *Scratch's* easy to use interface allows students to propose their idea and test immediately, so that they can incorporate this feedback into their program. To further strengthen understanding of core programming constructs and provide a link between

the computer and practical environment, the Year 7s download their programs to LEGO *Mindstorm Robots* with *Scratch* commands through *Enchanting* software to program the robot to move and react to sensors.

At Year 8, students develop a variety of interactive key-controlled sprite games using *GameMaker* software. The *GameMaker* environment is easy to use and engages girls in a game-orientated environment. Students also learn in context about the features that make a good game: from story, gameworld, characters, media and music, to setting a goal for the game, scoring, lives and engagement. Students develop games in the arcade game genre, with some Year 8s developing platform games, similar to commercially made games with scoring and intricate game play.

At Year 9, students use *Alice 2* software to develop a 3D world that allows interaction of models to tell a 3D-animated story. Students select 3D objects such as people and animals to populate a virtual world and then use drag and drop tiles to create a program. The interface allows students to see immediately how their program runs their animation, and allows the student to adjust their program to their requirements. The 3D world requires manipulation of objects in 3-dimensions and calls for the understanding and application of spatial relationships to their problem

solving approach. At Year 10, students can elect to take a Stage 1: Information Technology subject that allows further development and use of programming constructs using *Alice*.

Through St Peter's Girls Year 7 to 9 IT programs, students are exposed to a variety of programming environments of increasing complexity, from 2D to 3D, from animation to key-controlled, whilst learning the programming constructs of sequence, selection and iteration. The incorporation of media elements requires student to be able to source, create and edit images, text and sound into their solutions which increases their understanding of digital media formats and how these elements can be manipulated in the programming environment. With choice of story and gameplay, our girls are engaged with the medium and enjoy their exposure to programming, and are very proud of their achievements and final products.

"...programming has evolved significantly from writing lines of code, to today's object-oriented and media-rich environments. The challenge, though, is how to engage girls in programming..."



The cutting edge: Laser cutting technology

Jes Scull, Head of Technology Department, Westlake Girls High School



An upgrade of technology facilities in 2010 at WGHS included a laser cutting machine for the Technology Department. The expense was justified when considering the benefits for the department and the school as a whole. Staff were particularly keen to have a laser cutter because of the versatility it has over other computer controlled machines, such as engravers or 3D printers. The fact that it could be used on a variety of different materials and across the whole technology curriculum was another plus.

Laser cutting involves using a very intense, focused beam of light, computer controlled to either cut or engrave with very high accuracy. The light source used is no more powerful than a domestic light bulb, but it will cut through materials several millimetres thick. As no forces are applied to the material during the cutting process, small or delicate parts are not damaged during manufacture. Laser cutting will work on a wide variety of materials including paper, card, fabric, plastic, leather and wood. It will engrave on most organic and inorganic materials including stone. Its limitation is that it is not powerful enough to cut metal.

Soft materials technology

Laser cutting technology has been used in fabric technology across all year levels. Junior classes have used it to cut intricate masks for screen printing. Delicate fabrics have been cut for applique work (an advantage of laser cutting is that the cut edge is heat sealed and will not fray) and students have designed and made buttons from wood and from plastic. It is also possible to engrave a design onto the surface of some fabrics by 'vaporising' the surface fibres. In food technology and hospitality, students have made packaging for food products and produced original table decorations and serving platters.

Design and Visual Communication students have used the laser cutter to assist with model making. CAD drawings are easily exported to the laser cutter, enabling the component parts to be cut out quickly and accurately for ease of assembly.

Hard materials technology

It has been with hard materials technology that the laser cutter has really come into its own. Students are able to mix traditional hand skills with modern technology. Their design work is not limited by the level of their workshop skills. They are able to design more intricate outcomes and to manufacture work to professional standards. It is possible for students to laser cut multiple components all identically and with high accuracy. In Year 9 and 10 classes, students use the laser cutter to cut small and intricate parts for exciting and fun automata. At senior levels, a student might make a scale ergonome (human figure) that can be posed to assist with design sketches. They might then laser cut a scale model of their design proposal and use the ergonome to check its sizes and proportions. Decoration may then be engraved on to the surface of the finished product.

Cross curricula links

Laser cutting has opened up opportunities for cross curricular work with other departments. Business studies and young enterprise students have designed and marketed laser manufactured products. Art and sculpture students have laser cut their work. Original parts have been manufactured for the robotics team. Each year, senior physics students come for help developing experiments for their young physicists' tournament. Much of this test equipment will be laser cut. There is further opportunity for student groups to look at fund raising opportunities using laser cut or engraved products.

Technology staff have used the laser cutter to produce numerous trophies for sports, for prize giving and for Maori language week and to make small mementos for overseas visitors. All permanent signs around school are now either laser engraved from laminated plastic sheet or cut from vinyl. The introduction of this technology has given Westlake students an insight into the technology of the modern world and they are continually coming up with innovative and creative designs and ways to include laser cutting in their work.

The Alliance of Girls' Schools 2013 Student Leadership

This was perhaps one of the most successful conferences so far, with Rising Generations continuing to inspire the girls throughout the five days. Again we had no trouble filling the places and welcomed 160 girls from 74 member schools. The Alliance awarded five scholarships to indigenous girls: from St Mary's College, Hobart; Ipswich Girls' Grammar; The Glennie and St Stephen's College in Hong Kong. Our newest schools in Hong Kong and Philippines sent girls and their teachers came too. They spent the time visiting schools in Sydney as well as taking part in the conference. The Celebration Dinner with the Principals and Deputies was very well attended, with 20 staff, 6 representatives from Alliance Partners, as well as the guest speaker Lynne Sawyers.

Make sure your girls don't miss out on this valuable experience in January 2014. SLC is moving to Bond University on the Gold Coast in Queensland from 15-19 January 2014 and will again be facilitated by Rising Generations. Registrations will be available on the Alliance website from August 2013.



Monkeys



Hong Kong girls and their teacher, Eva Sin (right)



Celebration Dinner

Read these comments from girls and parents of girls who attended in January 2013 and see why you should be sure to register your student leaders for 2014:

It was an incredible week that had a huge impact on me. It has really empowered and inspired me to be the best leader that I can be, to make that extra bit of effort and really make a difference. The conference has helped me to further identify my values and see what will be important for me this year as a leader, a fellow year 12 to the other girls and as a VCE student. All of the girls I met were fantastic and I am sure we will all be a great support network for each other this year. A friend commented to me on my return: 'Wow, what did they do to you up there? You are just so happy.' She is right and I am determined to make sure I do not hit the 2 week wall - I will endeavor to remain inspired and remember all of the lessons from SLC.

Molly, MGGS

We would like to take this opportunity to thank you and the Rising Generations team for providing such an inspiring and exciting conference held in Sydney recently. Our daughter returned home so enthusiastic and has conveyed to us the many leadership skills, quotes and advice provided to her over the 5 days. She now looks forward to relaying the information to the Student Council and is so excited to have built new friendships. Thanks again for giving our girls an amazing opportunity and skills, which they will carry with them into the future.

Parents

Thank you very much for providing the opportunity for [my daughter] to attend the Girls' Leadership Conference last week. She came home gushing about what a good time she had had and what she had learnt. It sounds as though the calibre of girls who attended was outstanding – as you would expect – and all seemed to learn lots. Because of my background, I am always somewhat concerned about experiential learning programmes, having seen many which were at best unethical and at worst actually damaging to participants. However, based on some of the details that [my daughter] provided and discussions about activities, it appears that the leaders were very professional and ran a wonderful workshop. In particular, I was impressed by [her] understanding of the Myers Briggs Type Indicator so I know that this section was well taught and facilitated. It sounds as though many of the other exercises were also well thought out to make the specific points that the leaders wanted to make. Thanks again for letting [my daughter] have the opportunity. She was already keen to do a good job this year but, in addition, she is now really excited about what she might be able to achieve.

Parent

I would like to say thank you for making a week of learning so much fun. Not only did I meet girls that I hope to one day make my bridesmaids, but I met amazing and inspiring women and leaders. I learnt a lot about leadership and myself that I didn't expect when I came into the week. I learnt that being a leader was about being unafraid, unafraid of new initiatives, of being an active leader and of failure. It taught me that it's okay to embarrass myself ... and to be myself. It taught me the logistics how to introduce the initiatives that we throw around in Prefect meetings. I learnt that there is more to being a leader than making the girls at my school laugh. I learnt that I am powerful in the role that I hold, and I now hope to go back to school, and pass on just a few of the things that the RG team has taught me in this last week – to be myself, be unafraid, and to understand that I am worthy, not only of this role, but to be treated with respect and kindness by those around me.

Emma, Roseville College

Conference



A reflection from USA delegates

Rita Shrestha, Archer School for Girls, Los Angeles, USA

The Student Leadership Conference I attended in Sydney, Australia was one of the most inspiring and life changing experiences I have ever had. I was able to spend five days at the beautiful Women's College at the University of Sydney meeting and befriending leaders my age from girls' schools around the world! The girls I met shared my passion and enthusiasm for leadership, making it an environment conducive to learning about ourselves, each other, and leadership as a whole. Over the course of five days, I learned lessons on leadership that I will continue to apply at school and in my community for the rest of my life.

One of the most important lessons I learned at the conference was about the qualities and traits of a good leader. Among them are passion, vision, values, resilience, and service. Of these qualities, resilience struck me the most because I believe it is what sets great leaders apart from the rest. A great leader must be resilient, never giving up even after many failed attempts, and continue to move forward. It is difficult to remain courageous and resilient at times, but this leadership conference has given me the confidence to persevere. I will apply this lesson at school, and I hope to spread the message to all the students there. I strongly believe that everyone in the world has the potential to be a great leader and I hope to inspire the girls at my school to begin their journey.

Another lesson I learned was the effect of personality type on leadership style. Extroverts, who get their energy from spending time with others, tend to speak before they think. In contrast, introverts, who get energy from spending time alone, often spend time thinking before speaking. This often results in extroverts dominating during a meeting or conversation. I will apply this knowledge to student council at my school, as I know that we have both extroverted and introverted leaders. Now that I understand the differences in personality types, I will make it a point during our student council meetings to hear from the introverts and extroverts in equal portions. This way, everyone will be represented equally, and all ideas will be heard. I know for a fact that both introverts and extroverts have amazing ideas, and allowing everyone to voice their ideas will lead to a greater end result.

The multiple lessons in leadership I learned, as well as the people I met from around the world, made the Student Leadership Conference an extraordinary experience. It inspired me to improve my leadership skills and share them with those around me. Hopefully I am able to inspire others at my school to achieve their full leadership potential as much as the conference inspired me. I feel so grateful to have been able to learn so much, and I am extremely excited to be able to share my knowledge with those around me.



NCGS delegates: Rita Shrestha, Archer School for Girls, and Haley Berling, Saint Gertrude High School, Richmond, Virginia.

A highlight from SLC2013: Bringing indigenous family together

The Alliance's 2013 Student Leadership Conference, held at the Women's College in Sydney, was highly successful. The 160 student leaders were inspired and stretched to broaden their understanding of leadership and collaboration. Each girl has taken these experiences back to their schools and the leaders are now working with other students and staff to translate their experiences into practice.



Emmaia and Lizzie

A particular highlight from SLC2013 came from two indigenous girls who had not met before the conference but realised during the week that they were related to each other. This moment is described by Emmaia Masso:

Sydney Leadership Conference was such an amazing experience, meeting new people from all over Australia as well as different parts of the world. During the final evening at the formal dinner, the Seals co-ordinator Airlie was talking to me and others about traditional feasts, which is the traditional way of having dinner after a particular ceremony. Whilst chatting to another girl, Lizzie, we learned more about each other's culture and celebrations and our backgrounds. The topic kept escalating to the point where Lizzie and I found out that we're related to one another! We couldn't contain our excitement! One moment we were casually walking up to grab our dinner then BOOM the next thing we knew was that we were related to the same family. It was such an astonishing feeling to realise that I had a relative at the same conference. Lizzie decided to go and tell Jan Butler about the exciting news. Coming to this Leadership Conference not only helped us to understand what leadership and teamwork are, but it also brought family together.

Ever since we've left Sydney, Lizzie and I still keep in contact with each other on Facebook, and we keep in contact with all of the girls who attended the conference. It was an amazing experience to spend time at Sydney University with 160 girls from all over the world, as well as to travel around Sydney and discover that Lizzie and I are from the same family.



Alliance of Girls' Schools Australasia Biennial Staff Conference

Creative Girls, Creative Women

25 – 28 May 2014, Amora Hotel, Wellington, New Zealand

Student Film Competition: Call for Entries

The Alliance of Girls' Schools Australasia's 2014 Conference theme, *Creative Girls, Creative Women*, focuses attention on creativity in all its aspects: in science, the arts, in business, in life generally. The Alliance is now accepting entries from Member schools for the 2014 Student Film Competition.

The Alliance films should be imaginative, original and created within the open dates of this competition. Your 3-4 minute films should demonstrate creativity. We encourage documentary, animation or drama. The Top 10 Finalist films will screen at the Conference Opening and the Top 3 will be presented by the Lead Adjudicator on 27 May. A jury made up of film industry professionals will judge films and award prizes for First, Second and Third Place.

Films are to be submitted in .avi or .mov format on the Alliance YouTube website.

ENTRY DEADLINES

Australasian entries must be received on the YouTube website by
5pm, Friday 2 May 2014.

An entry form must also be submitted online at the Alliance website
www.agsa.org.au by the same date.

For more information: Please refer to the Alliance of Girls' Schools website
www.agsa.org.au or you can contact Jan Butler at jbutler@agsa.org.au.

Full Terms and Conditions are available on the Alliance website: www.agsa.org.au

"Think left and think right
and think low and think high.
Oh, the things you can think
up if only you try!"

Dr Seuss



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