in Alliance

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The Alliance of Girls' Schools (Australasia) Ltd

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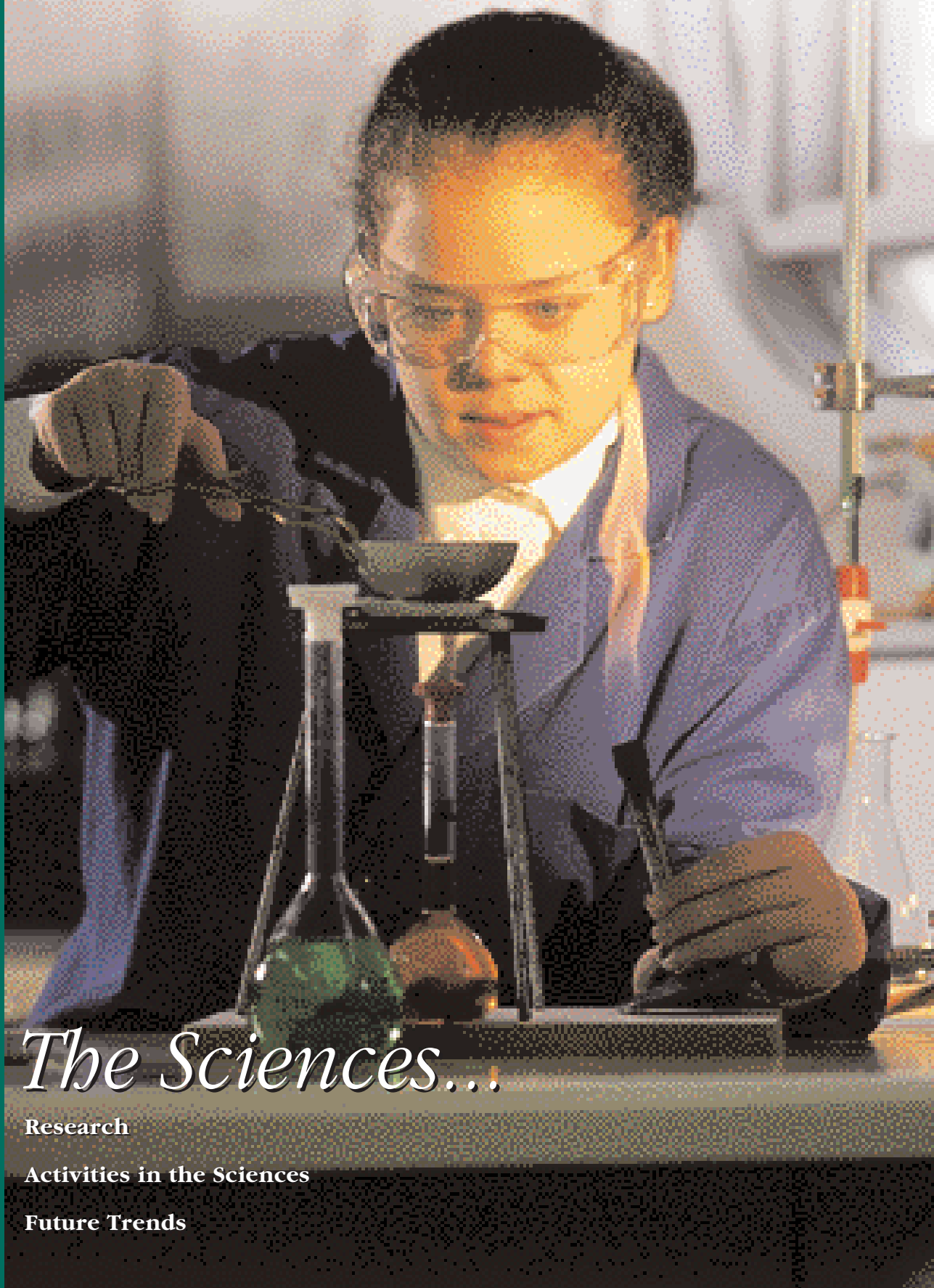


in this issue

The Sciences...

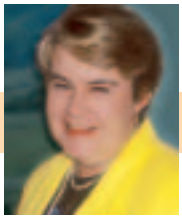
***In Alliance* Editorial Deadlines for 2002 will be announced in Edition 22.**

All copy is welcome and must be submitted to Dr Nancy Hillier, Principal, at Annesley College or through principal@annesley.sa.edu.au

Science at St Margaret's, Berwick

In This Issue...

From The Editor...



...Science and our futures.

The most exciting phrase to hear in science, the one that heralds the most discoveries, is not Eureka! (I found it), but "That's funny..." Isaac Asimov

Delving into the Sciences in this 21st Century and our 21st Edition of *In Alliance*, it becomes apparent that the divisions within education of Sciences, Arts and Languages have merged more than ever to produce the future strain of students. Albert Einstein said "the most beautiful thing we can experience is the mysterious. It is the source of all true art and science." "genETHICS" demonstrates this bond with an ethical argument on a scientific matter.

"Yes we are listening" states "Quality teaching and learning comes from a balance between curriculum enrichment and teaching performance." Further, this article makes a critical statement when quoting Robin Williams "…the most important part of …early development has been a teacher – not a parent or a computer."

Whereas Einstein stated "It is a miracle curiosity survives formal education" we are enthused by the diversity and variety of learning today. "Looking at Mathematics in the past and the future" shares the excitement and input of today's Science students and looks to the boundary-less future. The Children's Encyclopaedia, 1926 stated "Man shall never reach the moon for such a quantity of gunpowder would be needed as to gravely injure the crew". Today we are able to laugh at such a statement with the knowledge of what is rather than what might be.

The Ravenswood Eco-Sleuths display yet another facet of Science and their learning format again demonstrates innovative teaching methods being applied to facilitate instruction.

Robotics and Technology reveals the need to "meet learning outcomes and be prepared to take risks to find solutions." Without such risk taking, which may lead to mistakes, problems will not be solved. It is the knowledge that making mistakes in an attempt to search for the right path is not a bad thing, which is inherently vital.

We must understand that the significant problems we face today cannot be solved at the same level of thinking we were at when we created them. This is the case with the Solar Car article demonstrating the move from a student made solar car to the use of a converted production car.

St Margaret's Berwick shares some exciting programmes in their Science department while we are challenged with questions of statistical participation of Girls in Mathematics in Queensland by Moreton Bay College. This article is of great interest to us all in looking at how girls have advanced over the past decade, as is the article from Ruyton giving some insightful research into choices of activities between Year 7 girls and boys.

We look forward to another exciting year with The Alliance in 2002 and wish you all a very happy and safe Christmas and New Year.

Nancy Hillier, Editor

Executive Appointment

The Alliance has much pleasure in announcing the appointment of Mrs Ann Mildenhall, Principal of Queen Margaret College, Wellington, New Zealand to the Executive of the Alliance of Girls' Schools (Australasia) Ltd.

Ann Mildenhall is not just a woman with a vision; she has the drive and planning ability to implement a course of action as well. Soon after she was appointed as a new principal to a school with a falling roll, she attended a Principals' Summer School run by John Edwards and Jim Butler from which she drew the inspiration to set the school along the successful path it now follows.

Having already set up a Developing Gifts in Students programme, the three year school –wide involvement with John Edwards helped the school to evolve towards its present position of teaching a programme of thinking under the direction of a full-time Thinking and Philosophy Facilitator.

Ann Mildenhall ensured that Queen Margaret College was involved from the inception with the Alliance of Girls' Schools and she is one of three founding principals for the Queen Margaret of Scotland Schools' Association. Establishing a number of international exchanges has been another method of developing her students' awareness of the global community.

An understanding of the necessity to be proactive has led Ann to serving on the Board of the Auckland Teachers' Centre, the Advisory Board of the Auckland College of Education and currently she has been co-opted into the Executive of the New Zealand Independent Schools Heads Association.

As we currently have a significant number of New Zealand member schools, Ann's inclusion on the Executive underlines the significance the Alliance places on our New Zealand members.

From the Executive Director...

...a summation and projection.

STOP PRESS: The 2002 Annual Alliance Conference is 24-26 May, 2002.

As 2001 draws to a close we are able to reflect on what has been.

In Alliance commenced the year sharing the experiences of the delegates at the 2001 Student Leadership Conference *"Leadership for Women of the Future"*. Following this we explored the area of Health and Well Being.

Subsequent to the Joint Conference at the beginning of August, our next issue focussed on The Arts and an overview of the conference *"Equal and Different?"*

Our current issue covers The Sciences and, as Dr Hillier has stated, there are many exciting programmes obviously being enjoyed in our member schools.

At last our website will be a reality as the contract with Aussie Schools has now been finalised and signed. You will be hearing from us in the near future on this matter.

The National Coalition of Girls' Schools has forwarded a number of articles, which you will have received. Our association with our counterparts in the United States is not only valuable but gives us all a global perspective and a sense of unity in the education of girls in girls' schools.

We look forward to our 2002 Student Leadership Conference – bigger than ever – and over the weekend of 24-26 May, 2002 we will enjoy a conference in Melbourne for members of The Alliance of Girls' Schools. Details will be forwarded – please put this weekend aside in your diaries.

In the meantime, may I join with Dr Hillier in wishing all a happy, contented and secure Christmas/New Year holiday.

Edwina Sear, Executive Director

Robotics and Technology in Sacred Heart Science Classes

...taking risks to achieve.

In our Science classes at Sacred Heart, Geelong and indeed across the school, we endeavour to produce students who can work in teams, solve problems, have thinking strategies, communicate their ideas, meet learning outcomes and be prepared to take risks to find solutions.

Our Year 7 Science students can readily use temperature probes attached to computer laptops to tell us what to use for the handle and base material in Goldilocks and the 3 Saucepans and then interpret the graphs after saving them into an excel spreadsheet. Students in Year 7 at Sacred Heart can comfortably use Power Point programs and create data-bases to report on their wildlife sanctuary visit in Classification (complete with the appropriate bird calls from a CD). Year 8 students do not have difficulty using icon programming to participate in sensor driven Robotic soccer. For many of our interested, capable students, being told to wait until Year 9 or 10 for these types of activities, sounds the death knell for their participation in Science careers-they are often lost to Science. They are exceedingly capable with this technology and lose interest when its employment in the classroom is put on hold for years. Our students are genuinely seeking relevance and engagement, which is why we integrate Technology into our Science, courses as we meet the CSF requirements.

Secondary Catholic teams are entered in the state and national finals of Robocup -soccer playing robots with sensors - this year for example Sacred Heart and Clonard College in Geelong, will enter five teams in different sections.

Motorola, Ford, NRC have told us that students could certainly use an idea of programming in Basic (computer language) to run systems including manufacturing, motor vehicle monitoring and security programs, CPU's and linked to pneumatic and mechatronic processes. A unit is being offered in our Middle School as an introduction to Physics to include this with hands-on models programmed in an industrial Basic language. As part of their general Year 9 course students at Sacred Heart are introduced to icon-driven computer control models, including washing machine systems, robotic arm control and decision making with model traffic lights and lift mechanisms. Our students are keen to learn relevant things, such as, why basic printer colours are cyan, magenta and yellow while television colours are red, blue and green (some great java applets on this). When coupled with significant learning skills they are quite discerning about what a valuable education involves and what context it has been placed in. This goes hand in hand with their Chemistry, Physics, Biology and Psychology studies-in fact it enhances them.

We acknowledge and thank Sacred Heart, Geelong for this article.

"Yes, We Are Listening"

…stimulus for reflection.

This article is an extract from a paper entitled "Yes, we are listening", presented by Gayle Osborne and Simone Ireland at the Australian Association for Research in Education Conference in December 2000. This paper reported the effects of student voice on teachers' professional practice, using focus groups of Year 9 Mathematics and English students to collect data on students' perceptions of teaching and learning. It also draws on material contained in the presentation " by Gayle Osborne, "Making girls count in Mathematics", at a recent Alliance meeting held at MLC School.

Evidence-Based Practice

In her paper, Evidence Based Practice – Towards Whole School Improvement, Susan Groundwater-Smith (2000) outlines evidence-based practice with its origins in medical practice and describes how education has developed a broader and richer understanding of the term growing out of a tradition of action enquiry and practitioner research. Davies (1999) identifies school-based research occurring at two levels: the evidence from global research and literature that influences and directs educational thinking and practice, and, data that schools may systematically gather in relation to their own practices and context. To improve practice, a school needs to use both forms of evidence.

"Examing what students said about their learning, teachers commented on how insightful, perceptive and mature the girls were..."

The School Context

Located in metropolitan Sydney, ours is a kindergarten to Year 12 independent girls' school with an enrolment of around 1200 students. It is a leader school in the context of educational change and innovation.

Our school has a demonstrated commitment to evidence-based enquiry and practitioner research. The appointment about four years ago of a researcher-in-residence, Dr Susan Groundwater-Smith, is significant in our intent to "embed school based enquiry into the norms and values of the school and professional development of (our) teachers" (Groundwater-Smith, 2000; p4). We have established a Research Advisory Committee, with its membership comprising of students, parents, teachers and researcher-in-residence, to manage our school-based educational change. Many projects have been undertaken using student voice. These include examining: technological innovation and management, assessment and reporting, Middle Schooling, independent learning, teaching and learning in Mathematics, English and Music, and collegial professional development by teachers. (See Groundwater-Smith, 2000: "Evidence Based Practice – Towards Whole School Improvement" for greater detail).

Listening to Student Voice - The Process

Students care about their education. They want to learn. They want to be challenged. They want to have a say in how they learn. Our school is concerned with aligning educational experience with stakeholders' expectations. This encompasses consideration of what is being taught, how it is being taught, how students learn and how students' school experiences are transformed for life-long learning.

Quality teaching and learning comes from a balance between curriculum enrichment and teaching performance. The aim of the Student Voice Project is to hear what students are saying about their classroom experiences and about teaching and learning in general and to use the information to help teachers improve the quality of student learning.

The Student Voice Project in Mathematics and English involved inviting students to discuss issues of both pedagogy and curriculum quality. The initial phase of the Student Voice Project involved students from Year 9 English and Mathematics classes. From every class, five students were randomly chosen to participate in focus group interviews, facilitated by a Year 10 student representative and a teacher trained in generating student voice. A total of sixty students were invited to participate.

Each focus group session took about an hour and the facilitators lead students in discussions around the themes of: enjoyable learning, confidence in learning, the role of assessment in learning, being noticed in the classroom environment, and experience with different teaching and learning styles. Each focus session was taped and on conclusion of the focus session, the staff facilitator transcribed considered comments, keeping names confidential.

Workshops were then arranged as faculty inservices, with both English and Mathematics departments considering the implications of the data for their teaching practice and student learning. What follows is an outline of the subsequent process in the Mathematics faculty and a discussion of the impact on teachers' practice.

A Work in Progress - Mathematics

In response to the data collected in the Student Voice Project on Mathematics, several workshops were held with the Mathematics Department. These workshops focused on:

- Collating transcribed student responses using de Bono's PMI format
- Categorising responses under the headings: teaching, learning, assessment, homework, being noticed and classroom climate
- Personal reflection of the data collected
- Examining who the guardians of the existing culture might be and the implications of this on teaching practices
- Discussing future directions and commitment to action
- Nomination of a class/topic to trial Costa's strategies and feedback from the students in the next term.

Future meetings will focus on critical reflection and measurement of the success of the strategies incorporated into classroom practices.

Implications for Mathematics Teaching and Learning

Motivation, Engagement and Learning Outcomes

If we accept that in good learning, students take some responsibility for their own learning, then the motivation to do so is

a key factor here. In the discussion of each of the questions posed by Susan Groundwater-Smith, the importance and impact of the teacher on classroom learning was confirmed. In a study of the influence of motivation on learning, Middleton and Spanais (1999) identify five key points from research findings on motivation. Knowledge and understanding of these key points is essential to all teachers of mathematics in their desire to improve the learning environment for their students:

- Students who experience success in mathematics, particularly if it is derived from their ability and effort, are more likely to perceive the worth and importance of mathematics
- Motivation towards mathematics is developed early in a student's life but can be affected by subsequent teachers that a student may have throughout the course of their schooling
- The quality of a student's learning is enhanced if they can develop the intrinsic motivation to acquire new skills, rather than be urged on by extrinsic rewards
- Depending upon how they have been taught to regard mathematics, students can have vastly different views of the subject
- The motivation to learn and achieve is also affected by the design of the tasks that the students undertake as part of their learning.

Opportunities for students to experience success, on tasks that are appropriately challenging, need to be built into learning activities. These have a direct impact on students' sense of autonomy, interest and motivation, with students more likely to develop the confidence to try more difficult work and not be put off by failure.

There is considerable research on the high correlation between student achievement and the use of instructional time within the classroom (Chapman, 1998). A student's level of engagement is indicated by her level of motivation, task persistence, cognitive effort, excitement and interest in new ideas (Wigfield & Guthrie, 1997). The definition of student engagement suggested by Skinner & Belmont (1993; p 572) makes this even clearer:

> *Children who are engaged show sustained behavioural involvement in learning activities accompanied by a positive emotional tone. They select tasks at the border of their competencies, initiate action when given the opportunity, and exert intense effort and concentration in the implementation of learning tasks; they show generally positive emotions during ongoing action, including enthusiasm, optimism, curiosity and interest.*

The Significance of the Classroom Teacher

In his address to the Annual Conference of the Australian Association of Mathematics Teachers in Port Macquarie last year, Robin Williams (1999) stated that every leading figure that he has interviewed has insisted that the most important part of their early development has been a teacher - not a parent or a computer.

Mathematics is a subject to which people have a strong emotional response - they either love it, which generally means that they are good at the subject (Middleton & Spanais, 1999), or they dislike it, which generally means that they experience little success in the subject.

According to Baroody (1987), teachers' belief systems both influence and direct teachers in their decision making and development of particular teaching strategies. The investigation of the impact of teachers' belief systems in regard to teaching and learning, has been described by Pajares (1992) as a most important factor in educational research. This is also emphasised in the work done by Relich (1995) who claims that what happens in the mathematics classroom directly affects the way students think about mathematics.

Gayle Osborne (right) and Anna Moustacas talking to girls about learning in Mathematics.

Where to now?

Research, particularly practitioner research, is critical to furthering our knowledge and understanding of student learning. When classroom teachers undertake research, they are more likely to examine their own practices and effect subsequent change based on their findings.

The Student Voice Project at our school provides a stimulus for reflection that is particularly potent. They are our own students reflecting on their learning and instruction. Teachers involved in the process remarked on how thoughtful many student comments were about their learning, how perceptive, how mature. The data challenged us to reflect on our practice and established beliefs about the teaching of mathematics.

Leading edge schools, according to Peter Cuttance, are active participants in research. The findings from this research are then integrated into practice and the whole process begins again. This is the way we operate now - innovation and improvement have to become our daily business. Alan Parker (1999; p49) said of learning: "It's nice if it makes sense but it is better if it makes a difference". Our findings are not to be filed away like the notes from an in-service course once attended and added to the resume, they challenge us to action. We are committed to making a difference.

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SCIENCE

…science breaks the barriers.

The study of Science has continued to evolve and provide a stimulating environment for students to investigate and explore scientific phenomena. A highlight for Year 12 St Margaret's Chemistry students was attending a Monash University workshop, where they gained valuable first-hand experience of instrumental design features, practical applications and concepts of quantitative analysis. Year 11 Biology students consolidated their field-work experience when they visited Jack's Reserve in Hastings, gathering data on the vegetation and fauna that inhabit the mangrove ecosystem. The Year 12 Biology and Physics students also attended the CSIRO complex where they looked at structures and materials (Physics) and Genetic Engineering (Biology). The Year 11 and 12 Biology students also visited the zoo to explore evolution and reproduction.

Science week was celebrated this year with static displays and a competition based on the theme 'Biodiversity'. All students from Years 7-10 and nominated students from Years 11 and 12, successfully completed the Australian Schools Science Competition. In conjunction with the Geography department, all Year 7 students participated in 'Murder Under The Microscope', where students solved an environmental crime identifying the villan, victim, crime-site and cause. The Year 8 students also participated in the Crest Awards, where they studied and built a model of a house.

We acknowledge and thank St Margaret's Berwick for this article.

GENETHICS

…science and ethics.

In a school with a reputation for excellence Cassandra Devine stands out as exceptional.

Cassandra has recently achieved national recognition when she won the State and then the National Finals of the 'genETHICS' competition. Cassandra saw the posters for the competition displayed at Mac.Rob. and decided to enter. Her studies in Philosophy and Biology meant that she was well versed in the factual understanding of genetics and in the ethical issues that surround this subject. Her teachers, Jenny Lowman and Davydd Griffiths, provided her with support and encouragement.

Cassandra Devine

The topic for the state finals centred on information that a new biotechnology company was offering to screen unborn babies for four genetic conditions. Cassandra's presentation demonstrated the differing opinions on whether the company's proposal was ethically acceptable and the implications of parents having to pay for the controversial test. Cassandra used a highly innovative puppet show for her presentation.

The National Finals of the 'genETHICS' competition called for a presentation on genetic engineering. Cassandra won the $1,000 prize and $400 for textbooks for the school.

What is particularly impressive is to consider this success in the context of Cassandra's other interests and achievements. This year Cassandra is studying French as part of the University of Melbourne's program for High Achieving students. She was second in the state in the Japanese Speech Contest and last year she won first prize in the state in the National English Competition.

Cassandra's co-curricular activities are also outstanding. She conducted her House in the Madrigals competition, is a member of the school's Chamber Voices, is Co-leader of the school's Writers Club and a founding member of the Philosophy Club.

When school finishes this year Cassandra plans to go to France for a back-packing holiday and then to return to complete a new degree at the University of Melbourne in Media and Communication. For the future she is not quite sure but is interested in journalism, diplomacy or world activism.

We acknowledge and thank The MacRobertson Girls' High School for this article.

New Ideas in Solar Car Racing

…the solar force.

Sunday 2 September saw the wheels turn for the first time on the new EOS Solar Commuter. The car, a converted Holden Barina, has been two years in the planning and construction and is entered in the new Demonstration Class for the World Solar Challenge beginning in Darwin on 18 November this year. This class has been instituted for vehicles and teams that demonstrate advanced concepts and technologies which is exactly what the Annesley College team in Adelaide has been working on.

The car, supplied by Holden, has been converted to an electric vehicle with the 21 Kw motor from Lynch in England, controllers from Curtis in the USA and Maximum Power Point Trackers from Brusa in Switzerland. The solar panel on top has been supplied by Cummins Power Generation and was sourced in Germany.

A semi trailer, supplied by Parnell Mogas, and a forty-foot container will be converted to our solar powered service station and will be charging battery packs throughout the race. Three battery packs will be used each consisting of eight Genesis, Lead/Acid 12V batteries. Each pack will power the car for about an hour of running and will then get two hours charging in the solar powered service station.

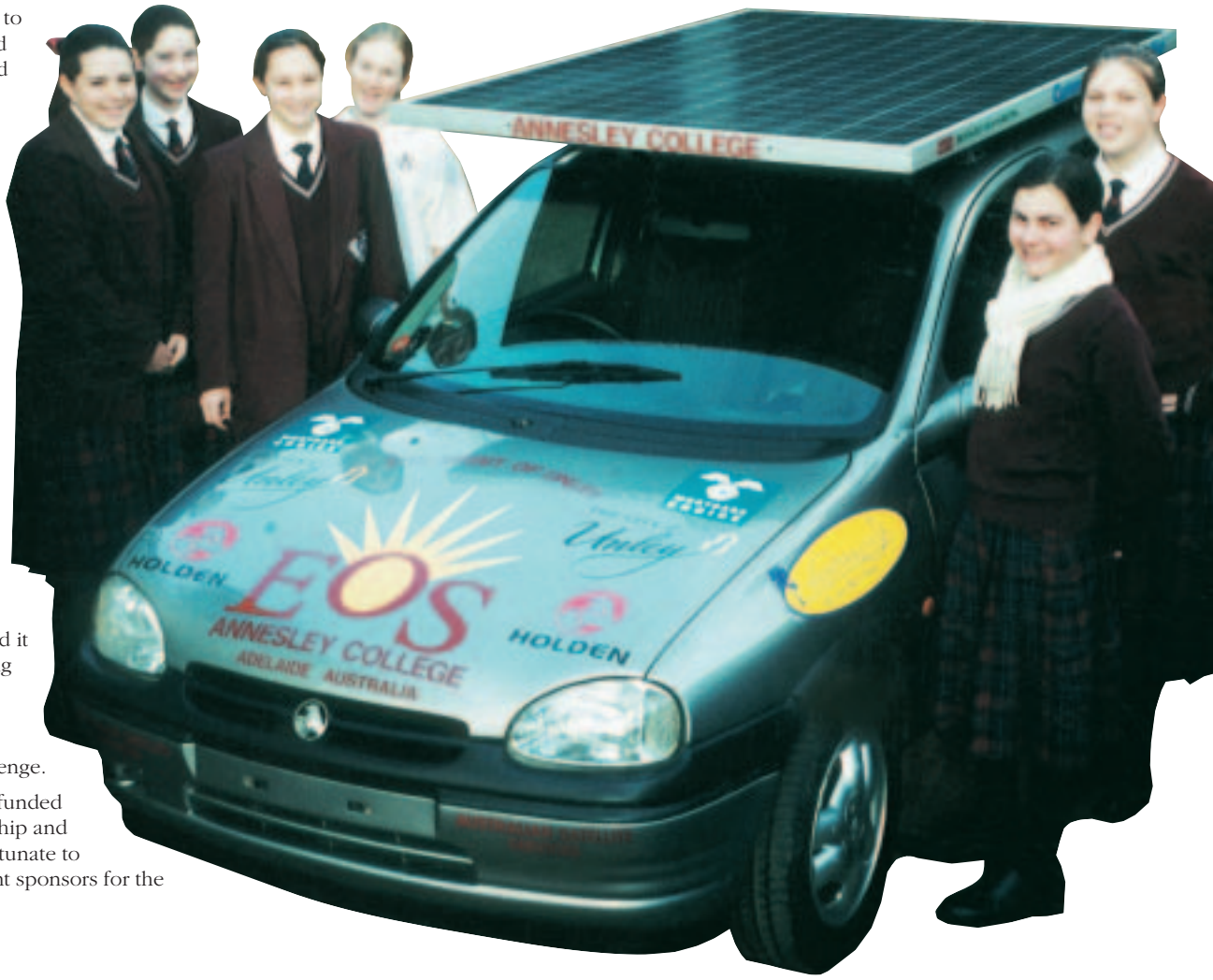
This new concept car is the first of its type and it will be challenging and fascinating to see how it performs in the World Solar Challenge.

The project is funded through sponsorship and we have been fortunate to secure magnificent sponsors for the project. The major sponsor is the City of Unley and the name of the team is EOS, The Spirit of Unley. Major support has come from Holden which has supplied the vehicle and technical support. Parnell Mogas has supplied the semi trailer and container. Mortgage Choice, through previous Annesley physics teacher, Alan Heath, has given financial support. Bridgestone has supplied Firestone low rolling resistance tyres, Cummins Power Generation has supplied solar panels, Mediterranean All Suites Hotel, Darwin has donated accommodation for the team and Australian Satellite Services are supplying our satellite communications for the race.

"This new concept car is the first of its type and it will be challenging and fascinating to see how it performs..."

Annesley students, staff and supporters have donated many hours of work. Without the massive support of all these people, the project would never have been possible.

We acknowledge and thank Annesley College for this article.

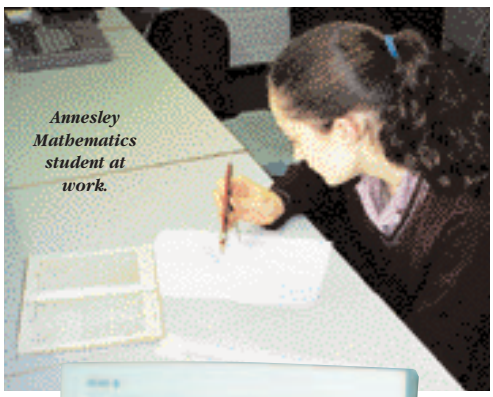


Mathematics in the Past and the Future

…log book to calculator and beyond.

Do you remember using a slide rule or are you old enough to remember the log book we used to do arithmetic which is now replaced by a calculator doing the same task in just seconds ? How far has mathematics education come in a short time and how far has it yet to go ? The following article is my reflections on the past and my predictions for the future of mathematics education.

When I first arrived at Annesley we still did not use calculators in the Junior Secondary classes and now some 13 years later, we are about to introduce Graphics Calculators to our 13 year olds with Algebraic manipulation already here in the next generation of calculators. As a parent I suppose along with many others we were initially worried they would not have the numeracy skills that we had, how will they cope we asked. Let us perhaps look at the other side of our changing world with the growth of technology, how competent is my generation with technologies compared with our children and students. Our world is changing, we are told our students will perhaps have several careers throughout their lives, many study double degrees where we only studied one. Annesley has always been a school that embraces such changes and moves to quickly adapt to our ever changing world so as to best equip our girls for their futures. For the last 13 years the mathematics faculty here has been teaching graph drawing and aspects of co-ordinate geometry with the aid of computers using such packages as ANU Graph, Green Globs and more recently FX Graph, while Geometry learning is enhanced by Geometer Sketchpad. The style is based more on experiences and when our students are encouraged to "play" and discover properties, how much more fun it is and this wider experience of these basic concepts ensures a better foundation for their learning. This investigative style helps to nurture a more independent style of learning which can be ongoing in their lifetime. Graphics calculators are far more accessible than computers, far cheaper and they are valuable learning tools. Our students embrace new technology with ease as we share how to experiment with them and sometimes are shown better ways than we perhaps suggested, but to learn with your students is a rewarding experience and reinforces that we are all constantly learning. Annesley College has for many years now had a lap-top programme which was easily adapted into the Mathematics programme, given our previous experience with computers. Our latest text books have an interactive CD with them so the student can "play" with and discover new concepts. It is a style which I believe offers to improve their problem solving strategies as the independence it fosters gives them more confidence and planning skills. Students at Annesley College are able to access our Intranet from home which allows them information on mathematics courses, including tests and solutions from the previous year's work and suggested sites which give further insight into mathematical topics such as Algebra and Matrices. There are fun sites which are just that, playing with mathematics for its sheer delight. Logic Puzzles which you may yourself thoroughly enjoy are excellent strategically for problem solving and those students who have no particular strategies can be taught how to approach these and it is no different from how I would teach Deductive Geometry. With time I see the intranet being expanded to include on-line learning for students unable to attend classes for whatever reason, and as we move into the 21st century many changes are before us, learning is becoming more interactive and I believe in my life time we will see on-line learning being common place with individual programmes being developed so all students can reach their potential. As a teacher I feel my place will be that of a facilitator where I too will enhance their learning but not control it, they will be guiding where it is to go according to their interests and career choices.



Annesley Mathematics student at work.

…and at Moreton Bay College girls also enjoy Mathematics.

This article was written by Val Frost, Head of Mathematics at Annesley College. We acknowledge and thank Annesley College for this article.

Eco-Sleuths Solve National Problem

...ecological investigations and solutions.

Eco-sleuths from Ravenswood have scooped the nation's schools by solving the ecological problem posed in "Murder under the Microscope".

"Murder under the Microscope" is an interactive eco-game designed for students from Years 5 to 8 to have fun while learning about environmental issues. The game integrates the application of internet, intranet, television and classroom-based activities.

The Ravens, Year 5 students from Ravenswood, won first place in the competition from 1500 teams throughout Australia. They were the first team to solve the eco-problem of "Terror in the Township", an ecological crime committed somewhere in a catchment area in Australia and submitted the best Catchment Management Plan to prevent the problem in the future.

The Ravenswood eco-sleuths' task was to identify who (the victim), why (the villain), where it happened (the crime site) and the underlying issue in the shortest possible time.

Over a period of several months teams of students across Australia were given successive "tipster" clues to lead them through an environmental murder mystery.

Using integrated curriculum, site maps, internet and intranet searches and links to research sites, students were able to formulate proposals and to post their own research papers on the "Murder under the Microscope" web site.

As the research took place students could post questions to scientific 'Experts' involved in the game and receive their answers through the Experts Message Board.

The game offers the students a fascinating study into aspects of Science, English, Environment and Technology. Not only are the students highly motivated but their skills are extended in many curriculum areas particularly in terms of research.

The Ravenswood team, *The Ravens*, was made up of girls from three Year 5 classes. Not only were they correct in their findings but they were also the first in Australia to submit their correct accusation of a solution to the crime. The Solution offered by *the Ravens* was: The Crime site – Macquarie Catchment; the Victim – Couch grass; The Villain – overwatering; and The Issue – Salinity.

Classroom teacher of one Year 5 class, Ms Melissa McClintock said, "The girls have gained so much from their involvement in this investigation".

She said, "They have learned advanced concepts and the self-centred learning has created particular enthusiasm within the classes which everyone has enjoyed".

We acknowledge and thank Ravenswood School for this article.

Girls Participation in Mathematics

…a decade on.

In 1987, as part of a federal election campaign, the Prime Minister of Australia Mr. Bob Hawke promised that his government, if re-elected would set up a national program to increase the participation of girls in mathematics and science. Indeed this was a high profile issue in the late eighties and early nineties and the Prime Minister's view was roundly supported across the education community. Where have we come in 14 years?

This article examines the participation of girls in mathematics in the Year 2000 (in Queensland schools).

Participation by Boys and Girls in Mathematics

Table 1 shows the total number of students enrolled in Year 12 Mathematics in Queensland schools in 1992 and then again in 2000. It also shows the participation by boys and girls.

Boys and Girls in Mathematics

		1992	2000
Mathematics A	Boys	8484	9069
	Girls	10283	11393
	Total	18767	20462
Participation by girls	**%**	**55**	**56**
Mathematics B	Boys	8130	8713
	Girls	7020	8017
	Total	15150	16730
Participation by girls	**%**	**46**	**48**
Mathematics C	Boys	3142	2233
	Girls	1213	1009
	Total	4355	3242
Participation by girls	**%**	**28**	**31**

Table 1

Quite a striking feature of this data is that the proportion of girls in mathematics classes falls dramatically as the perceived (and actual) level of difficulty of the subject grows.

Mathematics A is less demanding than Mathematics B, which in turn is less demanding than Mathematics C.

For example, in 2000, 56 % of the students enrolled in Mathematics A were girls, but this proportion drops markedly in Mathematics C where just 31% of the students enrolled were girls.

This immediately prompts the question, why do girls choose to participate in fewer numbers than boys in the more difficult mathematics subjects?

Examining the participation of boys and girls, on the surface, at least, it appears as though the participation rate of girls in mathematics has increased since 1992, but only marginally.

Participation by Girls in Mathematics as a Proportion of the Total Year 12 Population

Table 2 shows the total number of students enrolled in Year 12 (mathematics is optional in many Queensland schools). It also shows the participation of girls in mathematics as a proportion of the total number of Year 12 students.

Proportion of the Total Student Population

		1992	2000
Mathematics A	Girls	10283	11393
	TOTAL	33407	38727
	%	**30.8**	**29.4**
Mathematics B	Girls	7020	8017
	TOTAL	33407	38727
	%	**21.0**	**20.7**
Mathematics C	Girls	1213	1009
	TOTAL	33407	38727
	%	**3.6**	**2.6**

Table 2

As a proportion of the total population the participation of girls in mathematics has actually declined since 1992. In the three mathematics subjects the proportion of girls enrolled in mathematics as a percentage of the total student population has dropped since 1992. This is quite striking, because the participation of girls in Year 12 as a percentage of the total Year 12 population has actually increased over that period from 52% in 1992 to 55% in 2000.

Indeed the participation by all students in mathematics has declined since 1992. Boys and girls are choosing to study less mathematics than they did in 1992.

Why are girls choosing to study less mathematics? Since the early nineties there have been campaigns by governments, professional associations, Universities and schools to increase the participation of girls in mathematics, at least this was the case in the early and mid-nineties?

A popular mythical response has been that girls do not achieve as highly as boys in mathematics. This of course has been discredited and the Queensland context soundly dispels this myth.

Achievement by Girls in Mathematics

Table 3 examines the achievement of girls in mathematics by analysing the award of levels of 'Very High Achievement (VHA)' and 'High Achievement (HA)' in mathematics in Queensland schools in 2000. Student achievement in Queensland schools is recognised by the award of five levels of achievement, VHA & HA being the highest awards.

Achievement by Girls in Mathematics

Levels of achievement (in 2000)

		Number awarded
Mathematics A	Boys	1626
	Girls	2845
	participation by girls	56%
	% awarded to girls	**64%**
Mathematics B	Boys	2342
	Girls	2126
	participation by girls	46%
	% awarded to girls	**48%**
Mathematics C	Boys	902
	Girls	503
	Participation by girls	29%
	% awarded to girls	**36%**

Table 3

These results show that proportion of VHAs and HAs awarded to girls exceeds the participation rate of girls in each of the mathematics. Consider Mathematics C, 36% of the VHAs and HAs assigned were awarded to girls, yet girls made up just 29% of the Mathematics C population.

Without too rigorous an analysis this would indicate that girls achieve at least as well as if not better than boys in mathematics.

Researchers in the late 80s and early 90s were asking the question, 'why do girls choose to participate less than boys in mathematics?'

This fairly limited examination of the Queensland context would suggest we have not found the answer, or we have simply stopped asking the question.

At the very least this brief analysis of the Queensland situation should prompt mathematics educators across the country to engage in meaningful dialogue with colleagues.

References: *This data has been supplied by the Queensland Board of Senior Secondary School Studies and is available on their web-site at www.qbssss.edu.au*

We acknowledge and thank Moreton Bay College, Qld for this article.

Combined Science Research Project

Ruyton Girls' School and Trinity Grammar School …difference and choices.

Co-ordinators: Cathryn Furey (Dean of Science, Ruyton Girls' School) &
Dr Heather Evans (Co-ordinator of Teaching and Learning Strategies, Trinity Grammar School)

Science teachers at Ruyton Girls' School and Trinity Grammar were interested to see how different the choices of activities were between Year 7 boys and girls when it came to studying a unit such as 'Forces'.

Using a grid based on the taxonomy of thinking formulated by Blooms and the multiple intelligences identified by Gardner, the students were allowed to choose from a variety of tasks to investigate and record their understanding and findings about 'Forces'.

The tasks ranged from an experimental investigation based on sports shoes, to the investigation of whether the size of a parachute affects the time it takes to fall to earth, to writing a poem or song about forces.

The research findings suggested that:

- Selection of the combined analysis and body kinaesthetic task was the most preferred task by both genders
- In the selection of activities related to Blooms thinking skills, boys were more likely to choose tasks requiring application and girls were more likely to choose tasks requiring analysis
- In the selection of tasks along the Gardner's list of Multiple Intelligences, boys were more likely to choose tasks concerned with Maths/Logic and girls were more likely to choose Visual/Spatial and Musical tasks.

Observations drawn from the selection of the ten most popular choices of activities indicated:

- Significant concentration in the selection by the girls of the Synthesis and Body/Kinaesthetic task and the Comprehension and Music task
- Selection of Verbal/Linguistic tasks were similar for both sexes. This is interesting in light of research which suggests that boys are not as comfortable working in this area
- Greater selection of the Application tasks may support the preference for more activity for boys
- Mathematical/Logical tasks were chosen by boys but not girls.

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Continued from page 5...

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