



Pymble Ladies' College

Illuminate

RESEARCH AND INNOVATION

EDITION 2 2019

Contents

From the Principal	Page 3
From the Editors	Page 4
Our People	Page 6
Spiral of inquiry – from research to practice	Page 10
She Runs... Active <i>Pymble</i> Girls Lead	Page 13
School's in for summer – University summer programs	Page 16
Running the right race	Page 20
Enhancing teacher practice	Page 22
Is the use of mobile devices in schools really innovative?	Page 26
Innovation and collaboration – where to from here?	Page 29
Improving outcomes for Indigenous students at <i>Pymble Ladies' College</i>	Page 30
The fear factor	Page 37
Challenge accepted – Junior School robotics: reflections and learnings	Page 38
Notes	Page 46



The ability to embrace complex challenges with courage and integrity is absolutely essential for our students as they graduate from the College and move into a portfolio of exciting careers in the future, many of which are currently unknown or emerging.

At *Pymble*, we foster a world-class educational environment that is enriched by our global outlook. Our innate interest in building connections and broadening our perspective can be seen in both students' curricular and co-curricular opportunities, and in our teachers' Professional Learning program. In this, the second edition of *Illuminate*, we proudly share with our readers insights into a number of the College's programs and opportunities.

This is a collection that highlights two key elements: our desire to learn with and from others, especially in global contexts; and our passion to make valuable new contributions to educational knowledge in a vast range of fields. From teaching STEM to our Preparatory School students, to advances in design technology in the classroom; from our ground-breaking Indigenous Scholars program, to our Upper School global exchange with Oxford and Cambridge universities, I invite readers to appreciate the diversity of projects in which College staff are participating and also, in many cases, taking the lead.

Importantly, our own reflections and research, as showcased in *Illuminate*, make an immediate contribution to our own decision making and educational planning. A strength within the College is undoubtedly our hunger for pursuing new ways of looking at ideas and challenges, and for identifying gaps where our own

research, strategy and planning readily steps forth.

Likewise, creating exciting opportunities for our students is a hallmark of a *Pymble* teacher's approach to his or her work. Our own Director of Research and Development has begun tracking the professional learning journey of College teacher-researchers and, unsurprisingly but pleasingly, identifies "making a difference to student learning" as a core motivation for our teachers to engage in research. You can about the results of this investigation on page 22.

The ability to embrace complex challenges with courage and integrity is absolutely essential for our students as they graduate from the College and move into a portfolio of exciting careers in the future, many of which are currently unknown or emerging. We are honoured to seize the opportunity to participate in research and learning partnerships which expand our world view and improve outcomes for our own students. This is the core to which our research-based and innovative thinking returns.

I commend this edition of *Illuminate* to readers in the *Pymble* community and beyond as one which will inspire and challenge all to consider what other worldwide opportunities are possible.

MRS VICKI WATERS
PRINCIPAL



In the 21st century, what you know is not sufficient; it is also how you use and apply what you know to engage and adapt to a rapidly changing world.

Research from the Foundation for Young Australians (2018) indicates that young people today are likely to have 17 jobs over five different careers in their lifetimes. How is *Pymble* preparing our students with the knowledge and skills they will need to thrive in a constantly changing environment outside of school? As educators of the next generation of leaders, some of our responses are explored in this edition of *Illuminate*. This edition shares ways our *Pymble* teachers are expanding their professional outlook through research, especially into areas relevant to the challenge of educating for the future.

For some time there has been a widespread concern among both academics and teachers about student engagement in school and in learning (Fredericks et al.,

2004; Zyngier, 2004). There is a need for an approach to pedagogy that allows students and teachers to focus on improving the process of learning, enabling them to reflect on their approach, developing self-awareness about the reason for study, the learning process itself, and how education is of benefit.

When we look at education, we often look at it in terms of student outcomes, growth and learning. Education should enable all students to understand, or at least, to make sense of the world around them and the qualities within themselves so that they can participate as active, compassionate contributors to society. We need to shift from a knowledge-only based education towards incorporating skills such as creativity, critical and creative thinking, communication and collaboration. It is essential for students to acquire a deeper knowledge and versatility around these key skills.

Students need to be able reflect and adapt; learning how to learn through metacognition and a growth mindset.

At *Pymble Ladies' College* we continue to innovate in both the theory and practice of teaching and learning to ensure quality opportunities that prepare our students for life and work in a globally connected society. This second edition of *Illuminate* takes readers on a global journey, exploring opportunities beyond our gates and contributing meaningfully to research, the wellbeing of students, professional learning as central to practice, and students' holistic progress. It is here our teachers challenge conventions in the learning environment to reveal themselves as innovators and designers. Education is not a linear algorithm but a human endeavour. Education of the future needs to reflect the intricacies of this human endeavour known as teaching, giving attention to the people operating within the system, valuing teacher and student voices on learning and instruction, building social capital and culture, using technology as an accelerator of learning, and emphasising the strength of collective learning. This edition presents articles on a range of topics. The University of Cambridge and the

University of Oxford program saw students immersed in the global academic community where minds were opened to global educational practices, enhancing future passions. The Junior School Robotics STEM program reflects the resilience of our students to cope with uncertainty and the importance of 21st century skills. Additionally, the NSW Association of Independent Schools *Research to Practice Project* in the Preparatory School has afforded teachers the opportunity to “use high-impact techniques in classroom practice and be on the front foot with the new NSW Syllabus for the Australian curriculum: Science and Technology K-6”. The Enhancing Professional Practice report emphasises the positive impact that designing and conducting research has on student learning and teacher purpose. This edition also contains a critical book review focusing on the measuring and ranking of school performance and the effects this has had on the Global Reform Movement.

“ At Pymble Ladies’ College we continue to innovate in both the theory and practice of teaching and learning to ensure quality opportunities that prepare our students for life and work in a globally connected society.”

We commend to you the article on our Indigenous Scholars Program which shares the College’s strategy around improving outcomes in Aboriginal and Torres Strait Islander literacy and numeracy. Through collaboration with the NSW Association of Independent Schools, the report which underpinned this article was compiled with

a plethora of *Pymble* data. The report and article provide an insightful look into what works in this vital educational area and the very firm platform upon which we stand to continue making a positive difference.

In the 21st century, what you know is not sufficient; it is also how you use and apply what you know to engage and adapt to a rapidly changing world. This edition reflects our teachers’ and students’ abilities to adjust to the dynamics of the Information Age, coupled with the need for multi-tasking, versatility and speed, to form an essential component of the new learning paradigm. It mirrors the ability to continue to learn in deliberate and comprehensive ways, awakening the passions within. As Plutarch states, “The mind is not a vessel that needs filling, but wood that needs lighting”.

DR SARAH LOCH
DIRECTOR OF RESEARCH
AND DEVELOPMENT

MS TRICIA ALLEN
DIRECTOR OF TEACHING
AND LEARNING

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OUR PEOPLE

Contributors



Ms Tricia Allen

Tricia is the Director of Teaching and Learning at Pymble Ladies' College and a Doctoral Candidate in the Faculty of Arts and Social Sciences, in collaboration with the Gonski Institute for Education, at the University of New South Wales. She believes that every student at *Pymble* has the right to demonstrate growth through a personalised learning environment so that she develops a passion for learning and scholarship, self-assurance, and a capacity to contribute meaningfully to society. Students are no longer the passive recipients of knowledge; they are the co-creators of their own learning experience.

Ms Tricia Allen
DIRECTOR OF TEACHING
AND LEARNING



Mrs Katie Barten

Katie has more than eight years' experience working in early childhood and other education settings. Her approach to teaching has been shaped by child development and the importance of learning through play and exploration. She is keen to continue investigating students' understanding of Science to further develop her holistic understanding of the way children learn.

Mrs Katie Barten
PREPARATORY SCHOOL
TEACHER



Miss Emily Boyd

Emily has been working at *Pymble* for more than nine years and has been teaching in the Preparatory School for the past six years. She is passionate about Science and Technology and about instilling this interest in her students. She was motivated to investigate this topic after identifying a need for change in student engagement in Science and Technology, and development in skills essential for future success in schooling and beyond.

Miss Emily Boyd
PREPARATORY SCHOOL
TEACHER



Mr Dan Brown

Dan has been working at *Pymble* for more than six years. A teacher in the Junior School for four years, Dan has applied his passion for Technology and creative thinking in many areas, including co-ordinating STEM initiatives, running a Junior School Robotics program and being involved in many extension opportunities across a range of key learning areas. Dan's skills and experience in this forum has recently seen him change role and become a Digital Learning Leader at *Pymble* from K-12.

Mr Dan Brown
DIGITAL LEARNING LEADER



Professor Kevin Burden

Kevin is Professor of Educational Technology at the University of Hull in the United Kingdom. He is an international expert on the application and impact of digital technologies in learning where his research focuses on the transformational uses of mobile technologies. Kevin leads international collaborative projects in mobile learning with partners including the EU, the British Council and UNESCO and is a distinguished visiting professor at the University of Technology Sydney. Kevin is the Project Co-ordinator of the Erasmus+ Designing and Evaluating Innovative Mobile Pedagogies (DEIMP) project.

Professor Kevin Burden
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Miss Skye Halliday

Skye has been teaching Personal Development, Health and Physical Education and coaching high level sporting teams for more than 20 years. She is passionate about gender equality in sport and opportunities for leadership positions within sport for women. She has been the Co-ordinator of the *Pymble* Elite Sportswomen's Program (PESP) at *Pymble* for the last ten years, helping students balance the demands of training and competing with their academic requirements.

Miss Skye Halliday
CO-ORDINATOR OF ELITE
SPORTSWOMEN'S PROGRAM



Mrs Victoria Harrison

Victoria is the Head of Learning Area – Personal Development, Health and Physical Education (PDHPE). She has 20 years of experience in teaching PDHPE and motivating young women to value their health and be physically active. Victoria is a strong advocate for moving beyond simply giving information to students and instead helps them build skills that help prioritise their health. She is committed to a more effective relationship between policy development and what happens in the daily lives of our young people in terms of their health.

Mrs Victoria Harrison
HEAD OF LEARNING AREA -
PDHPE



Miss Kate Howie

Kate's teaching background is in Personal Development, Health and Physical Education (PDHPE) and she loves all sports. She especially loves trail running and the opportunity that Sport gives to be outdoors and connected to the natural environment. Kate assumed the role of Indigenous Student Co-ordinator in 2017 where she supports our Indigenous students to engage deeply in all aspects of their education. She is committed to her own learning in this role and is thankful for the opportunities the students give her to learn about their lives and stories.

Miss Kate Howie
INDIGENOUS STUDENT
CO-ORDINATOR

OUR PEOPLE

Contributors



Mrs Christine Lang

Chris has been teaching Personal Development, Health and Physical Education (PDHPE) and coaching Diving for more than 30 years. She is passionate about providing opportunities that take students outside the classroom and allow them to experience challenges for growth in body, spirit and mind. The skills of Diving require courage, commitment and resilience – life skills that cannot be underestimated. Chris’s love of teaching and Diving coaching allows her to enrich the school years of students in a unique and specialised way.

Mrs Christine Lang
COACHING DIRECTOR -
DIVING AND HEAD COACH
DIVING



Mr Gabriel Langford

Gabriel has been teaching Geography at *Pymble* for five years. He is passionate about solution-focused learning and helping students find their voice. His teaching practice has been shaped by PBL (Project Based Learning) design frameworks where individuals determine the best path forward and harness mistakes and errors to create a better solution to real-world issues. Gabriel fell in love with urban geography at university and enjoys seeing societal shifts towards better quality of life for all people.

Mr Gabriel Langford
GEOGRAPHY TEACHER



Dr Sarah Loch

Sarah is the Director of Research and Development at *Pymble* and an Associate in the Faculty of Arts and Social Sciences at the University of Technology Sydney. She is committed to enhancing diverse and impactful educational practices by supporting teachers to engage in, conduct and communicate their own research. She currently teaches Year 9 History where she loves helping her students discover primary sources and conduct their own research.

Dr Sarah Loch
DIRECTOR OF RESEARCH
AND DEVELOPMENT



Associate Professor Matthew Kearney

Matthew is an Associate Professor in the area of ICT in Education at the University of Technology Sydney (UTS). His scholarly interests focus on innovative technology-mediated learning in K-12 and teacher education contexts. He has published widely in high-ranking journals such as the *Australasian Journal of Educational Technology and Computers & Education*. Matthew is Acting Director of the STEM Education Futures Research Centre at the University of Technology Sydney.

Associate Professor Matthew Kearney
SCHOOL OF EDUCATION,
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Mrs Sree Raniga

With expertise in project and problem-based learning and the flipped classroom, Sree joined Pymble Ladies' College in 2016. She is passionate about innovative teaching practices and has received training at the Republic Polytechnic, Singapore, enabling her to plan and implement innovative lessons to enhance the learning experience of students in a technologically advancing world. She was motivated to participate in the Designing and Evaluating Innovative Mobile Pedagogies (DEIMP) research project to further extend her expertise in this learning area.

Mrs Sree Raniga
STAGE 4 ENGLISH
CO-ORDINATOR



Professor Sandra Schuck

Sandy is a Professor of Education in the Faculty of Arts and Social Sciences at the University of Technology Sydney (UTS). She started her career as a Secondary School teacher and then became a lecturer in primary and secondary Mathematics education. She was the Director of Research Training in her Faculty 2011-2018 and was the co-founder of the STEM Education Futures Research Centre. Sandy is a team member of the Erasmus+ funded project, Designing and Evaluating Innovative Mobile Pedagogies (DEIMP), led by the University of Hull.

Professor Sandra Schuck
SCHOOL OF EDUCATION,
FACULTY OF ARTS AND
SOCIAL SCIENCES, UTS



Mrs Julie Shaw

With a teaching background in Personal Development, Health and Physical Education (PDHPE), as well as leadership experience as Deputy Principal and in the co-curricular domain, Julie is proud to oversee *Pymble's* Indigenous Scholars Program. The program has grown substantially over the past 11 years and Julie is committed to ensuring its future growth, as well as its sustainability. Julie is a strong advocate for a balanced and healthy lifestyle and enjoys bike riding and travelling in her free time.

Mrs Julie Shaw
DEPUTY PRINCIPAL

Spiral of inquiry – from research to practice

By Preparatory School Teachers, Miss Emily Boyd and Mrs Katie Barten



Through the Research to Practice initiative, the Association of Independent Schools (AISNSW) gives teachers the opportunity to use high-impact techniques in classroom practice and be on the front foot with the new NSW Syllabus for the Australian curriculum: Science and Technology K-6. This grant facilitates a year-long partnership between AISNSW and Primary school teams to transform the teaching and learning of Science and Technology through a framework called the Spiral of Inquiry. For more information, see <https://www.aisnsw.edu.au/EducationalResearch/Pages/research-to-practice-initiative.aspx>

Towards the end of 2017, three teachers from the Preparatory School – Miss Emily Boyd, Mrs Katie Barten and Miss Amanda Smith – successfully applied to take part in an AISNSW Research to Practice project with a specific focus on the teaching of Science and Technology within the early years.

“The Spiral of Inquiry model is an inquiry-orientated, evidence-based approach to teaching and learning.”

Research tells us that many Primary teachers are not confident in their ability to teach Science and Technology. This project was designed to support teachers' skills by examining ways that Science and Technology are taught in the Preparatory School and comparing this with literature outlining effective practices in the area. This project used a specific teacher-action research model called the Spiral of Inquiry. First developed by Dr Judy Halbert and Dr Linda Kaser, this model has proven to be very effective with positive outcomes for students.

The Spiral of Inquiry model is an inquiry-orientated, evidence-based approach to teaching and learning. It comprises six stages, and throughout the year, our team worked its way through these stages, examining current strengths and reflecting on how these correspond with best practice in the field. We used research to make changes to our practice where our analysis revealed gaps.

We began the year with a full-day training session during which the model was outlined in detail. We were provided with a range of documents commissioned by AISNSW outlining effective practice in Science and Technology. We also had an opportunity to hear from a participant at another school, to help us understand the extent of the project, and its results. AISNSW consultant, Sue Pike, was then allocated to work with our team, helping us throughout the year as we navigated the stages of the Spiral of Inquiry.

SPIRAL OF INQUIRY

The first stage of the spiral required us to scan the current status of the area of interest with three key questions in mind: What is going on for our learners? How do we know? Why does this matter?

Drawing upon the effective practices outlined in the research, we developed a range of tools to gather data to help us understand the current nature of Science and Technology teaching and compare this with research evidence. These tools included a survey for teachers, a survey for students, and, given that we were working with Preparatory-aged students, it also included



Preparatory School teachers' professional learning meeting

SCIENCE AND TECHNOLOGY

an interview and student-drawn pictures of a scientist (see below). We also explored teacher programs and school documentation such as Scope and Sequences of our curriculum.

From the scanning phase we found that 61 per cent of students believed that scientists only work in professions involving laboratory coats and laboratory equipment. The majority of students also said that scientists are men. Our student survey showed that students felt our current Science lessons were teacher-led, and that not enough time was given to students to design their own experiments, or to reflect on and retest results. The teacher survey further demonstrated that a greater link needed to be made between Science programs and real-world problems, and that a stronger understanding of the Technology side of the syllabus was required.

During the second phase – focusing – we triangulated the data looking for patterns and key trends. Some of the trends that we identified were that a new Scope and Sequence document was required and that

we needed to change the way in which our units of learning were developed. We also found that there needed to be greater focus on scientific terminology and vocabulary used with students throughout a topic, and greater professional learning for teachers, particularly on the understanding of the processes of design and production and working scientifically.

“ After working our way through the Spiral of Inquiry phases, we now have greater capacity to use evidence-based research as a way of informing our practice and we can see how this model could be used in other key learning areas.”

The third stage of the spiral was developing a hunch. It required us to inquire more deeply into why there was a disparity between the research evidence and our current practice.

Our hunches included:

- Teacher knowledge of the syllabus and confidence with its content was limited due to minimum professional learning at this early stage.
- The legacy of Science and Technology meant it was considered a 'speciality' subject, rather than a core subject like Numeracy and Literacy.

These factors have had a major impact on the quality of Science teaching and learning within classrooms.

From this, we moved on to stage four of the inquiry process – professional learning. We were particularly fortunate that the NSW Education Standards Authority (NESA) had released its new Syllabus K-6 to assist with its familiarisation in readiness for implementation in 2019. This was an ideal opportunity to undertake relevant professional development.

Professional learning in Science took numerous forms, including several workshops led by an AISNSW



Student drawings of their impressions of a scientist



Students actively exploring Science

“ After working our way through the Spiral of Inquiry phases, we now have greater capacity to use evidence-based research as a way of informing our practice and we can see how this model could be used in other key learning areas.”

Throughout this entire process we had the support of Sue Pike from AISNSW who met with us twice a term and acted as a mentor through the inquiry process. We are now eagerly awaiting implementation of the units and for opportunities to gather further data that will provide us with evidence to show if changes in teacher practice have resulted in improvement in student knowledge and skills in Science and Technology. After working our way through the Spiral of Inquiry phases, we now have greater capacity to use evidence-based research as a way of informing our practice and we can see how this model could be used in other key learning areas.

Acknowledgement

We gratefully acknowledge the support of the College and AISNSW in giving us the opportunity to take part in this project. We feel that we have professionally grown and can shine a light on our current practice. This initiative has transformed the way we work, strengthened our own capacity to teach Science and Technology, and we are now in a better position to support our colleagues as they implement the new Syllabus.

The Spiral of Inquiry provides an evidence-informed and disciplined approach to professional inquiry that is used to change outcomes for learners in a wide range of settings. It provides a ground-breaking framework focusing on changing the experience of learners through the development of new learning and new actions. Recent research suggests that the Spiral of Inquiry is one of the most impactful examples of professional learning in the world, consistently delivering demonstrable outcomes for learners.

(Jensen, Sonnemann, Roberts-Hull, & Hunter, 2016).

consultant, involving all teachers from the Preparatory and Junior Schools. We worked closely in our regular team meetings to unpack the Syllabus in greater detail to understand its key intents and to consider its implications for programming and planning, as well as for classroom practice.

Once we had engaged in some extensive professional learning, we then took action in a range of ways, including:

- creating a new K-2 Science and Technology Scope and Sequence, which we presented to colleagues
- designing a new program template and creating a program checklist to guide teachers in their unit planning; we drew upon research about effective practice to create this checklist
- writing the first 2019 units in preparation for the new Syllabus roll-out.

She Runs... Active *Pymble* Girls Lead

By Head of Learning Area- PDHPE, Mrs Victoria Harrison and Co-ordinator of the Elite Sportswomen's Program, Miss Skye Halliday

This article shares insights we gained into girls' physical education following a global conference we attended with four *Pymble* students in March 2019. We also celebrate more than 100 years of girls' sport and physical activity at the College and look to the future with ideas for meeting the challenge of encouraging healthy and active lifestyles for girls and women in the years to come.

Understanding the links between a healthy, active body and a balanced, resilient mind are increasingly important to educators. Our background as Personal Development, Health and Physical Education (PDHPE) teachers gives us a good insight into ways young people approach physical activity and, along with that, the very different levels of enthusiasm and confidence they demonstrate. While teachers and schools can encourage their students to follow sustainably healthy lifestyles and mindsets, it is important to take steps to understand students' perspectives if curricular and wider educational goals are to be realised for upcoming generations of Australian women.

The Australian statistics are concerning. Between 13 and 17 years of age, girls drop out of organised sport in significant numbers. According to the Australian Institute of Health and Welfare, only 7.9 per cent of Australian children aged from 13 to 17 meet the minimum standard of physical activity per week. It is important to recognise that even in an active school like *Pymble*, students who rely solely on their Physical Education lessons will fail to meet the minimum hours of recommended activity. Accumulating 60 minutes or more of moderate to vigorous physical activity per day involving



Miss Skye Halliday and Mrs Victoria Harrison with students (L-R), Georgia Richens, Tess Orton, Alexandria Johnson and Rose Tate, heading to Paris for the She Runs Active Girls' Lead conference

mainly aerobic activities should be every girl's goal. This is important as research also shows the connection between physical activity, wellbeing and academic performance.

SHE RUNS ACTIVE GIRLS' LEAD CONFERENCE 2019

Four *Pymble* Upper and Senior School students were honoured to represent Australia at the inaugural She Runs Active Girls' Lead conference in Paris, France, in March 2019. Our role was to accompany the group as they participated in this very active and varied conference. Indeed, the term 'conference' falls short in describing She Runs which included physical sessions, such as a scavenger hunt around Paris and a fun run along the banks of the River Seine with all 500 participants running and 2,000 local school girls cheering them on.

Other highlights included:

- Inspirational speeches by women known for their advocacy for girls' and women's empowerment and leadership in sport. Stand-out moments for our girls were listening to the English marathon runner, Paula Radcliffe; Italian Olympian, Valentina Marchei; and Birgitta Kervinen, winner of the IOC and Sport World Trophy.
- Birgitta reinforced the message that, "Now, the culture of sport offers more opportunities to girls and women than ever before. However, promoting equality has not reached the end of the road. In fact, the work has only begun". We hope that this message will inspire our students both within the *Pymble* community and further afield to be strong female advocates in many ways.

- The scavenger hunt which took in the sights of Paris. The girls warmed up with international Olympians against the backdrop of the Seine for the La Lycéenne Race with 2,000 other girls from Paris and around the world. This was a valuable opportunity to celebrate inter-cultural friendship and the benefits of sport for health. The scavenger hunt was complemented by 'The Village' which gave our students the chance to experience rowing, boxing step aerobics, yoga and dance with their new friends.

With only two Australian schools selected to send delegates under the School Sport Australia banner, *Pymble* was honoured to have been selected.

102 YEARS OF PROMOTING GENDER EQUALITY IN SPORT AND PHYSICAL ACTIVITY

For more than 100 years, *Pymble* has encouraged generations of girls to strive for the highest in all areas of school life and has linked optimal learning with physical and mental wellbeing. In a safe and inspiring environment, students of all ages and abilities have every opportunity to benefit from, and be empowered by, an ever-growing range of sports and physical activities, including those which have typically been male dominated. No sporting field, court, or arena is off limits to our students.

Pymble promotes gender equality through sport by:

- challenging gender stereotypes
- promoting our proud history of girls' school sport
- demonstrating that sport is beneficial and necessary for girls and women of all ages
- portraying a positive and healthy body image
- providing positive female role models.

The contribution of an active lifestyle to an individual's wellbeing and

academic achievement has been a cornerstone of education at *Pymble* since the College was founded. The College's outstanding facilities and dedicated teaching and coaching staff ensure that no matter where their sporting interests lie, students' enthusiasm, passion and dedication to physical activity and sport will be wholeheartedly supported.

From Kindergarten through to the end of their schooling at *Pymble*, the PDHPE and Sports staff are committed to their role in facilitating opportunities through the curriculum and Co-curricular Sports program for girls to be engaged and enthusiastic lovers of physical activity and sport.

From the time girls arrive at *Pymble*, they are exposed to non-competitive and competitive sports and develop a love for being active. Valuable life skills such as teamwork and self-confidence are developed through PDHPE, Sport and House Sporting Events. At each Preparatory Sports Carnival, for example, a student reads the following oath in support of the College's Core Values and their alignment with Sport:

PREPARATORY OATH

"In the name of all competitors, I promise that we shall take part in this Athletics Carnival responsibly, respecting and abiding by the rules that govern them. In the true spirit of sportsmanship and for the glory of sport, we will honour our houses, Gibbs, Mackellar and Turner. We also promise to participate with integrity, respect and care for others, and with courage within ourselves. Most importantly, we promise to have fun!"

COMPETING ON A WORLD STAGE: FEMALE ROLE MODELS

Pymble's pro-sport environment has nurtured many Australian

Student perspectives:

"We should encourage more gender equality in sport by employing stronger female role models as coaches rather than having women as coaches for netball and men as coaches for rugby (which is reinforcing society's views on what sports are for girls). It's important that girls have someone like them to look up to." **Rose Tate (Year 10)**



"I think, as we are an all-girls school, we should work together in supporting each other. Celebrating everyone's achievements no matter what level of sport, as we already do, is great; however, *Pymble* could set challenges to motivate girls to achieve their own personal goals. As we have many high-achieving athletes, it can be easy for girls to compare themselves to others and even male athletes, so it's good to be encouraged by peers and teachers no matter what level of physical activity they choose their goals around. Having the elite sports women to congratulate can help to encourage girls of all levels." **Georgia Richens (Year 11)**

"I learnt to believe in myself and encourage other girls because we are always putting each other down instead of lifting each other up." **Tess Orton (Year 11)**



"I think the TED talk we had was an amazing experience and a key message from Valentina Marchei was that 'perseverance is the key to success' which I think is very important in both school and sport. I think it was also a very important message that we are the start in getting more girls involved in sport. The other key message I took away was that girls empowering girls was the easiest and most effective way of getting girls to participate in sport and physical activity".
Alexandria Johnson (Year 11)



role models throughout the decades. Ex-student and dual international cricketer and footballer, Ellyse Perry, is the youngest Australian (male or female) to have represented Australia in cricket and the first Australian (male or female) to have appeared in both the Cricket World Cup and the FIFA Women's World Cup. The College's Elite Sportswomen's Program was inspired by Ellyse and developed to support more elite athletes at *Pymble* to balance the demands of training and competing with their academic requirements.

At *Pymble*, our girls are fortunate to be coached and mentored by a dedicated team of strong female coaches across a range of sports. We know that same-sex role models positively influence girls' self-perceptions and self-worth. These inner values help to challenge stereotypes around leadership and gender. Our female coaches can offer diverse insights and advice to our students as they consider professional careers in sport or as they negotiate their passion for sport with other interests and goals.

The girls are encouraged to be competent and engaged participants in physical activity. They are given opportunities to participate in sports such as AFL and Rugby Sevens which have been traditionally viewed as male sports. Indeed, *Pymble* is leading the way in establishing AFL and School Girls' Rugby Sevens competitions, and the latter has been enhanced by a formal partnership with the Sydney Rays Women's Rugby Sevens team which gives players access to professional Rugby coaches, players and support staff. In addition, this partnership gives our students the opportunity to experience the business side of sports events and management which offers another string to their sporting bow.



Pymble's She Runs delegates exploring Paris during the conference

With the implementation of the new Australian Curriculum, *Pymble* has a renewed focus to provide girls with more opportunities for engaging in relevant physical activity. These activities are aimed at building girls' confidence and skills to be lifelong participants in sport and physical activity. Research suggests gender equality can be improved by females having equal opportunity to engage in sport and being encouraged to be physically active. This leads to them being more likely to develop the leadership skills required to climb the career ladder.

SHE RUNS ACTIVE GIRLS' LEAD – THE NEXT STEPS

The She Runs initiative will hopefully be held again in the future and it would be exciting to see an Australian school consider hosting an event such as this. She Runs aligns very well with *Pymble's* approach as it focuses entirely on the voices and passions of young women; harnessing those from participants spanning the globe, including from Europe, Africa, the Caribbean, Asia-Pacific and the Americas.

The *Pymble* students who attended the event returned inspired and motivated to make change in their school community and beyond. The experience allowed them to share and learn from other young women from around the world and to appreciate that Australia is leading the way in women's sport. The girls also developed insight into the important need for strong female role models and leaders for progress to be made in gender equality across all sports.

School's in for summer – University of Cambridge and University of Oxford summer programs

By Geography teacher, Mr Gabriel Langford

In Term 3 2018, *Pymble* nominated ten students to represent the College at the Cambridge Programmes and the Oxford Royale Academy in England. The summer programs, which are run by top universities including the University of Cambridge and the University of Oxford, aim to open young minds to leading global educational practices in fields that students elect as their potential future passions. The universities offer courses including Law, English Literature, Advanced Mathematics, Medicine, among others, as well as a raft of elective courses designed to capture the minds of the next generation of researchers and business leaders. Below are some reflections from our girls that illustrate how the programs extended their thinking and challenged their intellect in incredibly poignant ways.



Shivashankari Kathirgamalingam, left, debating the merits of legal protection for people who act outside the law

THE CAMBRIDGE PROGRAMMES

Pymble students, Akina Li, Viveca Tang, Rachel Tang, Amelie Reed, Shivashankari Kathirgamalingam, and Corinna Chen, visited Churchill College at the University of Cambridge. Our girls exemplified the College value of Integrity by putting themselves in challenging situations

to further their understanding of their fields of passion. During the first week of the program, Shivashankari represented *Pymble* in the Law course and earned high praise from the program directors and mentors by winning a mock legal trial (moot) of a case in England that had previously drawn ire in the public realm.

“ Students reported that their studies suddenly became valuable and they reported increased metacognition in viewing the bigger purpose behind education.”

“We competed in a moot at the end of the first week, which I thoroughly enjoyed and am eager to try again at school during the next few years. As someone who enjoys debating, mooting was a really great opportunity to challenge myself to apply the oratory skills I have thus far developed to an advocacy setting... and (we) were challenged to utilise proper legal reasoning.”
Shivashankari Kathirgamalingam

Rachel, Viveca and Amelie participated in the Medicine program where they were exposed to the fascinating research fields within the industry, as well as applied Medicine in the operating theatre. Our girls offered insightful reflections about the value of being exposed to world-leading research practice, and learning alongside people of diverse backgrounds:

“During the course of the fortnight-long Cambridge summer program, I found that I gained some overwhelmingly valuable medical insights, in addition to having built genuinely unforgettable connections with students from all over the world. This can be largely attributed to the cohort of dedicated, enthusiastic and insightful lecturers and mentors I engaged with. I would like to make special mention of Dr. Kourosh Saeb-Parsy, consultant transplant surgeon at Addenbrooke’s Hospital, who was the Medicine program’s main lecturer. His wisdom, guidance and leadership were instrumental in allowing me to formulate my decision to pursue a career in Medicine. The teaching style he employed, which consisted of effective collaboration and meaningful group discussions, made the learning experience highly enjoyable. Furthermore, interacting with students from geographically distinct backgrounds lent itself to a diverse, enriching and educationally fulfilling exchange of knowledge and conventions.” Viveca Tang



'Phoem' created by Akina Li, Year 11

"It was amazing to be able to interact with students from countries all over the world and exchange knowledge and culture. The highlight of the experience for me was when we were in the operating theatre. We learnt about anaesthesia, sterilisation and the general equipment used when performing surgeries." Amelie Read

Akina challenged herself in the English Literature program. The students were asked to produce a creative expression in a modality of their choice. Akina chose the 'phoem' method, where a poem is superimposed over a photo (pictured, above) to illustrate the student's thinking.

THE OXFORD ROYALE ACADEMY

Alannah Webster, Teresa Su, Carina Ma and Tiffany Tang pioneered the *Pymble* journey to the Oxford Royale Academy at the University of Oxford. As the first group of students from *Pymble* to attend the course, our girls earned accolades from their mentors and were phenomenal representatives for the College.

While on another program to Cambridge, our girls stayed in separate colleges and participated in a variety of activities well outside their comfort zones. In this, they exemplified the College value of Courage, forging new friendships and showing themselves to be resilient to challenges when meeting new people and learning new content.

Alannah stayed at St Peter's College, and reflected on the different teaching styles she witnessed, which align with university praxis:

"Something that was extremely different to Pymble Ladies' College, was at the end of most lessons we had to make a short group presentation to our class of about 15 students about the different aspects of the topic we learnt that day. This helped me gain so much confidence as the short time frame did not allow for excessive preparation. It also forced me to be adaptable because I had to change what I was saying depending on what my group members said. From this experience, I realised that there is more than one path that you can take - both to an answer and throughout life." Alannah Webster

Carina and Teresa stayed at St Catherine's College in Oxford and participated in the medicine branch of the Academy. Their reflections speak of the program's value in succinct and astute ways:

"The approach to learning has certainly been unique and engaging, and allowed me to learn each subject in great depth. This included class discussions, presentations, laboratory activities and clear explanations of concepts from knowledgeable teachers. This academic experience has complemented my learning at Pymble. In learning at Oxford, I have felt myself being positively challenged by the coursework and assignments, which gave me the opportunity to gain a better understanding of science on both a personal and global perspective." Carina Ma

"I was overwhelmed by the diversity of students who attended the course. They were from many different nations in Europe, Asia, South America and the Middle East. It was amazing to hear about what the high school experience is like across the globe. Seeing the power of knowledge in connecting people across race, gender and social background was the highlight of my trip." Teresa Su



Pymble students exploring the University of Oxford

GLOBAL PERSPECTIVES

THE VALUE OF THE EXPERIENCE

The programs challenged our students in ways that opened their eyes to the unlimited pathways of the future for a *Pymble* girl. Simply asking how their day was on the programs leant itself to a phenomenal conversation that sparked passion and interest in ways that cannot be quantified with words. Our students have genuinely engaged with the global academic community and have demonstrated that they are more than ready to pen the next literary masterpiece, or begin researching a field that may revolutionise the understanding of Medicine.

INQUIRING FURTHER

Following my experience with students in the 2018 Cambridge and Oxford summer programs, I was inspired to conduct research into these programs from the perspective of student feedback one to three years after their visit. The focus of this research is to ascertain the impact that these particular learning opportunities have had on the Year 10 students who attended. The students chosen by the College to visit these programs must demonstrate strong and consistent academic prowess, have good references from their teachers, demonstrate resilience and independence, and be able to show good qualities of character. They are required to submit an expression of interest and attend an interview with the Head and Deputy Heads of the Upper School in order to be a successful candidate.

The research was conducted online via Microsoft Forms, exploring the impact this experience has had on them as a learner from a qualitative perspective. The aim is to determine whether or not there was a positive, negative or neutral outcome on their learning styles, as well as future aspirations, and whether the program has had a lasting impact on their studies. Of the full sample of 22 participating students, 55 per cent responded, offering anecdotal feedback about the change they experienced as individuals. The following questions were asked:

1. In a word, how would you describe your overall experience in Oxford/Cambridge?
2. What were your expectations of going on academic exchange before your arrival in Oxford/Cambridge?
3. How would you describe yourself as a learner before this exchange?
4. How would you describe your perspectives of learning once you had returned to the College?
5. What would you reflect upon as the single greatest point of impact upon you as an individual whilst on exchange?
6. Has there been an impact or change on your future choices of study/work beyond schooling in Australia?

7. If yes, how has it shaped your expectations and intrinsic desires to study?

Following, is an interpretation of this qualitative data against a framework of the College's hopes for those who had the opportunity to participate. It was expected that students would respond with reference to the cultural differences they experienced amongst a group of like-minded students from across the globe, the challenge of academics at a leading global standard, and the aspirational growth of the individual.

Summary of Findings

- Students reported that their studies became valuable and they reported increased metacognition in viewing the bigger purpose behind education.
- Students began to value the processes of learning and critical thinking more highly, and saw these as beneficial beyond examination questions.
- Students were exposed to global thinking routines and gained confidence in their ability as learners. They recognised they were equally capable compared to the world's best minds who also attended the programs.

BACKGROUND TO THE STUDY

In a large school of more than 2,200 students, the breadth of individuals means that the College can expect to have a large pool of extremely talented and gifted learners in its midst. Between 2016 and 2018, this has proven true for the 22 candidates who visited Oxford and Cambridge as representatives of the College. Our students have a wide range of learning abilities, some of whom will likely have far eclipsed the curriculum due to their abilities at their chronological age. It is evident that the vetting process helps us identify students who will be most suitable for this program. It is apparent we are sending some of our best learners and as such it could be expected to see in the data an evolution from students we see as enormously capable, to students who have gained greater insight into their metacognition and capacity as learners.

As the teacher that accompanied students in 2018, and having taught most of them in my classroom at some point in their learning journeys, I was extremely interested to understand how the individual would reflect on her time in the program. Further, I wanted to determine if there had been an evolution of motivation; whether

there was still a highly extrinsic motivation to achieve outstanding results, or if a shift had occurred towards a more independently guided and intrinsic desire to learn amongst the best minds in the world.

“ Our students have genuinely engaged with the global academic community and have demonstrated that they are more than ready to pen the next literary masterpiece, or begin researching a field that may revolutionise the understanding of Medicine.”

FINDINGS

A number of key themes emerged from the data:

- There was an increased motivation for already high-achieving students who now saw more purpose behind the critical thinking processes they were being taught.
- The exposure to different learning styles evident amongst students from a global talent pool assisted *Pymble* students to develop confidence to debate and challenge ideas, and not be content to be passive learners.
- Learning as a point of pleasure and adapting to new learning methods is something that can bring satisfaction beyond extrinsic examination rewards.
- Students gained an appreciation for the calibre of learning in their home setting at *Pymble*.

Teaching methods at *Pymble Ladies' College* for high-potential learners places a strong focus on choice and self-efficacy in determining solutions to problem-based issues. At the top end of the learning spectrum, the girls are well versed in thinking critically and using language to extrapolate information and make qualitative judgements about most ideas. The Oxford and Cambridge program data revealed that students did not necessarily learn how to think critically or creatively at a deeper level; rather, students reflected on the need to be considerate of different learning styles. Being largely self-directed with an emphasis on tutorial style learnings, student reflections revealed a new appreciation for learning styles across a global context. Being exposed to students their own age from extremely contrasting backgrounds in both Eastern and Western settings enabled *Pymble* students to value the learning style, rather than the content they were expected to master.

There was a strong correlation in the data showing that students wished to attend an overseas university at

some point in their future academic careers as a result of attending the program. Students largely reflected on the fact that whilst this opportunity did instil a sense of nervousness, the program demystified the process of physically studying abroad.

Interestingly, some articulated that the opportunities in Australia were adequate for their future academic pursuits. It appeared that the need for a global experience could possibly be satisfied for some by a semester exchange to an overseas university. For these students, it seemed that they were happy to complete an undergraduate degree in Australia and potentially think of studying abroad for postgraduate purposes.

CONCLUDING THOUGHTS

Though there was an assumption that this research would find students highly impassioned to study overseas after life at *Pymble*, which was the case in most responses, it was pleasing to find that students gained confidence in their abilities to discuss great ideas with like-minded peers. Great leaps and bounds were made in student abilities to fully comprehend the logic behind why education is implemented the way that it is in Western countries such as Australia, and at schools like ours. This led to an increased intrinsic desire to learn, where grades no longer became the focus of achievement. The focus was on personal growth and capacity to understand others and disseminate ideas to their fullest extent.

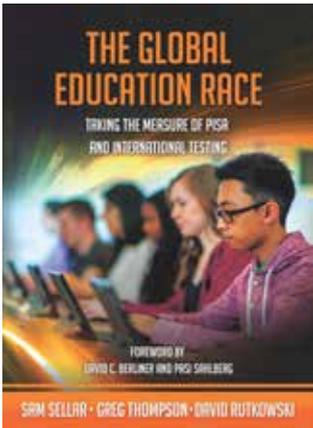


Pymble students experiencing the University of Cambridge

Running the right race

By Director of Teaching and Learning, Ms Tricia Allen

PISA is the Organisation for Economic Co-operation and Development's (OECD) Programme for International Student Assessment. The test - in reading, mathematics and science - is given every three years to 15-year-old students from all over the world. The tests are designed to gauge students' mastery of key subjects as they relate to learning needed for adult life. In most countries, 15 is the age at which students decide whether they want to continue their education and at this point they need to be prepared for adult life. *Pymble* has participated in PISA on numerous occasions, most recently in 2018.



THE GLOBAL EDUCATION RACE: TAKING THE MEASURE OF PISA AND INTERNATIONAL TESTING

Sellar, S., Thompson, G. & Rutkowski, D. (2017). *The global education race: Taking the measure of PISA and international testing*. Edmonton, Canada: Brush Education.

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We have reached a point in education where the measuring and ranking of school performance has created a global race. In recent decades, there has been a growth of testing in education and this has become part of a broader trend towards 'datafication,' which essentially means assigning numbers to objects and events. In Sam Sellar, Greg Thompson, and David Rutkowski's book, *The Global Education Race: Taking the Measure of PISA and International Testing*, the authors make clear that the Organisation for Economic Co-operation and Development (OECD) Programme for Student Assessment (PISA) is "...the main track on which the global education race is run" (Sellar et al., 2017, p. 6). This global education "race" has become a metaphor which has emerged in newspaper headlines, political speeches, and think-tank reports. It suggests that schooling has now become a global competition in which each country strives to surpass

“ In recent decades, there has been a growth of testing in education and this has become part of a broader trend towards 'datafication,' which essentially means assigning numbers to objects and events.”

another in terms of educational performance and that countries now worry about being left behind.

The book aims to provide an introduction to PISA, to highlight how it works both in technical and political terms, and to argue for a broader debate in the ability to meaningfully assign numbers to education, the rationality of data (mis)use, and the negative consequences of data.

What sets this book apart from other examinations of PISA is the target audience. Written to make the information accessible to all stakeholders, including educators, parents and teachers, it aims to examine how PISA shapes educational thinking and to challenge the myths about the performance comparison of school systems that have emerged as a result of PISA. In short, it aims to help people understand "...what PISA is, what it does, and what it cannot do" (Sellar et al., 2017, p. 7).

The book is not anti-testing nor anti-PISA, rather, it looks at the potential usefulness of PISA beyond national scores and rankings. It does not offer any simple solutions to the complex nature of educational reform. The authors stress the usefulness of PISA as a place to start a conversation about what the data can reveal, rather than a report card on the success of educational systems.

The early chapters focus on the myths surrounding media coverage of PISA data, with particular emphasis on rankings. The authors refer to the OECD explanation "that less than 1% of its PISA report focuses on league tables, a much higher percentage of the media reporting does focus on these tables" (Sellar et al., 2017, p. 18). According to an Education International publication "the impact of PISA through the media is undeniable" (Education International, 2007, paragraph 12). The problem arises when these results get amplified through the media where simplistic stories about crises and decline become detached from the basis of evidence itself and then get used to justify particular policies or reform. This was the case in the 2013 Australian Education Act, where one of the objects of this Act was for "Australia to be placed, by 2025, in the top 5 highest performing countries based on the performance of school students in reading, mathematics and science" (Australian Education Act, 2013, p. 3). This is a non-sensical goal

because the point is not about where you rank in PISA but what Australia might learn from the data as a useful tool in context, and for particular purposes.

The focus then shifts to the administration and technical aspects of the test followed by the problems with comparisons and correlations between countries. The authors then consider the validity of standardised testing and the politics of educational measurement. What must be noted is that PISA does not aim to measure how well students have learnt what is taught in schools. It is an assessment that measures what a 15-year-old knows on a given day about the content that the OECD thinks is important in terms of economic growth. In making clear some of the limitations and difficulties with PISA, the authors hope to reduce some of the pressure put on education ministers by the assessment, highlighting that rank does not correlate with performance and that hasty conclusions in relation to policy reform should be avoided. What is limiting in the book is the discussion around equity in PISA and the correlation of the questionnaire results with the assessment. This is a key point which links clearly with policy significance. Whilst this issue is mentioned briefly as a policy outcome, according to Mortimore,

“ This global education “race” ... suggests that schooling has now become a global competition in which each country aims to surpass another in terms of educational performance and that countries now worry about being left behind.”

“socio-economic backgrounds and school and educational system characteristics can add to our knowledge about how schools and school systems can promote achievement and increase the equity of educational outcomes” (Mortimore, 2009, p. 3). The authors might well have looked at the significance of equity in this context rather than solely in terms of policy outcomes. Although limiting, this is rather minor given the ultimate aims of the book.

The message given in *The Global Education Race* on questioning the validity of messages disseminated through the media, should also be transferred to other measures of data, encouraging consumers to raise the standard of the debate about these assessments, rejecting invalid, simplistic stories. PISA does give a set of data that can be used as part of an international conversation about education and its purposes. If seen in this light, having a robust data set is useful.

The Global Education Race encourages informed, critical engagement with PISA and its implications. It equips the reader with the knowledge to question what is presented through media outlets. This consideration can help shape effective policy through informed, public pressure. There are right and wrong ways to use the data. This book makes it easier to navigate this race. What matters most is that countries are running in the right direction, in the right race, for the right reasons, rather than being at the top of the rankings.

Reviewed by Tricia Allen, Director of Teaching and Learning, Pymble Ladies College, Doctoral Candidate (EdD) UNSW Faculty of Arts and Social Sciences.



PISA data from online testing can start a conversation about school reform

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Enhancing teacher practice

By Director of Research and Development, Dr Sarah Loch

Inquiry curious and research fit: Enhancing educational practice through teacher research

“Before an educator can marshal the mental energy and commitment to change her practice, it is necessary to become aware of that practice as she is currently engaging in it”, Sue Nichols and Phil Cormack (2017, p. 15).

INTRODUCTION

Those who have studied Education at university are likely to have experienced a research subject within their degree, especially at postgraduate level, but when studying to become a teacher we are focused on mastering all we need to be, do and say to create effective learning environments for our students. Once we begin working in our classrooms and with the progression of time, our identities as teachers become more secure. The connection to the school community and the ability to manage multiple situations improves.

For many teachers, problem solving and the drive to improve can lead to an interest in conducting research. Rather than focusing solely on issues of teaching and wellbeing, the inquiring practitioner emerges with deeper curiosity around educative processes. Making a contribution to knowledge production is supported when school leaders, teachers and students incorporate practitioner

research into their approach (Charteris & Smith, 2017) and is driven further when the research process prompts us to think differently about practice and inquiry that we may be replicating, possibly with limited value, without question (Mockler & Groundwater-Smith, 2015).

Research is noted as having a positive impact on teacher practice (Nichols & Cormack, 2017). Beyond the value of deepening and expanding one’s skills, the teaching profession now has further motivation to use and conduct research. Formal accreditation for teachers at highly accomplished and lead levels requires competence with conducting research projects. However, teachers’ research skills are typically limited by a lack of experience and access to research training. Teachers also encounter challenges in finding the sustained time required to conduct research. But teachers are typically passionate about inquiring more deeply into how their teaching works and reflecting on opportunities and necessities for improvement and innovation.

THE INQUIRING PRACTITIONER

Engaging in formal inquiry through a research project utilises the energies of curiosity, wondering and questioning and combines this with structure, purpose and outcomes. The process of planning, conducting and sharing the project adds to teachers’ skills as intentional knowledge-makers in their areas of expertise. In the collaborative environment of teaching, teacher-research emerges as an important component in enhancing the ways by which educators find purpose, build meaning and approach the

“But teachers are typically passionate about inquiring more deeply into how their teaching works and reflecting on opportunities and necessities for improvement and innovation.”

accountability required across all sectors of academic, social and emotional growth for our students (Lytle & Cochran-Smith, 2009).

This article explores the landscape for teachers on the pathway to become teacher-researchers. It is informed by a short cycle of action research conducted at the beginning of 2019. In conducting my research, I was interested in teachers’ experiences of themselves conducting research to inform planning for professional learning in this area. Action research is highly contextual (the situation of this school and these teachers are key) and any findings should immediately inform the next cycle of planning and decision making (an iterative approach). There is also strong argument that action research should contribute to change and hence listen to and take action with some of the more difficult, “unwelcome truths” that practitioners encounter (Kemmis, 2006; Mockler & Groundwater-Smith, 2015). This article shares some of the comments collected



Director of Research and Development, Dr Sarah Loch, conducting professional learning for Pymble teachers

through an online survey with ten teachers and my reflections on how and why teachers engaging in research can contribute positively and transformatively to the College's professional learning ecology.

ACTION RESEARCH STUDY

The Director of Research and Development position is a new role in the College, and with this comes a new strand in the professional learning available for staff. As I begin developing professional learning that meets the needs of our teachers, it will be useful to gain insights into teachers' views about research and, significantly, their feelings about embarking on research projects. Using action research methodology, I developed my first cycle of data by writing a reflection

“ The opportunity for the College to allow teachers to design and conduct research and to achieve their research goals is a hallmark of an educational community with great potential to transform learning as we alter, not just add to, what we know in the field.”

on what motivated and challenged me as a teacher-researcher. I also reflected upon conversations with colleagues where we discussed my new position, what I would be doing and ideas they had for research. The results communicated staff enthusiasm and, in some cases, existing confidence. However, not all were in this category. Some were uncertain of their capacity and felt rusty regarding skills they had used in the past.

INQUIRY QUESTIONS

The survey asked four key questions, highlighted below with some discussion.

Q What seems exciting in terms of doing research?

As I am interested in building my understanding of what *Pymble* teachers find most relevant when it comes to improving their practice through research, I am interested in the notion of motivation and personal meaning-making through conducting a research project of each participant's own choice. Respondents said they were excited about:

- Learning new things and finding better ways of enhancing the learning experiences of students.
- Learning and discovering something new.
- The prospect of using real data to make real change.
- Many opportunities for better outcomes. Using the amazing resources of *Pymble*, especially excellent staff, to find better ways to do things.
- The opportunity to be engaged in discussions around educational practice.
- Exploring a concept in detail.

Educational researchers, Annette Hilton and Geoff Hilton (2017), suggest that teacher-researchers are motivated by a sense of ownership and relevance which contributes to them feeling valued as professionals. The responses to my question strike me as energetic and optimistic. I perceive a notable and admirable drive towards learning new things to improve oneself and to improve our work, even as teachers simultaneously recognise the challenges of actually doing a project. There is also a theme of collaboration as opportunities for new partnerships amongst colleagues unfurl and people tap into the human resources within our group of staff. The respondents are looking to find meaning in their research work and they anticipate excitement in opportunities to work with others in the same conceptual space:



Junior School Language Arts Co-ordinator, Miss Sarah Wells; Head of Learning Area – Modern and Classical Languages, Mrs Salina Bussein; and Deputy Head of Upper School – Year 10, Ms Gina Ventura sharing insights into research

- Interaction with colleagues, and increased personal capacity.
- Collecting evidence about the efficacy of what we do.
- Collaborating with others, working with colleagues.
- I value different perspectives and look forward to being engaged in deeper and conceptual thinking around our practice.

From this question, I gain a sense of how *Pymble* teachers see many opportunities in research projects. They can build new skills as they contribute to the work of colleagues and their students. There is an inter-relatedness as teacher-researchers commit themselves to a project, and find excitement in the experience of “real change”, “finding better ways of enhancing learning” and “discovering something new”.

Q What concerns you about doing research?

The respondents spoke overwhelmingly about the challenge of time – “time management” and possibly not having “time to do it well”. There was also concern for taking other people's time “knowing how busy they are”, “not [having]

enough time” and needing to spend time “getting the buy-in from others”.

With time being a finite quantity in any situation, how can I support people to work with their available time, utilising a network of fellow teacher-researchers to share their tips and successes around time management? The data shows me it will be crucial to address this concern if teachers are to relate to professional learning in research and if they are to have useful experiences conducting their own projects.

Skill building to facilitate conducting research (“scale, process... and finalising [the] proposal question”) and maintaining people’s motivation through a possibly lengthy project are also mentioned as concerns. “It is easy to lose motivation”, writes one respondent, “particularly when research enters the ambiguous, grey areas”. Another respondent points to the challenge of “keeping it as a high priority” amongst the demands of her job. It will be important to acknowledge time pressure as a relevant concern and infuse professional learning with practical strategies that can assist, so as not risk teachers switching off their research projects before they begin. Helping prospective teacher-researchers maintain their motivation for their project, possibly by highlighting connections to the altruistic goals of making a difference and discovering new knowledge, is another way of helping teacher-researchers to find pleasure and meaning in the research process.

Q What benefits do you see in doing a research project?

The responses to this question were strongly focused on one main benefit which again highlights teachers’ reasons for doing the work they do – “to improve student outcomes”. Six of the ten respondents explicitly mention this as a benefit from their own research project in language which included:

- Enhancing learning practice to improve student outcomes.
- Ensuring the effectiveness of programs thus motivating staff and ensuring we are making a difference to the students.
- Thinking that a research project would offer excellent opportunities for ongoing reflection and the implementation of varied or new approaches, which would certainly enhance the students’ learning experiences.

Additionally, respondents note the benefits they anticipate in terms of enhancing their skills. One respondent highlights the benefit of taking time to dig more deeply to source “in-depth knowledge of the topic being researched”. Other benefits include influences on educational practice, leadership, critical evaluation skills and pedagogical approaches, and being in a better position to effect change. Some have already experienced these benefits through prior projects:

- “My experience conducting educational research has also enhanced my confidence in my ability to carry out leadership roles and contribute towards College-wide strategic discussions.”
- “It is a way of looking at and evaluating practice objectively in a form that is shareable.”

These responses point to *Pymble* teachers’ firm focus on improving student outcomes and to teacher expectations that research will work in concert with other College approaches to that same end. Teacher-initiated, collaborative and communicative inquiry platforms sit at the heart of *Pymble’s* Teaching and Learning Framework which seek to promote opportunities for deep learning and improvement in our learning environments. Teacher-developed inquiry and research is an example of professional learning in context and it is this type of experience which gives teachers

agency, in turn allowing them to “enhance decision-making with a view to improve students’ learning outcomes” (Charteris & Smardon, 2015, p. 123). Ultimately, one of the benefits of teacher-research is that it is a form of professional learning which can be experienced as “effective, relevant and enjoyable” (Goodyear, Casey, & Kirk, 2013, p. 21) and this leads to a more lasting impact for students and teachers.

Q What would you like to know more about or gain more skills in at this stage?

The diversity of suggestions made by respondents indicates that teacher-researchers must have opportunities within their professional learning to select skills and pathways of most relevance.

For some, the next steps are very practical:

- “I would like to map out the research journey in my own particular area so I know the big picture ahead of me.”
- “I would like to collate evidence, create suitable surveys.”
- “I’d like to gain in confidence and understand the basics of how to go about it.”
- “I’d like to know what sort of support will be available (even time-wise perhaps?) and what the process will look like as we embark on this project.”

Also apparent is the sense of the audience at the other end of the study and the opportunity to form networks:

- “It would be good to find ways of structuring the research to be accessible to other stakeholders.”
- “I think it would be valuable to bring together colleagues who were currently engaging in (or keen to begin) practitioner research. I have found being a postgraduate student and full-time teacher isolating at times.



Pymble teachers working together to build their research skills

A group of like-minded colleagues could be an incredible 'resource' that builds the body of specialised knowledge at the College and supports the teachers engaged in research."

WHERE DOES TEACHER-RESEARCH FIT IN THE COLLEGE'S PROFESSIONAL LEARNING LANDSCAPE?

The College is fortunate to have a well-established professional learning program. Positioning teachers centrally in relation to school improvement is a key component in contemporary school change. This sees educators constructing and co-constructing inquiry processes and taking responsibility for changing their own practice according to their own findings (Butler & Schnellert, 2012). The reliance on one-off, magic-bullet workshops and seminars to influence what we do with our own students has fortunately now fallen away. Educators now experience the more impactful strategies of inquiry, especially collaborative inquiry.

An emphasis on the impact that 'inquiry-curious' and 'research-fit' teachers have on their students, colleagues and wider school community has attracted much

attention in educational research and the literature in this area is most encouraging and exciting for schools. Susan Lytle and Marilyn Cochran-Smith (2015) were early advocates for teachers producing and critiquing their own knowledge about classroom practice, rather than allowing this to sit solely in the hands (and pens) of university academics.

“Most educators are drawn to their careers through the desire to make a positive difference to children, young people and their futures.”

This gives great impetus for teacher-research at *Pymble*, which has the benefits of being a large learning community with very diverse curricula and co-curricula options. The *Pymble* landscape, therefore, provides a rich, diverse and ever-changing research site. We all have the opportunity to add capacity, experience and output to extend and deepen the capacity of our teachers and educational leaders in the confidence they bring to their observations and decisions.

“ In the highly collaborative environment of teaching, teacher-research emerges as an important component in enhancing the ways by which educators find purpose, build meaning and approach the accountability required across all sectors of academic, social and emotional growth for our students.”

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Is the use of mobile devices in schools really innovative? What does the evidence say?

By Professor Kevin Burden, Professor Sandra Schuck and Associate Professor Matthew Kearney

This article reports the initial findings undertaken by a transnational team of academics and teachers funded from an Erasmus+ project entitled 'Designing and Evaluating Innovative Mobile Pedagogies' (DEIMP). We recognise that mobile technologies have been used inappropriately by students and do not deny that smartphones have generated problems and challenges for teachers, leading to concerns amongst parents, teachers and headteachers around the disruption caused by personal mobile devices in schools. However, we are also cognisant of the benefits for learning that these technologies can offer when used appropriately (Bano et al., 2018; Ng and Nicholas, 2019). The research reported here therefore seeks to help teachers to identify and design innovative mobile learning pedagogies that make a tangible difference to the lives and experiences of learners.

“ Innovation is a complex and contested concept, but our own findings suggest that it can be best understood as a continuum.”

WHAT IS INNOVATION?

The word 'innovation' is used rather loosely in education, but the research literature suggests that it requires more than superficial change and should be impactful and valuable to individuals or communities (Denning, 2004; Lindfors and Hilmola, 2016). Innovation is a complex and contested concept, but our own findings suggest that it can be best understood as a continuum. At one end are 'sustaining innovations', where an existing idea or practice is adapted but not radically challenged (Christensen et al., 2008). At the other end of the spectrum, 'disruptive innovation' is extremely different to the status quo and can initiate a paradigm shift (Christensen, 1997), transforming existing, dominant practices.

THE RESEARCH METHODOLOGY

With the above discussion in mind, academics and teachers from the DEIMP project team have conducted a systematic literature review to identify how the use of mobile technologies supports innovative teaching and learning practices for school-aged learners. Unlike a traditional literature review, a systematic literature review adopts a clearly defined set of criteria and search protocol to scan academic and other research databases for articles that match. In this case, the criteria focused on the terms 'mobile learning', 'innovation' and 'school-aged children', along with various synonyms. The initial search yielded 208 academic papers. A further refinement was then conducted, in which pairs of researchers applied the following selection criteria:

- published in English between 2010 and 2017
- SCImago journal ranking (SJR) in the top two quartiles
- targeted school-aged learners (five to 18 years)
- study adopted a rigorous methodology with compelling evidence
- focused on innovative mobile pedagogies
- strategies and approaches used were effective (e.g. had positive learning outcomes).

This process reduced the number of suitable papers to 72. Subsequent refinements reduced this to 57 papers, which were then ranked along the innovation continuum described earlier, using the following criteria identified in the literature on innovative mobile learning (Law, 2003; Law et al., 2005):

- innovative nature of the task
- context of the learning
- relationship between teacher and student
- extent of student agency.

A table was set up so that each criterion could be scored from 1 (low) to 3 (high). Each team member independently scored a selection of papers, and scores were statistically analysed for outliers. Papers with a score of 4–6 were identified as low in innovation, 7–9 as medium, and 10–12 as high in innovation (see Figure 1).

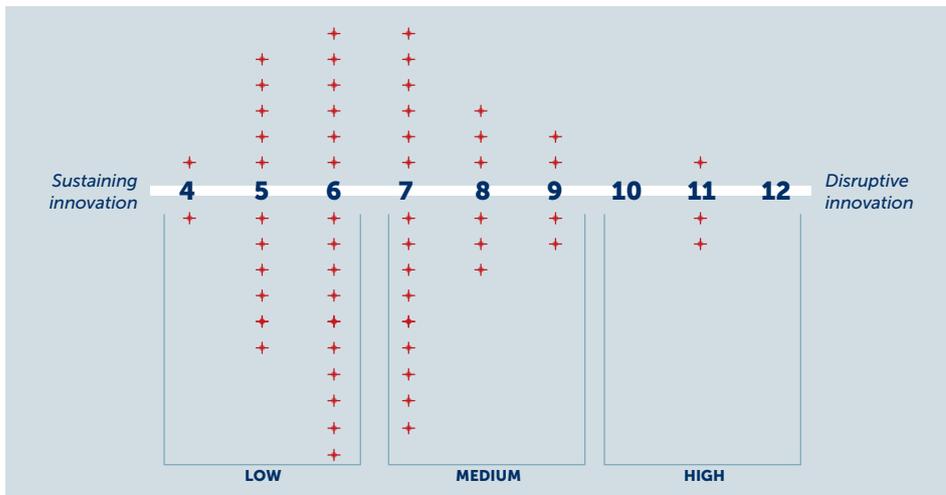


Figure 1: Innovation Spectrum

FINDINGS

Of the 57 papers, only three demonstrated high levels of mobile pedagogical innovation that could potentially disrupt traditional practices. Twenty-five papers were placed as medium on the innovation spectrum and 29 at the low point. All three of the high-scoring papers featured high levels of student autonomy, such as in how, where and when they undertook a task and how they demonstrated their learning. The relationship between students and teachers was more democratic than normal, with tasks such as the co-authoring of a mobile learning activity. Most significantly, learning occurred across multiple contexts, such as the classroom and the local environment, and the mobile device bridged the boundaries between these contexts, potentially making learning more authentic and meaningful.

An example can be seen in a study undertaken by Barak and Ziv (2013), which investigated Year 9 students' use of a tool called Wandering to facilitate outdoor, interactive learning in their environmental studies. Students used the program to design and create their own short, reusable learning packages, which included an objective, a learning activity

and peer assessment. Learning was enhanced through students searching for information, creating a 'LILO' (location-based interactive learning object), and then sharing it with the community using social media. Findings indicated high motivation amongst students, not only for completing their school assignment, but also for contributing to the community. By contrast, in the studies that were scored 'medium' or 'low', students were granted fewer opportunities to demonstrate agency. An example of a study scored as 'medium' can be found in Looi et al.'s study (2011). Over a period of 21 weeks, Grade 3 students in a Singaporean primary school used mobile devices in the Science curriculum to investigate a series of scientific challenges created by their teachers, with a focus on 'seamless activities' that crossed between formal and informal learning contexts. These tasks were highly student-centred and collaborative in nature but none were significantly disruptive and most of them followed

traditional classroom practices. Whilst the mobile devices played a significant part in supporting students to undertake these tasks (e.g. video recording the experiments they undertook at home with their parents), they were not indispensable and most of the tasks/activities could have been undertaken with more conventional tools. Unlike the disruptive innovation illustrated above, this study was more typical of the medium-scored papers in which teachers made most of the decisions about the overarching nature and design of learning tasks.

In this example, and more so in the examples classified as low in innovation, mobile learning tasks that teachers designed were often not uniquely mobile and could have been completed in more traditional ways. These tasks tended to be simulated, rather than the authentic activities identified in the high-scoring papers, and this often reflected the more traditional contexts, mainly the classroom, where the mobile

devices were being used. An example of a low-scoring paper was Smith and Santori (2015), which investigated the typical use of iPad devices in two middle schools in the USA. The authors described tasks that resembled traditional activities that might have been undertaken on a computer,

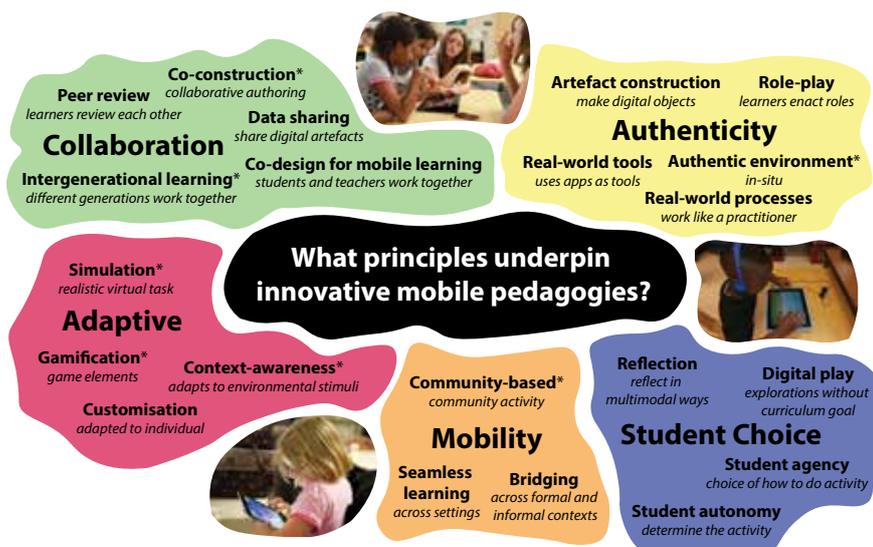
such as web browsing, and which were all completed in one space – the classroom.

“Most significantly, learning occurred across multiple contexts, such as the classroom and the local environment, and the mobile device bridged the boundaries between these contexts, potentially making learning more authentic and meaningful.”

EMERGING PRINCIPLES

Based on a thematic analysis of all the papers, we identified a set of 21 pedagogical design principles that underpin the innovative and disruptive use of mobile technologies (see Figure 2).

MOBILE TECHNOLOGIES



* Denotes principles located in more than one cluster. All images are labelled for non-commercial re-use.

Reference: Kearney, M., Burden, K. & Schuck, S. (2019). Disrupting education using smart mobile pedagogies. In L. Daniela (ed), *Didactics of Smart Pedagogy: Smart pedagogy for technology-enhanced learning* (pp. 139-157) Cham, Switzerland: Springer.

Figure 2: What principles underpin innovative mobile pedagogies?

DISCUSSION

All of the studies identified in this systematic literature review illustrate how mobile technologies can be used by school-aged students within existing educational systems to bring about meaningful learning. Whilst few of the studies were radically disruptive in nature, they all demonstrate positive benefits for learners, such as greater student agency, choice and opportunities to work in more seamless and varied contexts. Therefore, we conclude that there is a need to support teachers and pre-service teachers in designing similar mobile pedagogical activities. The 21 principles identified can be used for this purpose, and the DEIMP project team is currently analysing the findings from a worldwide survey of teachers and mobile learning experts to identify which of these principles are most effective and most likely to be incorporated in mobile teaching and learning activities.

“ We conclude that there is a need to support teachers and pre-service teachers in designing successful mobile pedagogical activities.”

To support teachers, the DEIMP project is developing a selection of multimedia scenarios, a bespoke mobile app and an online training module. Pymble Ladies' College is one of the international schools trialling these through 2019 and 2020. You can visit the project website for more information at www.deimpeu.com.

*This paper is based on Burden, K., Schuck, S. & Kearney, M. (2019). Should we be concerned about mobile devices in the classroom: What does the evidence say? *Impact. Journal of the Chartered College of Teachers*. UK. Jan, 2019.

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CONCLUSION AND RECOMMENDATIONS

The initial findings from the DEIMP project reveal a diverse range of pedagogical strategies for using mobile devices for beneficial purposes and in ways that begin to challenge existing practices and structures. Based on these findings, we recommend that teachers:

- Design mobile pedagogies that incorporate change that is not merely incremental in innovation, or what we have called 'sustaining innovations', but ones that have some elements of disruption in them.
- Recognise that radical or disruptive innovation is too challenging for most to adopt immediately; rather, we suggest that we encourage innovation somewhere between conservative and radical and view disruption as being on a continuum. An important aspect of disruption in the context of school-aged learning with mobile devices, we argue, is that it is feasible.

Innovation and collaboration – where to from here?

By Stage 4 English Co-ordinator, Mrs Sree Raniga

This term, I've had the wonderful opportunity to participate in a global research project with partner schools of the Erasmus and Designing and Evaluating Innovative Mobile Pedagogies (DEIMP) project in the United Kingdom, Ireland, Belgium, the Netherlands, Cyprus and educational institutes within Australia such as University of Technology Sydney. This course has been designed to allow educators to further their expertise in designing, evaluating and sharing innovative pedagogical experiences for students through the use of mobile technologies for teaching and learning. So far, what I have found most interesting is how new mobile learning activities allow for greater student engagement and aims to enhance learning within and outside the context of the classroom. As the project progresses, participants will be guided on how to design and share lessons implementing mobile technology. These teaching strategies are proposed to be shared on an app that allows for global collaboration which educators can access across the world.

The research project is undertaken online through the use of Harvard University's Massive Open Online Courses (MOOC). We began our journey by firstly understanding the 21 principles underpinning innovative mobile pedagogies. These key principles are grouped in clusters, drawing an explicit focus on collaboration, authenticity, student choice, mobility and being adaptive to enhance the learning

experience of students. The primary intention of designing the app is to allow educators to access lesson strategies that implement innovative technology to enhance students' autonomy and agency where they become active participants in determining and selecting their own learning experiences. These innovative teaching strategies ideally allow for seamless learning to take place where learning is not bound within the classroom but is accessible in a wider context.

WHERE TO FROM HERE?

At present, I have undertaken some research to analyse the needs of students within my classroom space. This research project has allowed me to recognise that as educators, we need to implement innovative lessons in order to engage students within a technologically advancing world.

Implementing technology and innovation would also allow for differentiation, whilst extending students beyond the classroom space and aligning their learning with innovative tools familiar to them. I believe this project aligns with our teaching philosophy at *Pymble* to create an engaging, interactive and personalised learning environment for our students. So far, the project has positioned me to embrace innovative strategies in order to stimulate and nurture agile critical thinkers within my classroom. The next stage will involve collaboration amongst a team of teachers within the College to further experiment and implement mobile technology within the *Pymble* community.



Stage 4 English Co-ordinator, Mrs Sree Raniga, and colleagues working on the DEIMP project

Improving outcomes for Indigenous students at Pymble Ladies' College

By Deputy Principal, Mrs Julie Shaw, Indigenous Student Co-ordinator, Miss Kate Howie, and Dr Sarah Loch, Director of Research and Development

“The number of Indigenous students finding success in attaining student leadership positions in the College is worthy of note. This reflects their self-confidence, skills and feelings of connection to their school. It is also important to note the high esteem in which Indigenous students hold their Indigenous peers. Girls naturally look up to older students as role models.”



Shakira Tyson (Year 11) with fellow diver Paige Jackson (Year 12)

THE INDIGENOUS SCHOLARS PROGRAM AT PYMBLE

Since 2007, *Pymble's* Indigenous Scholars Program has been making a difference to the lives of Indigenous students by providing access to a *Pymble* education. The benefits for staff and students are evident in the conversations and activities now embedded in the fabric of the program itself. As a result, an increased cultural understanding for students and staff has evolved and enabled a two-way exchange between Indigenous and non-Indigenous members of the community. Increasingly, and intentionally, Indigenous and non-Indigenous people have been brought together as learners and teachers as the College plays a part in improving cultural knowledge and understanding. It is our hope that the Indigenous Scholars Program will make a lasting difference to the wider community as our students complete their secondary studies and progress to the next stage of their lives.

There are currently 19 Indigenous students at the College. Of these, 16 girls have Indigenous Scholarships; however, all 19 students are included in the program. The girls are from metropolitan and rural/remote locations with homelands including Daly River and Darwin in the Northern Territory; Townsville and Toowoomba in Queensland; Moree, Lightning Ridge, Dubbo, Narrabri, the Central Coast and Sydney in New South Wales. In partnership with the Australian Indigenous Education Foundation (AIEF) and the Goodes and O'Loughlin (GO) Foundation, Abstudy and a number of private donors, the College supports the students educationally, financially and socially.

“Going to *Pymble* was the most amazing experience I've ever had, and I was so proud to be there. Everyone was so welcoming, kind and caring which made it feel like home. I love the trees, birds and the people at *Pymble*. When I came last year, I saw a kookaburra as Mum and I drove in, since then I have known this is the school I want to go to.”

IMPROVING ACADEMIC AND WELLBEING OUTCOMES AND BUILDING CULTURAL COMPETENCE

Following a two-year grant from the NSW Association of Independent Schools (Improving outcomes for Aboriginal and Torres Strait Islander students, 2016-2018), we recently submitted a report on the College's program. The report highlighted important strengths and key features relevant for our community which we now recognise as hallmarks of our approach. Of interest to the investigation team were the shifts observed in relation to cultural change in the College. An increase in awareness, interest and pride in Indigenous history, language and society, encapsulated by the term 'cultural competency', was identified amongst Indigenous and non-Indigenous staff and students.



Indigenous students from Year 7 to Year 12 (2018) with Mrs Vicki Waters, Mrs Julie Shaw and Miss Kate Howie

This finding was especially noteworthy as the Indigenous Scholars Program has primarily focused on academic and wellbeing outcomes for individual students with broader cultural impact being a secondary, albeit desirable, outcome. In data collected for the report, greater interest and confidence in engagement in Indigenous Australia from a widening range of people, was noted. Barbara Hill and colleagues from Charles Sturt University (2018) write, "cultural competency is more than academic knowledge; it is, among other concerns, to do with attitudes, with reflexivity, with openness and sensitivity to other cultures; in this case, Indigenous Australian cultures in all their diversities". This definition points to ways the Indigenous Scholars Program is making an increasingly positive impact on the lives of our students and their families.

This article will give insights into two key focal areas of the College's Indigenous Scholars Program: the transition phase which supports new

students as they commence at the College (usually in Year 7, although girls are also accepted in other year groups); and the academic and wellbeing strategies employed to assist students to achieve at their highest. It will then share some examples of the positive impact the program is having on cultural competency within the entire College community.

MAKING THE TRANSITION TO THE COLLEGE

As students prepare to commence at the College, the Indigenous Student Co-ordinator (ISC), sometimes accompanied by the Deputy Principal and/or a member of the Learning Support staff, visits the girls and their families in home communities. During the visits, the ISC aims to build positive and respectful relationships with family members by sharing information about the College and seeking information about the prospective student. The students and families also spend time on campus, visiting

at least once prior to the student commencing. They try classes, stay in boarding, participate in some co-curricular activities and possibly undertake some educational testing. Parents can meet key staff, get a feel for the learning environment and understand more about the College culture and communication pathways. A significant benefit for the College is that teaching and boarding staff develop a much greater understanding of students' needs prior to entry and they utilise these insights to support students' academic, emotional and social needs from the very first days.

We have found great value in creating mutual opportunities for shared experiences between students, parents, families and College staff. These allow for authentic and respectful relationships to flourish. In our experience, students feel more secure and better known because key staff, such as the Indigenous Student Co-ordinator and Indigenous Learning Support Teacher, know where each

INDIGENOUS EDUCATION

girl comes from and can share information with boarding staff and academic teachers in a proactive way. As key staff have already spent time visiting students in their home community, there are authentic opportunities to share information, ask questions and build relationships. The process gives the College a multidimensional picture of each student. Compared with the early stages of our Indigenous Scholars program, where College staff visited girls at home in places including Thursday Island, Darwin and Moree, to interview them before deciding if the placement was suitable, the process today is a two-way exchange of information over a period of time.

The following excerpts give insights into how the transition program supports students, families and teachers. Parent and student responses to the transition program give very valuable insights into what different people find meaningful and how feeling familiar with the College environment supports the transition considerably. To preserve privacy, names have been changed to non-identifiable initials.

An email from a Learning Support teacher to the Indigenous Student Co-ordinator on the first day of L.S.'s visit to the College, 2018: *"L. is off and running. She seems excited to be here and open to all we have to offer. Her words, 'I want to achieve this week so I can be a lawyer when I leave school'. No pressure."*

The following comment was made by a parent after her stay at the College with her daughter: *"The week at Pymble Ladies' College was a great experience as it allowed us to get an insight into the school, and to get a feel of the school environment, students, boarding house and opportunities the school has on offer. This was great, it made B. and I feel so included and comfortable being away from home and knowing what to expect. I don't think B. would*

feel as comfortable going to Pymble without the transition program."

This email was received from an incoming Year 7 student in the holidays before commencing at the College: *"Hi Miss Howie!!! I'm so excited to start boarding at Pymble this year. Myself and the girls have started a group chat ... so we have been staying in contact and we have had phone calls everyday since three days ago and we are counting down the days! We all are so excited. Thank you."*

The following reflection was written by an incoming student, following her stay on campus in late 2018: *"Going to Pymble was the most amazing experience I've ever had, and I was so proud to be there. Everyone was so welcoming, kind and caring which made it feel like home. I love the trees, birds and the people at Pymble. When I came last year I saw a kookaburra as Mum and I drove in, since then I have known this is the school I want to go to. My buddy ... was so helpful, it was delightful to have ... as my buddy. She was so funny and sometimes forgot about me, which was ok, it made me meet other girls. I also made friends with ..., ... and a couple of the day girls. It was funny because ... lives 45 mins and ... 1 hour down the road from each other which is cool. Pymble's classrooms are so neat and modern which makes it easier to learn in. All the staff and teachers were great and helpful which made everything a whole lot more comfortable. Ms Howie always checked in on me and made sure I was ok, she arranged a busy fun schedule for my visit, which was great. The boarding house was so fun, it was like having nine other sisters living with you. I thought the food was great too, I have tried the food at other boarding schools before when doing netball carnivals, but their food was nowhere near as good as yours.*

The coaches were great, I especially liked the high jump when we jumped

off the gymnastic spring board, imagine how high I could jump with a coach. I also enjoyed the Diving because at the end I got to jump off the five-metre platform. It was nice that you took such good care of my mum too and the parents can stay. The week at Pymble was the best experience of my life and I thank you all for giving me this opportunity. I hope I can come to Pymble Ladies' College next year, thank you."

FOSTERING ACADEMIC AND WELLBEING SUCCESS

Creating an environment conducive to success at school for Indigenous students is enhanced by academic and wellbeing support which aligns with Pymble's Personalised Learning approach. The suite of support strategies, utilised where needed, include diagnostic testing, Personalised Learning programs, in-class support, one-on-one tutoring, and small-group Literacy and Numeracy programs. The College's Literacy and Learning elective is also available as an option but as staff have already gauged whether academic support is needed, these are carefully selected. Other aspects of student support include increased communication with parents, parental involvement, community visits, teacher-to-teacher and day-school-to-boarding co-ordination, and co-curricular participation. The College has strengthened its partnerships with the AIEF and the GO Foundation and last year fostered new partnerships with the Australian Indigenous Mentoring Experience (AIME) and the Police Citizens Youth Club's (PCYC), Culture Club. These partnerships allow us to support students' social and emotional growth in environments both on campus and in the community.

Academic tracking, differentiation of content and assessment, and specialised literacy and numeracy support are available to all students in need of these interventions, but

AUTHENTIC CONNECTIONS

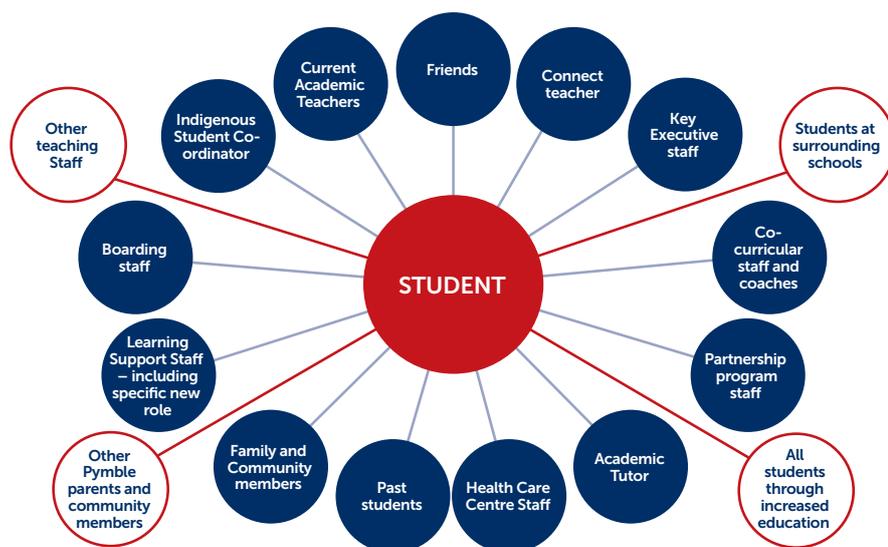


Figure 1: Support structure for Indigenous students

the Indigenous Scholars Program takes a holistic view of ‘support’ by deliberately blending academic and wellbeing domains. Figure 1 illustrates the range of support we provide through this approach and the people involved in its provision.

In Pymble’s program, the Indigenous Student Co-ordinator and Indigenous Learning Support Teacher work together to ensure a personalised approach to student learning and wellbeing. Together, they identify and discuss pressure points, opportunities and conflicts in expectations relevant to each student and modify these where it is possible to do so.

AIME mentoring sessions are run once a week. Two representatives from AIME hold a yarning circle with the students. They aim to encourage respectful and honest interactions where students feel safe to be heard, ask questions and seek support on issues they are facing. A student attending AIME reflected: *“The AIME sessions on Mondays are great! It gives me realistic standards and goals for myself. I ask questions about my culture and ask questions about my future or at least, how I can shape it. My aspirations are always respected by others which is comforting.”*

Culture Club sessions at the local PCYC are attended by close to 12 students. The Culture Club is designed to allow students to network with other Indigenous youth in the area while participating in a range of activities and exploring Indigenous culture. For the end-of-year Christmas party, our students also invited a non-Indigenous friend to come along and join the activities. Of the program, one student reflected: *“I feel heavily connected when I am at the PCYC. The people, dance, poetry and fun have kept me hooked in. It interlocks culture with making new friends which boosts my attitude towards everything, including school.”*

The number of Indigenous students finding success in attaining student leadership positions in the College is worthy of note. This reflects their self-confidence, skills and feelings of connection to their school. It is also important to note the high esteem in which Indigenous students hold their Indigenous peers. Girls naturally look up to older students as role models. When Lily Bougoure (Year 12 2018) was appointed Captain of Sports and Activities, a younger Indigenous student commented, *“I really want to be Sports Captain like Lily. She has*

done such a great job and I feel like I could do that too now”. Similarly, when Onyinye Nwamadi (Year 12 2019) was announced as Head Prefect, another Indigenous Scholar, talking to Miss Howie, reflected emotionally on how significant and meaningful she found the moment to be.

RAISING CULTURAL COMPETENCY WITHIN THE COLLEGE COMMUNITY

Through the collection of evidence for the AISNSW Report, we observed a shift towards higher engagement by the wider College community in activities and events related Indigenous Australia. We noticed ways that our Indigenous students are developing more confidence in their own culture and are feeling safer to share this with others. We also identified increased staff involvement in activities and educational programs with Indigenous themes, such as NAIDOC Week and the Indigenous Sports Round. By way of example, in the performing arts, five non-Indigenous students joined the Indigenous dance group, keen to gain a greater understanding of the importance of dance within this culture. We have also experienced an increase in non-Indigenous students requesting to be involved in helping lead assemblies and speaking in Chapel for NAIDOC celebrations, Sorry Day and Reconciliation Week. The Indigenous Student Co-ordinator facilitates students’ attendance at events and activities and this is having a snowball effect by engaging others.

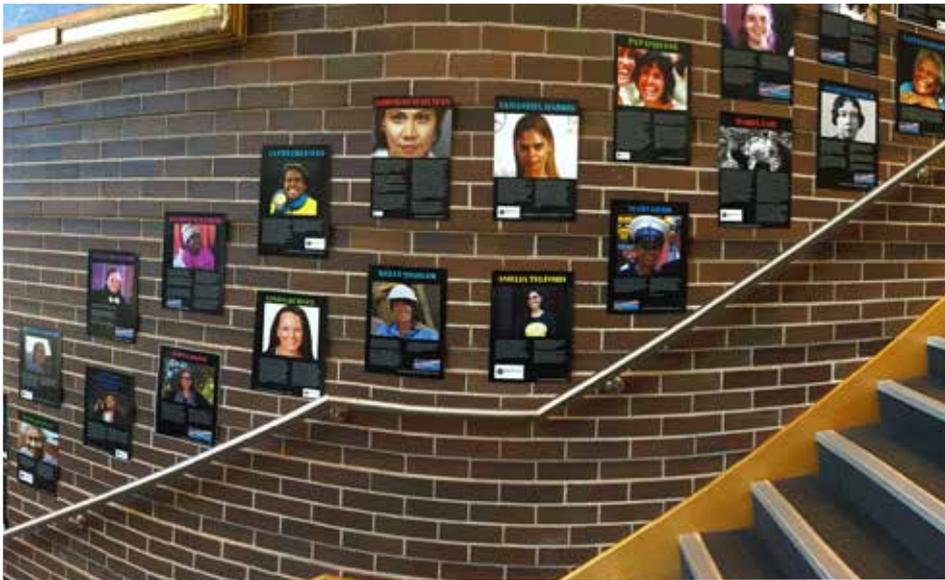
COLLEGE EVENTS

NAIDOC Week 2018 was a very popular College event. The slogan, *“Because of her, we can”*, was especially effective, perhaps because as an all-girls school much of our discourse centres around women’s effort and achievement. To celebrate the week, posters were created by students and staff following

INDIGENOUS EDUCATION

an invitation to contribute from the Indigenous Student Co-ordinator. Sixty-five per cent of posters were created by non-Indigenous staff and students indicating strong involvement beyond the Indigenous scholars themselves.

A video was also created by the Indigenous Student Co-ordinator with assistance from Indigenous students. An increase in participation from Indigenous students themselves indicates a growing understanding and valuing of their culture within the College community. The Indigenous Student Co-ordinator notes growing enthusiasm around Indigenous students writing their own Acknowledgements of Country using a model whereby they share parts of their own stories and family histories. A recent example was a student who shared her personal story of identity and home at Jacaranda Day as she gave the Acknowledgement. Following her heartfelt and personal story, there has been a much greater sense of the individuality possible in the delivery of this message and greater interest amongst our Indigenous scholars in doing the Acknowledgement to Country.



Student-made posters for NAIDOC Week 2018, main foyer of the Kate Mason Building

EXCHANGES

As part of Pymble's National Exchange Program for Middle School students, six non-Indigenous students visited Worawa Aboriginal College in Healesville, Victoria, for an annual Reconciliation Week sports carnival. Staff organising the Year 8 National Exchange have built a high profile around this opportunity for students which attracts both Indigenous and non-Indigenous students. There are five to six spots available on this exchange each year. A number of students requested to attend this event for a second year in 2018, indicating ongoing commitment and interest. In 2016, nine per cent of student applicants placed Worawa as their first preference. In 2018, 27 per cent of students placed Worawa as their top preference, with 41 per cent of students placing Worawa as their first or second preference.

In her application, one student wrote: *"I am particularly interested in Worawa College for exchange. It is interesting to me because of the way in which Aboriginal culture is embedded into its values."*

Another wrote: *"National Exchange is an opportunity for me to be exposed to and learn about a new school's culture, educational styles and meet new people in the hope of forming lifelong friendships. My first preference would be Worawa Aboriginal College. I would like to further my knowledge and connection to the Indigenous culture and believe visiting Worawa Aboriginal College would provide this opportunity for me."*

Other Indigenous cultural opportunities are highly sought after amongst the wider student body. College students and staff attended the Uniting Rural Presbytery Supercamp 2017 and 2018 in Nyngan, and then the Mini Camp at Enngonia in 2018, in partnership with small regional schools, fellow Uniting Church Schools and Distance Education in far west NSW. The Uniting Church has an organisation known as Uniting City Country which works to build partnerships between city and rural communities. Pymble works alongside this organisation, Pymble Uniting Church and Knox Grammar School to foster an ongoing partnership with Enngonia Public School.

An Indigenous student, after returning home to Moree on a Service Learning trip, commented: *"It was a great experience to go back home and see everyone with my school. It was cool to show the younger ones there that they can go somewhere if they work hard. The other Pymble girls got a chance to see what different lives they have and get a better understanding of me."*

A non-Indigenous student reflected on her experience at Supercamp with the following comment: *"Supercamp was an opportunity that was like no other. We met children from around rural NSW and taught them Music, Drama, Science, PE and Dance - some experiences they*

don't get in their everyday school days. We made friendships and gained a much better understanding of some of the issues in rural communities especially with higher Indigenous populations than the area I live."

The Supercamp is a Year 10 program but over the past two years, it has also attracted Year 11 students who have asked to attend for a second time in a mentor role. One Year 11 student presented a persuasive case to Deputy Principal, Mrs Julie Shaw, explaining her passion for the program and for continuing to contribute to its success. Permission was given for this student to attend again.

"I had such a wonderful experience last year and I only hope to further represent the school and strengthen the partnership between Enngonia Public and Pymble Ladies' College. I am very passionate about this specific trip and I would incredibly appreciate a chance to meet with you to discuss, very much so." Miranda Stewart, Year 11, 2019.



Onyinye Nwamadi, Head Prefect and Matilda Pennington, Captain of Sport and Activities



Pymble Firsts Football team wearing shirts designed for the Indigenous Round, July 2018

SPORT

There has also been considerable enthusiasm as students connected with pride with Indigenous culture on the sporting field. At the Indigenous Round of Sport, the Firsts Basketball and Football teams wore special strips designed by Indigenous artist, Rheanna Lotter. Following this, the teams requested permission to wear the strip permanently.

CURRICULUM

The following evidence shows how keen students are to share their knowledge with their classmates so that all may benefit from learning more about Indigenous people, perspectives, history and culture. The email excerpt below is written by a teacher recounting how a non-Indigenous student shared knowledge from her home community with her Music class: *"I just wanted to let you know about the great lesson with Year 10 Music students today. The girls had to present a research task on a contemporary Aboriginal musician. [Non-Indigenous Student] spoke about the Walgett Warriors and gave the best presentation to the class about her hometown. She also spoke some of the language including an Acknowledgement of Country in the Kamilaroi language. It was a really engaging presentation for everyone."*

TEACHERS

Staff are increasingly aware of, and sensitive to, the need to raise their cultural competency and engage more rigorously in curriculum that builds understanding of Aboriginal and Torres Strait Islander culture, language and perspectives. Outcomes of these elements are obviously important for all students. We recognise that increased cultural competency assists not only Indigenous students to reach their potential, but all students and teachers as the entire community benefits from better understanding of Aboriginal and Torres Strait Islander culture, language and perspectives.

INDIGENOUS EDUCATION

The Indigenous Cultural Competence survey, sent to Secondary School staff in October/November 2018, indicates a strong base from which to improve the learning and wellbeing environment for all students by making it culturally safer and more supportive for Indigenous students. The return rate was 73 per cent, which indicates a relatively engaged staff in the topic and is a measure we will monitor for the future. An important result was that 76.5 per cent of respondents wanted more professional learning in Indigenous perspectives, culture and language.

CONCLUSION

Over the course of the development of the Indigenous Scholars Program, we can testify that one size of support in relation to learning and wellbeing does not fit all. We originally faced some challenges with attempting to fit students into existing Learning Support programs and learnt that there were benefits with being flexible regarding the support offered. We are constantly reviewing and adapting our programs to meet the needs of the diverse range of students, and staff involved.

We have learnt that it is important to find a 'hook' for each student that connects her to the College. This is ideally something that each girl sees as leading her to her own definition of success and connection. We are fortunate to have an extensive Co-curricular program, which is in addition to the cultural activities provided, but we also have a busy and high achieving cohort of students. This can sometimes be overwhelming for some students as they work to find their niche.

We hope to attract Indigenous educators into roles at *Pymble* to add another dimension to our program. At present, we reach out to students, ex-students and families and ask for their help in guiding our approach. We also attempt to link with Indigenous people in the local Sydney community and to support students to build their own network of connections.

Some further directions in 2019 include work with the Association of Independent Schools of NSW on a sustainable 'hub' model whereby the College partners with schools new to Indigenous education and scholarships for Indigenous students. This initiative is currently evolving. Continuing to evaluate staff understanding of Indigenous perspectives through data collection is another priority for us, as is closely linking this information with tailored professional learning to enrich our teachers' approach to teaching, learning, wellbeing, boarding, sports and activities.

“...we observed a shift towards higher engagement by the wider College community in activities and events related Indigenous Australia. We noticed ways that our Indigenous students are developing more confidence in their own culture and are feeling safer to share this with others. We also identified increased staff involvement in activities and educational programs with Indigenous themes...”



Indigenous Scholar, Boarder and proud Kamilaroi woman, Shakira Tyson (Year 11), has found personal growth and success through her connection to the College's Diving program. Shakira had her first taste of diving as a Year 7 student, brand new to the College, having never tried the sport before. Five years on, she recently competed in the National Age Championships in Western Australia and has already achieved highly sought after places in the School Sport Australia and Pacific School Games Diving teams. *Pymble* is very proud to celebrate Shakira's success as one of our accomplished divers and as currently the only Indigenous diver in the New South Wales student program.

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The fear factor

By Coaching Director - Diving and Head Coach Mrs Christine Lang, and Year 11 student, Shakira Tyson.



Coaching Director - Diving and Head Coach, Mrs Christine Lang, reflects on the role diving has had in Shakira's journey and the role educators play helping students find a 'hook' to connect them to College life.

Q *How did Shakira join the Diving program?*

A I was Shakira's Connect Teacher and, in the earliest weeks of Year 7, I asked Shakira if she would like to try diving. I was pleased when she said yes. We quickly organised lessons and I taught Shakira four dives and, from that beginning, she made it into the Independent Girls' Schools Sporting Association (IGSSA) team. My focus was on teaching the skills needed but I was also becoming conscious of the benefits diving was having for her. Shakira was quickly gaining some deserved accolades and was building the identity of being known as 'Shakira the diver'. From IGSSA, at which she placed third, Shakira qualified for the NSW Combined Independent Schools Sports Council (CIS) competition and this was the hook she needed. From that point, she has worked extremely hard and has overcome many diving challenges and difficulties.

Q *How can students use their diving experiences for growth beyond the pool?*

A As an educator, I notice ways that learning to dive, dealing with fear and applying strategies to control it can have a positive impact beyond the pool. One of my observations of Shakira was how she was dealing with feedback.

Diving gave her the experience of listening to feedback, applying it and immediately seeing results in her performance, and then letting the cycle repeat. This was transferring to her confidence in academic learning. As a diver myself, I am very aware of the 'fear factor' involved in diving. Finding ways to manage fear is essential in this sport where it is a case of letting your muscle memory take over and not allowing your thinking to distract your actions. For young people, this relates to the fear of not fitting in, the fear of failing or being left out. Young divers can use feelings of fear to push themselves on to higher rewards, including in a range of other sports. Shakira's inner confidence and effective self-management skills have led to confidence in academics and an openness to face challenge head on where taking a risk and letting go of control are part of learning. The process of seeing students move through the full spectrum of emotions, including elation and disappointment, is a privilege for an educator as it is from these experiences that the most meaningful growth occurs.

.....
Year 11 student, Shakira Tyson, echoes these insights with her own reflections on how important it is to face fear and keep on going.

Q *How did you first become interested in Diving?*

A It was my Links Day visit, when I was in Year 6, that I first saw the girls diving. I said to my mum, 'I'd like to try that'. And I did!

Q *What impact has diving had on your confidence and ability to manage fear?*

A The diving platform is a very public and visible place where, if you aren't going to dive, you have to ask 'What's the point?'. My coach says to stay calm, use my muscle memory and if I need to re-start, I'll do another build up and find another way to do the dive. I think this is the same for leadership roles where it's about taking a chance, having a go and moving ahead.

Q *As well as being one of our Indigenous Scholars, you are also a College Prefect (Middle School Liaison Prefect) and a role model to many Indigenous and non-Indigenous girls. As you head into your Stage 6 studies, what inspires you to keep diving?*

A Diving has given me good opportunities to do new things. I am going to different places by travelling around Australia and I am meeting new people through competitions. It is now like a reunion when we see each other again and my sister is learning to dive now, too. My family has high hopes for me. They'd like to see me at the Olympics! I'm not sure about this, but I'm going to keep going. One of the best things is when I am home with my family and my little cousin asks me to do backflips from the bridge into the river. I can share my diving skills with my family and friends back at home.

Challenge accepted – Junior School robotics: reflections and learnings

By Digital Learning Leader, Mr Dan Brown



"Shrug" the robot completing a mission

What is an effective framework for STEM learning? How can students be engaged in effective learning of Technology and other STEM subjects? This is a report of a two-year journey into teaching STEM to Years 5 and 6 Robotics students in an after-school class, and the difficulties, benefits, frustrations and learnings of this experience.

Some people may be familiar with the phrase 'changing the goal posts' – a metaphor for when a team is given an intentional advantage or disadvantage during the proceedings of a competition. How about a team of ten girls keen on robotics, who, for months, have been meticulously planning, measuring, testing and refining a robot to navigate itself around a competition field the size of a large table, in preparation for an internationally renowned event, only to find that an error has been made

by the organisers? The dimensions of the competition table are sizeably different than given in the rules; thereby rendering months of work redundant in a matter of seconds through no fault of their own.

Without question, no advantage or disadvantage was intended by the organisers. Nonetheless, the girls had a stark confrontation with the metaphor of 'changing the goal posts'. How would anyone feel in such a situation? What would be the ideal way to react?

THE ROBOTICS JOURNEY 2017 TO 2018

Over the past two years, Junior School Robotics has evolved, and it is finding its footing in a shifting, unpredictable world. Perhaps more than any other field, Robotics embodies the STEM 'revolution'.

As the acronym makes clear, STEM is a learning experience that calls upon the fields of Science, Technology, Engineering and Maths. Art may also be added to the mix, creating STEAM.

To create a robot, all these fields are needed in equal measure:

Science: to understand how natural phenomena like infrared, friction, and centre of gravity for example, can render a robot a champion, or a disaster.

Technology: to provide clear, elegant instructions in the form of code to a digital brain so that it can co-ordinate a complex network of sensors and motors to utilise and manipulate scientific phenomena.

Engineering: to combine grand ideas and designs with the constraints of physical reality, to create a robot that is reliable and strong enough to handle the rigours of competition; while also being innovative without being temperamental.

Art: an elegant, high-functioning robot is often an aesthetically pleasing one, and EV3 robots can be used to artistically visualise Maths in Visual Arts.

Maths: to utilise algebraic equations to keep a robot on course and in a straight line so that it can hit the mark in any condition at any given time.

Under the direction of STEM Co-ordinator Dr Kristie Spence, the Junior School Robotics program was set up in 2017 to encourage and facilitate STEM skills. Due to the cost of robots and the logistics of

delivering lessons, it was decided that Junior School Robotics should be offered to Stage 3 students in classes of 24 girls, guided by two mentors per session including Mr Dan Brown, Ms Cristhina Boni Lavratti, Mr Asaph Mross Becker and Ms Minyi Zhong.

Each STEM field is as complex and multi-faceted as the next and it is a mammoth prospect to deliver experiences where students can not only delve into each field, but also to delve deeply. Where does an educator begin to plan and deliver a sequence of learning that is engaging, open-ended and student-driven, as well as rigorous, structured and thorough? Just over two years ago, this is where the Junior Robotics program started.

First, the mentors delved into the 'E' in STEM: To spark their curiosity in Engineering, students followed simple instructions and built everyday machines such as blenders and kinetic toys. After one machine was made, the girls happily moved onto another, hungry to make more items, but less inclined to explore the depth of the Science and Engineering behind the levers and gears. They preferred to move onto making the next item, playing

with it and then move on again. Within a couple of weeks, mentors were struggling to find more machines for them to build.

Next was the 'T' in STEM - Technology. Coding seemed like the next best path for engaging the students. In the first year, 2017, mentors were learning Mindstorm technology (the coding framework for Lego EV3s). The mentors were working faster than the students, discovering faults and quirks with the code and, on the spot, working out solutions. To be as skilled as possible, mentors connected with the learning community and participated in professional development sessions to become more expert. Teaching coding in the first year was along the line of a 'here's-the-code-and-go' approach, where mentors explicitly showed students the coding blocks, how they are used, and then students were sent off to apply the code in several tasks, including making sumo wrestling bots, dancing robots and robots to follow a black line through a maze.

The girls enjoyed most of these tasks, but learning seemed chaotic and keeping track of student development was difficult.

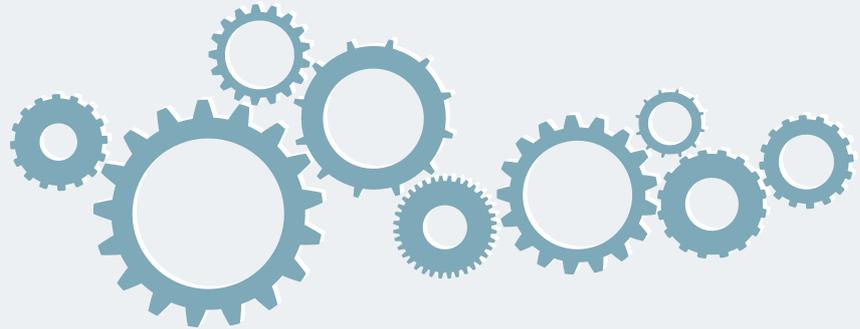


A highlight of the year was the First Lego League competition at Macquarie University 2018

Students were interviewed at the end of the year where they identified tasks such as the Sumo Bot as a highlight. The competition aspect was a key factor in this task success. However, the First Lego League (FLL) Competition was the most popular highlight.

In 2018, it soon became apparent that the breadth of coding abilities was vast, with some girls continuing from the previous year and some starting new. Further to this, numbers had doubled in 2018 to 43 students. In order to support the developing skill set of students, a self-directed matrix of activities accessed via an Outlook Group was created, sectioned under different skill sets and then differentiated further within each skill.

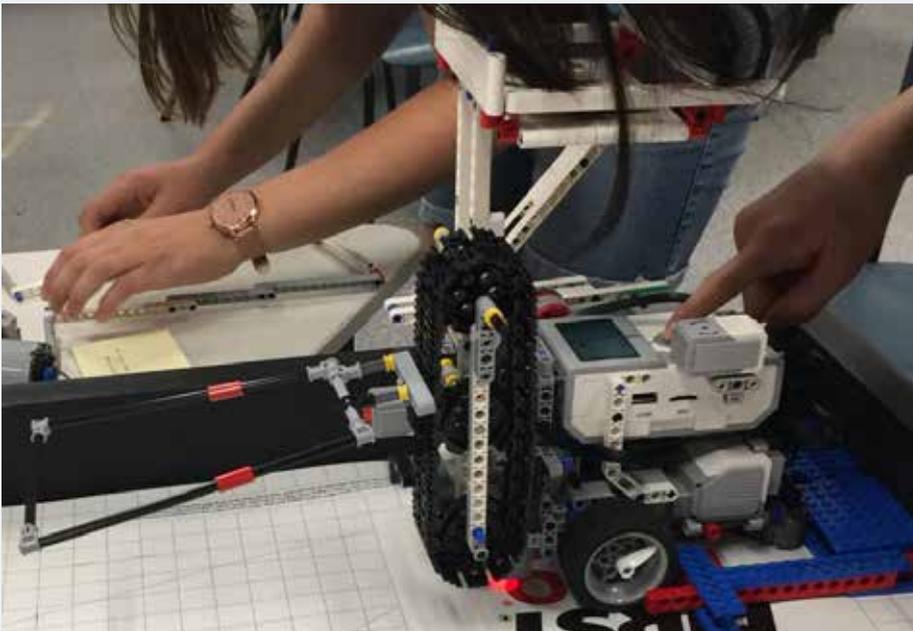
Each skill set was levelled Beginner, Core or Experienced. This is an example of a Core and Experienced skill set for understanding Gyroscopes, Colour/Light Sensors and Touch and Ultrasonic sensors. Each activity linked to a video or webpage with instructions and



tasks. 'GOT IT!' tasks were open-ended tasks that aimed to culminate skills learnt in a real-world situation, some of which were based on the 2017 tasks. Girls chose groups of three to four students with similar skill sets and experience. A points system was created, where emojis were scored for completion of tasks, with prizes given every half-term for the top three teams. An observable result of this approach was that it was easier for mentors to keep track of student progress, and the competition aspect added a sense of energy and urgency to the tasks. Some students even mentioned it as a highlight of

the year. Dolenc, Mitchell & Tai (2014) outline that a mix of students making decisions and doing team work, with mentors' guidance, is a contributing factor to creating a successful, self-directed learning environment. Furthermore, it is suggested that one of the four factors that also contribute to effective, self-directed learning is the extrinsic motivation of competition. The matrix incorporates these elements and reflected an observable success with engagement, while also dealing with the problem of students having varying levels of coding experience.

Engineering was revisited in Semester 2. The mentors decided to provide students with a gamut of different robot designs for them to follow and build, including cranes, a bipedal robot, guitars, dogs and even an elephant. This way mentors felt they provided some freedom to the students while also allowing them to follow proven instructions with the hope that by simply building machines, students would at least have some physical exposure to the building and workings of these machines. The result was not unexpected. Students created some very impressive machines that captured their imagination, such as a humanoid robot that used gears to walk on two legs around a table keeping balance and avoiding plummeting off the edge of the table.

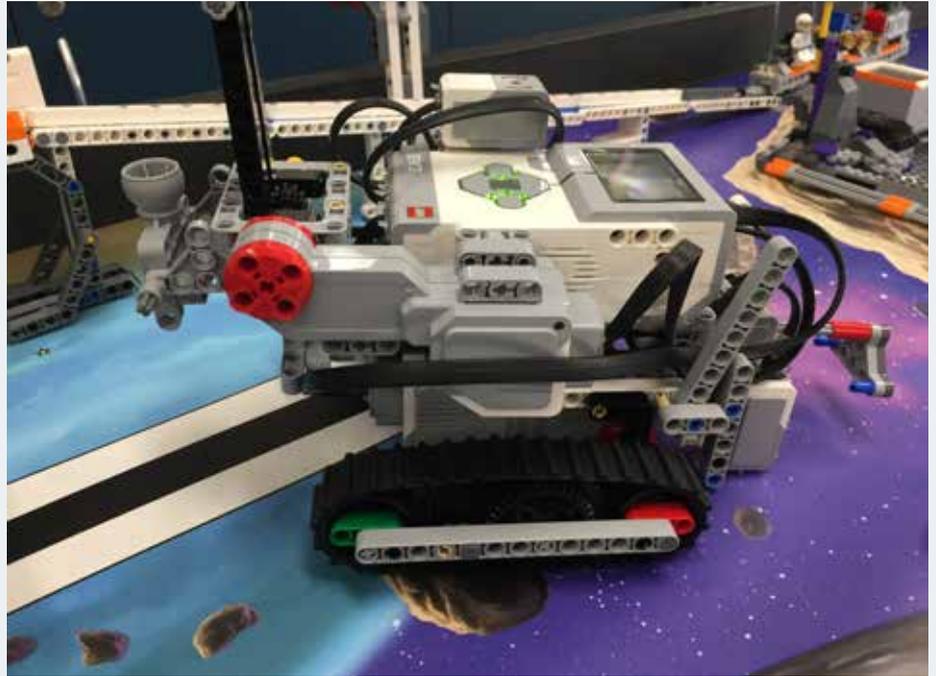


A robot with a complex, multi-purpose conveyor belt attachment

However, when probed to explain the inner workings of these machines, student responses quickly showed a low understanding of the engineering behind their creation. This became apparent again in August, when the First Lego League Competition started.

Pymble entered four teams of ten students in 2018 (up from three teams in 2017). The competition is an annual event, where every August the theme of the competition is released along with a set of missions that the robots need to complete. Students then need to select which missions they wish to attempt to complete in the given time of 2:30 minutes while staying within the rules and guidelines. The mission items are built from Lego pieces. These items are interactive with moving parts which the students' robots interact with in order to complete the mission. A synthetic mat the size of a large tabletop is provided with the mission items by Lego, and this map is placed on a custom-built table. Mission items are placed in fixed position on the map, and over a period of three months a robot is designed, built and programmed to find its way around the map and complete mission items. It is extremely rare for a team to complete all the missions in the given time, so students have to be wise in the selection of their missions. The competition is then hosted at venues around Australia in November.

In order to interact with the mission items, a robot needs an attachment of some description, like a lever, a hook or a claw. Initially, attachments were weak and ungainly; however, often they were sound in their theoretical application, just poor in execution. It became apparent to the mentors that the approach of getting students to follow build instructions



With the approach of mentors delivering short ten-minute explicit teaching sessions that built off student needs as they occurred, student attachments started to be of much great complexity

at the start of the year (physically building the machine) did not foster student understanding of the essential properties of machine symmetry and rigidity. As a result, mentors started to guide students on building effective attachments while they were building their robot for the competition. By assisting students when there was a genuine need, the mentors found that attachments started to become more structurally sound and complex in execution, thereby potentially affirming the importance of students taking the lead in working with the robot and the positive effect on learning (Dolenc, Mitchell & Tai, 2014).

After the competition, two of the four teams won awards, and three of the four teams finished in the top twenty (two in the top ten) out of a field of sixty-plus teams. Despite the robots not reaching their full potential in competition, there was a great feeling of progress by the students and mentors.

Compared to 2017's competition, code in 2018 was much more developed. In 2018, students used a gamut of sensors for the robot to navigate the mission map, whereas in 2017, students simply guided the robot by making it move forward and backward. Attachments were also more sophisticated.

2018 END OF YEAR SURVEY

Over the past two years, mentors have tried a variety of approaches to teaching and learning Robotics. Delivery of the learning opportunities between this spectrum ranged in the forms of explicit instruction, video instruction, text instruction, peer teaching, real-world problem solving, competitions and combinations of all the above. With a look towards 2019, a student survey was created at the end to collect such data.

SURVEY QUESTIONS TO STUDENTS

1. What did you enjoy most about Robotics this year?
2. What did you find frustrating?
3. What is your preferred way to learn about Robotics?
 - a. Teacher instruction from the front of the class
 - b. Watching videos
 - c. Reading instructions from the text
4. Rate this idea: At the end of Semester 1, we will host our own First Lego League (FLL) competition between all *Pymble* Junior School Robotics girls. Teams will be made up of three to four people. The competition will start from the first day of Term 1, and the focus will be on learning how to program and build a robot specifically for the FLL competition in Semester 2.
5. Would you like to continue FLL in Year 7?
6. What would you like to see in Robotics next year?



“ At the start of the year, I enjoyed doing the various problems. It was a bit challenging doing all of the First Lego League missions and at times I was lacking full motivation, but at the end, I really enjoyed the experience.”

KEY FINDINGS FROM THE SURVEY

- Key student enjoyments were the First Lego League (FLL) competition, working in a team, fine-tuning code, building robots to complete challenges and making attachments.
- Key student frustrations were the code not working, learning to code, and the robot failing to complete missions consistently.
- Preferred way of learning Robotics: teacher instruction.
- Key ideas students would like for 2019 were smaller teams, more code to learn, more FLL-type experiences.

COMPARISONS OF KEY FINDINGS WITH ACADEMIC STUDIES

Yuen et al., (2014) studied the dynamics of a mix of student interaction and activities and their correlation with engagement of Robotics students in Primary and Middle School and concluded that the main predictors of on-task engagement in addition to the extrinsic motivation of competition were observing, building, testing and hands-on interaction with parts. The *Pymble* survey affirms this as students proposed the FLL Competition, tuning code (testing), and building robots and attachments (hands-on building) were key to their enjoyment. Key frustrations were learning to code, code not working, and the robot failing to complete missions consistently. All these frustrations fall under the sphere of coding. Yuen et al., (2014) found that according to students, coding and debugging were low-engagement activities, despite the importance of these skills.

Morze, Smyrnova-Trybulska, Zuziak, Kommers & Gladun (2017) studied Robotics students’ favourite approaches to learning. The methods of ‘do-as-I-do’ teaching and instructional tasks ranked low, conflicting with Junior School results from 2018, where direct teacher instruction was the most popular response. Reading instructions ranked low in this study, aligning with results from the 2018 survey. This is explored in the next section in more detail.

“ I enjoyed being able to work on the robot with my friends, being able to build the robot and different attachments and I enjoyed the problem solving and experience of First Lego League.”



Three Pymble teams celebrating a successful competition

KEY TAKEAWAYS AND DIRECTION FOR 2019

Junior School Robotics could be seen as a microcosm of teaching STEM and the 21st century skills of creative thinking and problem solving. Without the need to report to curriculum outcomes, the program has had the freedom to focus solely on the teaching and learning of Technology and how to implement it in a learning framework. As the mentors of Junior School Robotics learn from their experiences over the past two years – and as they implement action from their learnings in 2019 – they hope to provide some key takeaways in teaching in STEM fields.

(A caveat: it cannot be ignored that these findings are context dependent and that teaching and learning technology and STEM in a non-Robotics environment

may not produce similar results and observations to teaching and learning in another context.)

“Over the past two years, mentors have tried a variety of approaches to teaching and learning Robotics. Delivery of the learning opportunities between this spectrum ranged in the forms of explicit instruction, video instruction, text instruction, peer teaching, real-world problem solving, competitions and combinations of all the above.”

First, students in Junior Robotics seem to prefer direct instruction from an educator. It is quite easy in a world of streaming media to turn to videos to deliver instructions. Previous studies (Morze, Smyrnova-Trybulska, Zuziak, Kommers &

Gladun, 2017; Dolenc, Mitchell & Tai, 2014) outline how teacher-driven and explicit instruction result in low engagement. However, it could be argued that the approach taken with such explicit, teacher-led instruction in 2018, in the form of short ten-minute sessions dependent on student-identified needs, added key factors of engagement in student-directed learning. These factors included students taking the lead in their learning and mentors acting as facilitators (Dolenc, Mitchell & Tai, 2014). Directed by these results, in 2019, mentors will be delivering short ten-minute instructions on all aspects of robotics from coding, to building robots, and building attachments throughout the year and will be collecting data on the effectiveness and popularity of these findings. The desire of students to learn more code could



The real-life application of technology assists our students to deepen their understanding of the world and to appreciate the contributions each student will make in the future

align with the students' responses to finding coding frustrating. An increase in student enjoyment of coding (a need found from the 2018 survey and findings by Yuen et al. (2014)) is a key intent of this approach. Second, the benefits of student-led learning may lead to improved engagement and learning in many areas. Teaching concepts in a timely manner when students have themselves discovered the need for learning a concept, reveals higher engagement.

“ The nature of Robotics requires students to have a wide-range of skills in many complex and technical learning areas. It is near impossible for one student to have the deep knowledge and skills in all these areas. Perhaps this is why teamwork, the pooling together of personalities, interests and skills to a collective end, is thought of so highly by Junior School Robotics girls.”

In 2019, greater student choice is also being given. For example, we have revisited our inaugural 2017 build-a-blender activity. In the 2019 iteration, students have been challenged to create new uses for their blender (for example, a blender that doubles as a back scratcher!) Students have been keen to improve upon their designs to provide a real-world application, more effective than their initial design. In 2017, such an active approach to deepen their learning was not observable.

Not only does real-life application of Technology observably increase students actively deepening their understanding, but so does the pressure and thrill of competition. In 2018, when implementing a self-directed learning activity, a point-driven competition system showed increased engagement. According to survey data, these competitive components are a student highlight and have encouraged girls to hone their Engineering skills and delve deeper into their understanding.

THREE IS A CROWD

Many responses to the survey revolved around group size: Groups of ten were considered too large, while groups of three often meant one student felt left out. Consequently, in 2019, all students are now working in pairs – this appears to be the ideal arrangement.

One last takeaway is the importance of teamwork and collaboration. A key element of STEM is the opportunity to create collaborative skills required for the 21st century. More than 50 per cent of survey results from 2018 showed that students saw teamwork and collaboration as a key part of their enjoyment. As outlined previously, the nature of Robotics requires students to have a wide-range of skills in many complex and technical learning areas. It is near impossible for one student to have the deep knowledge and skills in all these areas. Perhaps this is why teamwork, the pooling together of personalities, interests, and skills to a collective end, is thought of so highly by Junior School Robotics girls.

CONCLUSION

So, why teach STEM? What is the purpose of STEM? How quickly is the world moving forward and skills today becoming redundant? Is coding and thinking really a future skill? Are the goal posts really changing?

“ I think that it would be cool if we could create our own missions and tasks that others had to complete.”

After discovering that the competition table was too big, the girls' shoulders dropped. Months of design, problem solving, coding, building and testing became redundant. The girls' robot was not designed to navigate a table this big. The girls were being unfairly disadvantaged for their advanced and accurate approach to using the dimensions of the

table for navigation. The girls stood quietly, lost among the crowd. Two members of the group brought out their mobile phones, remembering an app they had used previously that measures distance using the phone's camera. Lining up the phone's camera, they measured the distance between where the table should have ended and its new dimensions. The table was 4cm longer to the east and 6cm longer to the north. Knowing the diameter of the robot's wheel is 3.7cm and knowing the ratio of the circumference of a circle to its diameter is pi, the girls brought out a calculator and worked out the distance of one rotation, which is pi multiplied by the diameter, giving the robot a distance of 11.62cm travelled per wheel rotation. The students divided the extra distance required to travel on both sides of the board by the circumference of a wheel.

The students now looked through their code and the notes they had created and pinpointed where these extra distances were needed. Heads buried in their computer, they added the extra distance to the line's code. Only five minutes later, they competed in front of hundreds of spectators. At the end of the day, they scored a respectable 79 points, finishing sixth, narrowly missing out on qualifying for nationals. They received a well-earned prize for their inspirational approach to the competition. The girls may have moved the goal posts back to where they should have been.

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All' Ultimo Lavoro – Strive for the highest



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