

The Office of Women's Policy presents the



13th Annual
Alicia Johnson
Memorial Lecture

Delivered by Professor Helen Garnett
Vice-Chancellor of Charles Darwin University

Making a Difference:
People, Science
and Technology

Darwin and Alice Springs
5th and 6th December, 2003



Northern Territory Government

Department of the Chief Minister

This is a publication of the Office of Women's Policy, Department of the Chief Minister, Northern Territory Government

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Alicia Johnson...

attended school and grew up in Melbourne. She graduated from Monash University in 1986 with a Bachelor of Law/Economics. She was admitted as a practitioner of the Supreme Court of the Northern Territory in 1988.

Alicia began working with the Australia Legal Aid Office in 1988 and resigned to lecture at the NT University Law School in 1991. Some of Alicia's commitments included membership of the NT Domestic Violence Task Force and the Family Planning Association, and being a representative of the NT Law Reform Committee. Alicia was particularly concerned and worked tirelessly for disadvantaged youth, and women who had experienced domestic violence and sexual assault. Alicia died in 1991 aged 28.



Professor Helen Garnett...

was born in Australia and educated at the University of Sydney, where she gained first class honours for her Bachelor of Science degree (1969), the University of London, and the University of Wales, where she completed her Doctor of Philosophy in 1974. Professor Helen Garnett commenced duty as Vice-Chancellor at the Charles Darwin University, in October 2003. Before taking up her role as Vice Chancellor, Professor Garnett was the Executive Director of the Australian Nuclear Science & Technology Organisation (ANSTO). Professor Garnett has a national and international reputation for her contribution to the life sciences and the peaceful development and application of nuclear technologies.

People make a difference; their creativity opens up new horizons, their passion and dedication can make things happen. Science and technology are rapidly changing the world we live in and education should be preparing our youth, not only for the present, but for the complex and no doubt different future they face. It is essential that pathways be available to allow individuals of all ages to re-skill, or to learn more about the many influences that shape the world now, have shaped it in the past, and those that might shape the future, wherever we might live.

I turn first to people. There are, and I am sure always have been, many great women role models; it is just that historically they have not always been recognised. There have also been some great male role models, as well as some interesting male characters served up over time. George Hegel, a renowned Professor of Philosophy in Berlin in the 19th century, was of the view that women's limited mental capacity equipped them only for housework and child rearing. Women could not possibly succeed in science and were in his view clearly not capable of any intellectual activity, or of creating any

significant literature or art. Closer to home a professor of one of our own universities, the Professor of Obstetrics at the University of Sydney in 1894, Professor William Balls-Headley, argued strongly against the participation of young women in tertiary education on the grounds that “the energy needed by the uterus would be diverted to the brain rendering them infertile”.

Clearly these two men, however eminent they may have been in the view of the intellectuals of the day, are not exactly on my list of role models or heroes. When I use the word ‘hero’ I mean people who through their greatness make significant achievements, which are lasting; individuals who make positive contributions to the society in which they are living; people who leave the world a better place than they found it.

I contrast this with celebrity. Those in the limelight, who celebrate a particular style, appear to have a great time and often are thought to ‘have it all’; people who make a splash but who do not always make a difference, and who can even influence segments of the population in an inappropriate way. Today we are bombarded by media and the quick grab. It is much easier to feature celebrities who can be



depicted by clothes and images reflecting material goods than it is to understand what makes a great achiever tick, or in my parlance a hero, and portray their complex message. Sharing and caring is not generally newsworthy and achieving public engagement in consideration of what the future might be is just plain hard.

Indeed in today's society, where sensationalism and glitzy messages suggesting life is a party are often across the pages of women's magazines and given prominence in other forms of media, it is just so important that mentors and role models feature in the lives of our younger people; role models or heroes who have made a difference and who epitomise balance; role models who believe that life is about learning, about loving, about caring and sharing, about working hard, about enjoyment and having fun, and who put these values into practice.

Alicia Johnson whose contributions to society we reflect on, and pay tribute to through this lecture, took advantage of her opportunities to learn and to help others to learn. She was clearly a loving, caring and sharing person working for disadvantaged youth and women who had experienced domestic violence and sexual assault. I would be

surprised that if in her short life, despite the fact that she could not bear to go on, if she had not shared many moments of fun and enjoyment with family and friends.

I stand here tonight as a new resident of the Territory, one who has the privilege of leading the Territory's university, an institution which has the responsibility of imparting learning to, and hopefully influencing a considerable number of Territorians; an institution which Alicia was about to join.

I only hope that I and many of my staff can be positive role models to our students and to our community, and that through our contributions we will make a difference...

I would not be doing what I am if I was not passionate about education, and about lifelong learning. Given my disciplined background and recent role – I am also passionate about the role of science in society. This is a field which does not always receive positive billing, indeed a field that is not always understood by society at large, and yet one which is influencing and will continue to influence our lives in the years ahead.



Let's explore the role of science.

SCIENCE – What do you think when you hear that word?

Do you, your family, your friends think of THINGS

- things maybe beyond your reach such as a *spacecraft*, or a *mini remote submarine* going to the bottom of the ocean to sample the ocean depths, or maybe a *pilot-free plane* taking measurements to assist in our weather forecasting...OR
- things that you have around you at home, at school, at work... *mobile phones, computers, CD players...*
- things such as machines found in industry, or on the farm across the length and breadth of Australia?

Do you think of PEOPLE DOING THINGS, of scientists

- performing exciting tasks to understand the natural environment – *in the field, in the ocean, in space...*
- exciting studies to develop new materials – new plastics for *motor cars*, new materials for *tyres for longer wear* and less chance of damage or blowouts, new materials

for faster, lighter *yachts, boats powered by solar energy*, new materials for better bank notes...

- exciting studies to develop *new foodstuffs*, better *wine*, new *cosmetics, recyclable plastic bottles* and even clothes made from this recycled material, newspapers we can de-ink and recycle to make stationery...
- exciting studies to understand what makes us *human beings function*, why we *age*, why we *dream*, how *different foodstuffs and exercise* can keep us healthier...
- performing important tasks to keep our companies running...
- delivering services such as weather forecasting, services in medical laboratories, veterinary laboratories and agricultural services designed to analyse information and provide advice to improve the quality of life - men and women working in companies in hospital laboratories, in the field, in the ocean...
- men and women contributing to almost everything you buy?



Do you think of an approach to life, an approach that influences **WHAT WE THINK** AND THE **WAY WE THINK**?

In the last century science, engineering and technology have changed not only **what we have around us** to the benefit of individuals, communities, business and society but also **what we think** and the **way we think**.

Recently I read an article, which claimed that while great men – notice in such articles it is always men – were vital to the past, the new engine of society was science. The article explained that, historically, universal solutions were promised by religions and by economic and political theorists; the scientific approach does not offer a fixed universal solution. Properly executed science cannot be forced into a particular agenda; our knowledge grows and we recognise as much what we do not know; we continually modify our knowledge base and as new facts are proven; we accept ongoing change.

The author claimed that for society to succeed in the future it must be open, endlessly modifiable, which is of course the scientific

methodology I have just described, where the knowledge of today is modified by the findings of tomorrow in a pragmatic way – *the way we think*. It appears that science and technology have changed *what we think* and will continue to influence philosophical thinking.

It is interesting to note that those trained in law and economics are finding more and more that the methodology used in scientific study – the scientific paradigm – can inform them and be beneficial. An understanding of some science and the scientific method - what might be fact, what might be the current state of knowledge, why it might change and what just might be fiction that you should not worry about – might just help many. I would contend that the scientific method, not just the laws of nature ought to be more prominent in the general education system.

At the turn of the 20th century the humanities were regarded as a superior form of knowledge - I do not believe that is true to day. All forms of knowledge: traditional, historical, scientific (and the list goes on) are equally important.

Along with the humanities, the social sciences and the professions,



science and technology have a very significant contribution to make to our socioeconomic development.

However, while the scientific method should challenge everyone to continue to find answers and take account of new facts, it is equally true that the successful adoption of new scientific and technological innovations will fail in the future unless the scientific community takes cultural, social and psychological considerations into account.

Early in the twentieth century the disciplines were very much separate entities. If you looked back at old text books it would startle you. Mathematics and biology were separate worlds.

As the century progressed the acknowledged disciplines grew rapidly and new disciplines emerged. However, towards the end of the century the interdependence of the disciplines has been evident, just as an appreciation has developed for the belief that the implementation of the benefits of scientific research requires social understanding.

Information is growing faster now than anything that humans

currently produce – we cannot afford to have key elements of that information segmented, or be owned by particular sectors of society as their knowledge...in the words of Julian Cribb, a well known communications specialist... *'lay knowledge' and scientific knowledge' are equal and necessary partners...* or as Sir Robert May, the UK Chief Scientist has stated that *there will be a need for a very considerable degree of dialogue between science and society...*

In my view, an understanding of some science and the scientific method - what might be fact, what might be the current state of knowledge, why it might change and what just might be fiction that you should not worry about - can help everyone.

In my view, everyone should have some education in science and the scientific method, and that exposure should start in primary school.

Let's look at how science influences our life. Let's take a Saturday morning in the life of a couple of Territory teenagers – John and Kate, lucky enough to be on a dream trip to the snowy mountains, one to learn to ski the other to snow board...



1. They get up and have breakfast.....*breakfast cereals* – associated with science YES...NO? Fresh fruit...Bacon and eggs/ toast – associated with science... YES...NO? Cup of instant coffee – associated with science YES...NO?
2. They undertake the normal morning rituals of cleaning teeth, washing etc. They do not use bicarbonate of soda, an odd tasting chemical powder their grandparents might have used, they use a specially formulated cleansing paste with a reasonable feel and flavour in the mouth, *toothpaste*, maybe including fluoride to preserve the teeth.
Is this product influenced by science...YES...NO?
3. They start putting on their clothes, clothes to keep them warm and dry, clothes made of *polypropylene*....*clothes of Polartec*, *clothes of Goretex*...Do you think of science...YES...NO?
4. Time to put on the goggles, pick up *the skis and snowboard* ... equipment whose shape is designed today using fast computers, equipment made of modern materials...even if there is still a heart of wood...thinking of science...YES...NO? Probably very few people would be, but without it we would be skiing on wooden planks.
5. You might need a ride in a snow-cat, on a ski-tube or some

other form of transport...unlikely to be a horse and cart...

6. You head off with the dollars to buy a ticket for a lesson.....money – *our money is made from a special polymer* – giving a flexible plastic note that lasts about four times longer than the paper notes we had till the nineties. Our money is cleaner and provides much greater security against counterfeiting...thinking of science when you put your had in your pocket...YES...NO?
7. Out onto the snow and ready to go.. what do you see – *snow-making*...much comes naturally but in Australia we owe our capacity to ski for several months of the year on a more reliable basis.. .make it worthwhile for that trip from the Territory... due to the man-made snow... thinking of science ...YES...NO?
8. You have a ball... maybe a few falls... but feel pretty good with yourself...and at the end of the lesson with a 'Sports Drink' – said to have the right electrolytes to keep you going - in hand use the *mobile phone* to phone Mum and Dad...it is not so long ago that you went to the snow and there were no phones except in the village or in the accommodation...science and technology has changed all that, now we can communicate up



and down and around the mountains...so far this technologically enhanced world is serving these particular Territory youngsters well—...

9. Mum appears a bit distant...you talk to Dad who explains that Mum is somewhat stressed, somewhat worried about the headlines in the newspaper...some medication she has been taking for some months seems to be a problem...The *headlines are a bit scary*...Over the days and weeks ahead, it turns out that maybe Mum's medication, hormone replacement therapy might not be so bad...the real risks of the side effects are lower than the early stories suggested, particularly when Mum was only taking the medication for a relatively short time...one has to get into the numbers and understand the concept of risk...something that those responsible for the headlines seem not to worry about.

This is something that with an understanding of scientific method, which is best learnt in school along with other learnings in school, and a questioning mind, the anxiety, the stress might have been reduced for many women who read the articles...I could even hope that the headlines might have been somewhat more accurate.

Recent reports from the National Academy of Engineering and the National Research Council in the USA reached the conclusion that Americans are in general poorly prepared to make decisions about technology and the impact of scientific advances in their own lives. Often there is outraged reaction to innovation based on myth and persuasion rather than a more considered risk assessment using facts and natural choice. Education from an early age at school to encourage not only an understanding of the scientific method and where to find the facts, but awareness of the interplay between science, legal, economic and social issues is essential.

If information is growing at the pace I have indicated, there is a real need to involve society at large more generally in the discussions as we develop the technology. John and Kate's trip to the snow was fun...

Such a trip for their children might well involve bread on the breakfast table made from genetically modified wheat, wheat that yields in our drought years; their clothes will probably talk to them, maybe sensing the temperature and indicating they should put another layer on – potentially changing colour to give a different look



in different lights; they might well be driven from the motel to the slopes in a car with just a single pedal for both brakes and accelerator, a car powered by hydrogen; they might have individual identity cards with in built security protection, including their own fingerprint, that enables them to purchase what they need with no long queues, and even if they queue and use money it will probably be different to today's money with biological ink and other security devices ...The shape of the skis and boards...that's for the imagination, but they might well have the option for GPS built in providing information on the best route down the mountain depending on their ability...Science and technology will provide the individual with greater control and/or freedom.

Do you want to take advantage of such technology...will it be better for you...and when that scary newspaper headline comes along...will you be stressed...will you feel confident of your analysis? What does this rapid growth in technology mean for those in remote communities who even today do not have mobile phones and internet connections...and what can we learn from an understanding of indigenous culture.

Properly executed science cannot be forced into a particular agenda; our knowledge grows and we recognise as much what we do not know; in new and emerging fields we continuously modify our knowledge base, and as new facts are proven, we accept ongoing change... we continue to modify the garden in which we live.

Knowing something about science, scientists and the scientific method, along with an understanding of other disciplines, of the arts, social sciences, economics and the law, will stand you, your children, your grandchildren and all of Australian society in good stead. It will enable you to grasp opportunities and thrive in this rapidly changing world.

I can't imagine a day without science!! But to achieve my dream that society at large can engage in the dialogue about emerging technologies based on scientific discovery, will require a change to our education process. Education is not and cannot be for the privileged; for those whose parents before them have been fortunate to have a good education. Education, particularly tertiary education, was once for the elite, and in many ways we are still struggling to come to grips with the fact that education today must cater for



individuals with a far greater cultural diversity and breadth of experience - for those who grow up with computers from an early age playing games and who think in parallel; those who have never seen a computer and who have learnt stories by listening; others who learn best by reading and others who learn from pictures...

Yes we do know from rigorous scientific studies that individuals learn in different ways, and that our cultural upbringing and environment to some extent influences that learning.

But is our school system coping with the very significant changes that technology has brought, or the very different learning that will need to occur if more in the community are going to have some understanding of the scientific method, and use that to engender the creativity that our society will need to thrive? Is the education system as we know it today coping with developing competence in innovation and the application of technology? Is it encouraging young women into scientific and technological disciplines? Is it even providing the basic foundations in literacy and numeracy for indigenous children for whom English is a second language? The answer is hardly. Indeed studies demonstrate that the gap in

outcomes is growing, that the traditional training of teachers and modes of delivery are not providing adequate levels of numeracy and literacy for indigenous youth, particularly where English is a second language. Neither is our traditional school system equipping students for an innovative technological environment where cross disciplinary skills and problem solving are key. Neither is it encouraging female students into technological areas as a career, not even the 'clean' technological areas such as IT. And, there are fewer and fewer students coming through the school system with an understanding of science and the scientific method.

There is emerging evidence which will challenge those currently in the profession, the policy makers and leaders in education, and demand very significant changes to the way we educate those who teach. We cannot afford not to learn the lessons. We must do it differently!! The technological world in which we live today will continue to change at a rapid rate.

So what might we do? Some success has been achieved in improving the participation of indigenous youth in school by a greater emphasis on music in the curriculum. Everyone wants to be Mandawuy



Yunupingu! The challenge will be to build on this interest. A pilot program called Scaffolding Literacy trialled in some schools across Australia, including Territory schools in urban areas, has resulted in improved outcomes in literacy. It requires extensive effort to assist teachers to jettison traditional views about those with poor literacy – a change in psychological approach. It requires choice of literature that will turn the students on, rather than the traditional English readers which, while appropriate for 6-7 year olds, are simply not appropriate for 11 or 12 year olds; it requires technological support to retrain the teachers and provide them with the tools and methodology to deliver the program and then it requires programs to continue to assist the teachers to continue to work differently. It will almost certainly require the establishment of buddy systems and other mentoring activities to enable the teachers to continue to do things differently.

Will the new method work in remote areas? Can our current IT infrastructure facilitate those buddy systems and networking activities? Will the improvements continue to come? If so, is there any one element that makes it work? Can we learn anything that may help improve the teaching of numeracy? This is all ahead of us. But there is no doubt that as a larger roll-out of the program occurs there

will be the need for sharing stories, and hopefully some real successes from within both the teacher and the student cohorts will emerge: individuals who can become mentors and role models for the future.

Can we improve the capacity for technological innovation through our school system? What does it require? The latest view is that equipping students to develop innovative technological competencies and awareness can be augmented by providing spaces and infrastructure where students can work in teams to attempt to solve a technological challenge, as and when they have the inspiration. That is the facilities and opportunity to leave a project, discuss it and come back as and when they want to...certainly a challenge for some traditionalists in assessment as well as a challenge for those concerned about space and cost...all drivers which have tended to influence education.

Some elements of this solution might assist in changing the attitude of young female students to careers in technology. For example, over the past few years the percentage of women enrolling in vocational or higher education in the ICT field has dropped – it was



never high. As we moved into the twenty first century it stood at just 24% of enrolments and the employment statistics now mirror that ratio of 3:1 male to female. And yet the ICT sector plays a very significant role in the design of products and services, the delivery of education and health and other public services and in the delivery of private sector services like banking.

Indeed it is difficult to name an activity that does not involve computer technology. It is essential that this industry is populated by representatives of our varied cultural groups and by males and females in reasonably equivalent proportions. What do we know and what might we do to redress the situation?

Some recent studies have shown some interesting results. Year 9 and 10 students, whether male or female, have very similar pictures of what a computer specialist or an ICT specialist is. However, the females appear to make the judgement that this picture is boring...the males do not! Why?? Well the same studies suggest that while both genders perceive the profession as being involved in problem solving, the females perceive the problems to be technical and mechanical problems rather than technological challenges, or creative problems related to some other field. Indeed the study

reinforced the view that boys are attracted by the toy aspect and are quite happy with the image of working alone, while the females are generally repelled by those images. They are only attracted when they see the computer do something useful or creative, when the 'social' overlays the 'technological' context...They have difficulty identifying possible models or heroes who might positively impact on this image.

Maybe, as has been suggested by some of my colleagues in the university sector, encouraging students from different backgrounds to work on multifaceted problems where computers play a significant role such as in design, might help attract women into this profession, potentially to the benefit of many. Interestingly this strategy again draws on the context of team based learning and a focus on addressing useful problems or delivering creative outcomes. It also enables the kind of exploratory study which reinforces the learning of the scientific method.

Where is this likely to lead us? To create the maximum opportunity for this type of learning where the learners learn by social interaction and sharing knowledge, one can conceive of the value of virtual



classrooms where the students can enter at any time of the day or night, where they can work on virtual blackboards and virtual designs ...Maybe this kind of creative classroom will switch on those young people who are simply not turned on by the straight jacketed classroom regime that is currently the norm, as well as engaging girls in technological based professions. There is no doubt that educational 'games' will also play an increasing role in the educational arena, particularly for the males who appear to have a higher attraction to them. Given the global village we live in, those that embrace these potential benefits of technology and different modes of education could well steal the march in the creative stakes; creativity and technological innovation being the basis of knowledge work that most economists agree will underpin the 'winning communities' of the future.

These possibilities will be a further challenge to our policy makers, to parents, to teachers and academics, who will have to continue to learn and evolve their ways of working at a rapid rate if we are to provide the best learning experience for the youth of the future to thrive in this complex, changing, chaotic world.

However, unless very considerable effort is expended and IT is seen

as just as basic an item of infrastructure as a dirt track, it is obvious that the gap between those that are literate and numerate and have access to the most recent technology, and those who don't will only grow - something that as a country we just cannot afford.

The question is: will we as a society take account of these likely scenarios, and will those in positions of influence recognise that the investment in infrastructure, and in a far greater diversity of learning methodologies is needed now?

It will require leadership, it will require passion, it will require determination, it will require partnerships between the public and private sectors, it will require community engagement, understanding and commitment. Indeed I am beginning to wonder if it will not require almost as much of a change in attitude as when women were given access to our universities.

However, I am an optimist. I can see that given the size of community and the potential for partnerships in the NT, that there just might be the opportunity to do things differently and as a team make a difference!



