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3Cs: CREATING A CULTURE OF CREATIVITY

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1. Introduction

As educators we encourage lifelong learning, help students to prioritise what to learn, how to learn and what issues are most vital to engage with. We aim to provide the timeliest content, in correspondence with the students' needs. Unfortunately, many of us do not teach the students how to think creatively.
Creativity and innovation are the future drivers of the global knowledge economy (Ian Pearson & Michael Lyons, 2005). 'Industries of the mind' will play a central role in regional and national economies and ideas will be the most valuable resource in the market place. If Australia wishes to be at the creative end of the knowledge economy, training to be innovative and imaginative all starts in students' early years.
From within a non-competitive and nurturing atmosphere, students need to develop their creative skills, expand their senses of perception, nurture their innovative problem solving skills, be inspired by brainstorming, and new ways of looking at life as being exciting and transformative.
Hardcore technology skills are important and essential, but producing young imaginative minds is crucial - people with stirring imaginations that dream and think creatively.
In order to take our student base to the next level of creativity and innovation, we need to take them beyond the rigid policies, prescriptive processes, and fragmented organisational structures of education, that stifle innovation. To create a fresh thinking environment and to inspire and generate ideation in our classes, a mindset of continuous innovation at every stage of learning needs to be adopted. Such a mindset will allow students to achieve and sustain creativity and leadership in all their areas of study.

2. Creativity is Not Learned, but Rather Unlearned

For our students to be creative and innovative, and to become leaders in their fields, teachers must develop the best climate to stimulate innovation, execute the processes that spark innovation, and deliver maximum results. It is a myth that creativity is a gift that a few select people are born with. As children, we were all more creative than we are today. Perhaps not to the same degree, but we all do have innate creative abilities. All of us have the potential to be creative and innovative. This premise has been tested through research study findings, documented, and published many times (George Land & Beth Jarman, 1992; James Higgins, 1996; Linda Naiman, 2000). As young children we are more creative because we are looking through 'unpolluted' and 'unsullied' fresh eyes. We are very inexperienced and unconstrained by existing knowledge, therefore fantasise and are unrealistic. As teenagers and adults, we start to filter everything we see, just like a polarised lens that lets in only light that is aligned one way. To reverse years of filtered thinking, we need to start connecting experiences and synthesising new ideas. We need to teach our students the creative steps to bring out new, innovative and imaginative ideas. Ideally, creative ideas that the students themselves thought they could never have previously conceived.

The reason children are so creative (Stephen Shapiro, 2001) is because they are always collecting information, data and particulars that they eventually compile together. Everything is a new experience. And rarely do kids jump to quick solutions. However, once they start going to school and socialise with other children, they are forced to fit in. Peer pressure drives conformity. Education focuses on the regurgitation of facts, rather than on gathering new experiences. Within a school and at university, students choose major areas of study and become proficient, and sometimes expert, in that area. As we get older we find things in life that we like, to the exclusion of all else. We read the same sections of the newspaper. Read the same magazines. We watch the same style of movies. Narrow down the foods we eat. Socialise with the same friends. We tend to find ways of functioning within our lives that work for us. We use these modes continually without trying anything new, such as our thinking patterns, communication style, our view of the world, and our political thoughts. As we get older, instead of collecting 'ideas', we begin a process of information elimination. We continue to narrow down our relevance, concerns, curiosity, concentration and awareness.
In 1968, George Land (George Land & Beth Jarman, 1992) gave 1,600 five-year-olds a creativity test. The test was the same as that used by NASA to select innovative engineers and scientists. He re-tested the same children when they were 10 years of age (1973), and again at 15 years of age (1978). In 1985 he tested 280,000 adults to see how creative they were.

Table 1. Test results

Age group tested	Number tested	Year of testing	Percent who scored in the 'highly creative' range
5 year olds	1,600 children	1968	98%
10 year olds	1,600 children	1973	30%
15 year olds	1,600 children	1978	12%
25+ year olds	280,000 adults	1985	2%

"What we have concluded," wrote Land, "is that non-creative behavior is learned." From this, and similar research, we can conclude that creativity is therefore not learned, but rather unlearned. We, as teachers, need to reinforce and encourage student's fresh thinking and promote high levels of creative behaviour, enriching their thinking skills - critical thinking, problem solving and decision-making.
Through well thought out projects and classroom activities, with well designed briefs, enhanced thought provoking content, encouraging guidance and frequent feedback, in conjunction with external influences such as media input, guest speakers and excursions, we can begin to reverse these figures.

3. Why Aren't Adults as Creative as Children?

For most, creativity has been buried by rules and regulations. Our educational system was designed during the Industrial Revolution over 200 years ago, to train us to be good workers and to follow instructions.
Creativity is the collecting and connecting of ideas, disciplines, ways of looking at problems, and experiences. We cannot revert back to a second childhood or hire five-year-olds to tap into this innovative potential. Albert Einstein once said, "Imagination is more important than knowledge. Knowledge is limited. Imagination encircles the world." (Linda Naiman, 2000). Knowledge, in many ways, is the enemy of creativity, for once your brain finds what it thinks is the best solution, it stops looking. We look for solutions in our memory banks of what has worked in the past. Finding an answer quickly is often not the best solution and often undersells our ability and intelligence. Unfortunately, these solutions might not be new, innovative, or even good. What we need to do is train our brain to keep looking, even when we have found an answer. Tackling a problem requires one to think outside the square and not be limited by the first ideas that come to mind.

4. Methods to Encourage Creativity

We have a talent shortage world-wide. Educational institutes and industries that understand the relationship between creativity, innovation and performance, and actively promote creativity in their

students and staff, will be the winners in the marketplace. The root of invention and innovation is creativity.
Listed below, are seven methods to get you started in creating a culture of innovation and creativity within your classroom.

4.1 Connect and synthesise new experiences

Creativity is having the ability to connect and incorporate ideas, disciplines, ways of looking at problems, and experiences. By encouraging students to collect and hoard every experience for later use, through journals, diaries, notes, digital recordings, photographs and memories, stored random experiences can be used as the catalyst for breakthrough thinking. Some students are more creative than others due to broader experiences and analyses. Like through the eyes of a child, having fresh approaches by looking at the world in a new way, with simplicity and imagination, students can then begin to see what they have never seen before, and can expand their foci. Students will see, interpret, and sense new things through these new filters.

4.2 Break old patterns

During class, students tend to do the same things over and over because our teaching is repetitious. Break this pattern. Give students unusual, controversial, and critical resources that they have never seen before. Test and expand their ideas on things they previously did not like. Introduce them to new people and influences. Try different angles of analyses of theories. The more you do this, the more new experiences they will gain and the more ideas they will be able to draw from in the future.

4.3 Reinterpret needs which reflect the now

As adults, when we try to solve a problem, we often try to pull the answer from our knowledge bank, just like finding the solution in a text book. By solving the problem the way it has previously been solved provides a limited set of possibilities: replication and regurgitation. An alternative and more insightful way of looking at problems is to make connections and find analogies, metaphors, and associations that fit the problem you are looking to solve. Combine ideas in new ways. This may include using structures such as process structures, function structures, and technologies. When redesigning students need to look at what the design is really about. For example, if redesigning the interior space of a cultural centre, the student could look at hospitals, airports, subways, hotel foyers and cinema designs, to see how they deal with human traffic. They could also look at ant colonies and bee hives, anything with a flow. One needs to take the design a step further and look to non-educational connections, analogies, metaphors, and associations. Students have limitless ways of recombining their ideas to conceive something new and creative. This is not about invention, which is pulling something out of the thin air. Innovation is about reinterpreting situations to create scenarios. Students should not always go for the obvious solution. Some of the best ideas come from some of the most unlikely combinations and abstract references.
For examples see Case Study 5, 6 and 7.

4.4 Look at nature

Look at nature, the evolution process, the ecosystem, micro organisms, astronomy, music, or any other inspiring discipline to find solutions. These disciplines have unique attributes that can provide an endless source of inspiration. The observation and analysis of nature's forms can yield a wealth of practical and useful building blocks in terms of structure, form, geometry, unique mechanisms, use of colour, surface language, pattern and practical strategies.
For examples see Case Study 1 and 2.

4.5 Force illogical assumption combinations

Turn everything upside down. Bring out the hidden assumptions we take for granted by asking the questions 'who, what, where, when, how, and why' (Frederick Taylor, 1911). Challenge the models of assumption. This may include forcing illogical assumption combinations through combining ideas and

making relationships that one would not normally make. Ask students to come up with various answers to some or all of the listed assumptions to solve a problem. Then randomly mix and match these various combinations.
For examples see Case Study 3 and 4.

4.6 Build on the inspiration of others

Students love to interact with toys, sporting equipment, gadgetry, technology and each other, where they fully use their imagination. This interaction can continue for hours. Interestingly, when adults congregate, such as in meetings or socially, instead of contributing, they often either criticise the previous idea, pass judgment, just agree, or do not add to the discussion or ideas presented. With little contribution and/or negativity, the process ends quickly. This is often the case in the classroom. We see all of the reasons why things will not work. In solving this, the next time students have a problem to resolve, such as the design of a good web site, have one student cast out the first idea, and let the class continue with, "Yes, and...", building on the previous ideas. Do not allow innovation to be crushed at the beginning. Do not accept the response of "Yeah, but…". The key is to answer quickly and avoid thinking too much. Top-of-head answers tend to tap into a part of the brain we don't use during our normal thinking process. And be sure that the students' answers are a contribution, which builds on what the previous student said, rather than invalidates it. Many of the new ideas will be ineffective, but don't be concerned. Work with it, as you never know when an excellent solution to an idea will be found. Over time, this will become a normal mode of operating. Your students will become masters of breakthrough thinking, by building on the ideas of others.

4.7 Welcome creative tension

It is human nature to surround ourselves with people we get along with. Unfortunately, students choose whom they collaborate with by focusing on this human chemistry and students with similar competencies. This perpetuates a limited set of creative possibilities. Instead, place students in teams with different analytical, creative, and personality styles. Welcome the creative tension. As long as the students are open to new ideas, creativity is bound to emerge. These team combinations can create an environment of original concepts and ideas.

5. Primary Steps to Creating an Innovative Environment

Place students in a whirl of uncertainty resulting from classroom challenges, tasks and projects. These uncomfortable situations demand sharp reflexes, creative thinking and pervasive innovation. The aim is to install a mindset of continuous innovation at every level of teaching, allowing you to achieve and sustain fresh thinking in your students.
This means improving the student's capability to generate innovative thought. There is a combination of primary factors and steps required to reach this level, not just a single process. In capability terms, students are required to be focused on meaningful output.
To cater for continuous innovation, I have outlined a lean, action-based framework, designed to put your students in a state of perpetual innovation that is necessary for creating sustainable education success.

- Create a culture of innovation through injecting creative challenges throughout each teaching process.
- Constant change is a prerequisite for continued success. Introduce constant change throughout your program, subject, course, class work, or project. Make sure that it is strategic, pervasive, challenging and sometimes conceptually overwhelming.
- Implement a capabilities approach at every level of your teaching. Coordinate the five components of teaching: strategy, assessment, learning process, student the individual, and technology, to consistently interrelate with each other so as to deliver measurable results.
- Align all stakeholders, from students to other members of staff, including librarians and guidance officers.

- Today's most innovative students, in combination with their teachers are 'doing it right now'. Research, analyse and replicate these educational successes with your own flair and passion. Design a blueprint for creating a flexible learning experience that builds upon current successes, as it promotes rapid change and adaptability for maximising those successes.
- Leading teachers know it is up to them to reach the next level of student and personal satisfaction. To become an educational leader, you must continuously pursue the obsolescence of your best teaching practices.
- Use information technology as a critical element to improve innovation. Technology can be used for communication, mutual understanding, organising, design and ideation.
- Enhance one's capabilities through external partners or the blending of individual processes better.

6. Skills for Creativity and Innovation

The 21st Century student must take a distinct look at what they do and the skills that makes them valuable. Students must go beyond being adaptive: having useable skills, and beyond being adaptable: having the ability to change, learn new skills, and add to their knowledge. They need to be transformative, with the ability to see changes that need to be made, work with people who have ideas and problem solve, have interpersonal and communication skills to make decisions and translate these ideas into practical accomplishments. They must go beyond problem solving so as to understand why a problem arises and see how it relates to other problems. They need the ability to see a holistic perspective, and to understand how it is interconnected.

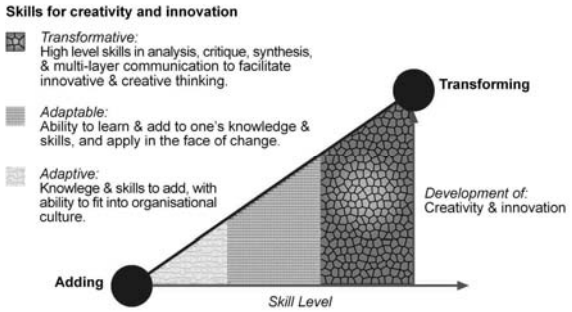

Figure 1. Skill level graph

7. Managing, Stimulating and Driving Innovation

Teachers should develop a new atmosphere to stimulate innovation; holding a few brainstorming sessions with a handful of students once or twice a year is inadequate. Instead, you must spread innovation throughout the execution of each process, every day, by everyone. To spark innovation and deliver maximum results, a teacher must consider innovation for student advantage, processes that enable innovation, create a culture of innovation, review teaching strategies and technology advancements, include innovation into assessment, target innovative students, simulate new models of learning, plan the innovation journey, and always look to the future. From an industry point of view, in today's age of unprecedented access and unlimited competition, constant change is a prerequisite for survival in the global knowledge economy.

8. Case Studies

Creating a unique journey of research and discovery for the student is essential. The following are a selection of case studies from my students' work, exemplifying how the methods of encouraging creativity and undertaking the primary steps to create an innovative environment can result in successful outcomes. Working drawings were required, with many designs being 3D printed through

rapid prototyping, and/or manufactured as a full size prototype model to check reliability, manufacturing conformity, and marketing potential.

8.1 Case Study 1: Computer mouse design

The 'Apharius' computer mouse was inspired by the Portuguese man-o-war (blue bottle), the second most dangerous jellyfish in the sea, an effective predator with few competitors (likewise product dominance is highly desired). The man-o-war's surface language is flexible, elastic, nodulated and transparent. The design fits the user's hand ergonomically and is therapeutic to hold and maneuver. It features four buttons for high-end modeling and scrolling, exterior rivets to allow air flow under the palm for long period use, and an overall form which forces the user to adopt a safer and more natural grasp. The man-o-war provided design solutions to the uncomfortable problems endured by those whose work and lives revolve around digital technology.

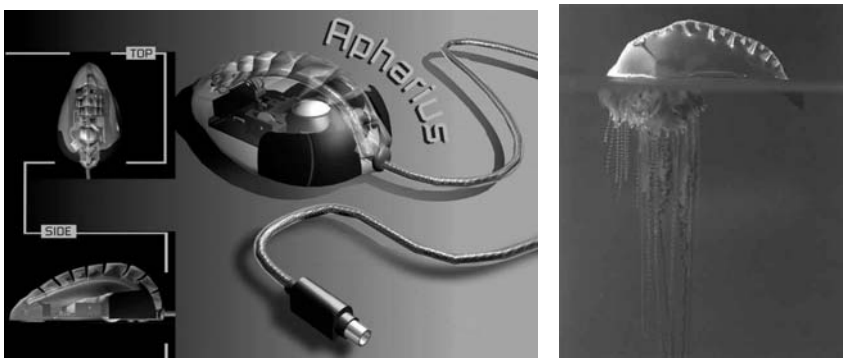

Figure 2. 'Apharius' computer mouse by Eliza Cole

8.2 Case Study 2: Bar stool

A bar stool 'Mantis' design was inspired by the pray mantis stick insect. The design concept was conceived from the interpretation of a patron having a few drinks while viewing the opposite sex at a public bar, being similar to that of a pray mantis waiting for its prey. It relates with nature's gesture of stealth, patience, timing and speed. The design epitomises the sexual cannibalistic behaviour of the pray mantis. The use of cold hard materials, such as cast aluminum and recycled rubber, and the style of the legs and foot rests relate to the form of the mantis' forearms and legs. The design shows the relationship between aesthetics and communicative qualities in nature's physical objects. The design has since been manufactured, and is now featured in a well known Brisbane hotel.

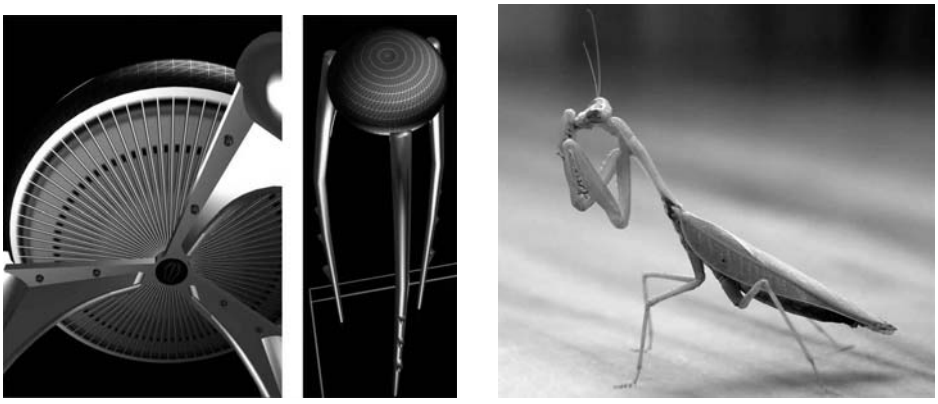

Figure 3. 'Mantis' bar stool by Alexander Lotersztain

8.3 Case Study 3: Cyclist universal mobile telecommunication device (UMTD)

In the process of designing a Global Positioning System (GPS) unit for bicycles, 'who, 'where', 'when' and 'why' are looked at. The typical combination for a GPS unit are: it is used by the cyclist (who), when the bicycle is parked and when ridden (when), for a bike on the road, off the road, circuit track, in traffic, etc. (where), for the purpose of showing various maps including topographic, aerial, route taken, scenic and direct routes, facilities and services (why). Now bring into the equation six illogical assumption combinations, such as: (1) body functions monitor for heart rate, blood pressure, calories, etc.; (2) trip computer for speed, kilometers and weather conditions; (3) security system with a tilt and movement detector; (4) MP3 player for portable music; (5) digital camera; and (6) mobile telephone. The forced amalgamation of these factors resulted in a design benefit: if the bicycle is ridden away or moved, the owner is alerted by receiving digital messages, allowing the owner to track and immobilise the bicycle. The Cyclist UMTD 'Psycom', is placed over the head of the steering stem allowing the rider to move hands freely across the bar. The functions are accessed whilst riding by the buttons at the rear of the unit using one's thumbs. Off the bike, once the lid is opened, functions are accessed by the inner controls. When there is an incoming call, the 'eyes' at the side of the lid light up and the rear screen disengages from its current function. Weight is kept to an absolute minimum with the use of titanium and other waterproof, durable and light materials. Thinking creatively a student has come up with a design that minimises the amount of gadgets a cyclist takes on their journey. It allows the most adventurous cyclist access to all the information needed to get into trouble and out again. Creative ideas often come from the most illogical combinations.

Figure 4. 'Psycom' bicycle GPS by Brent Philp

8.4 Case Study 4: Hand-held universal mobile telecommunication device (UMTD)

In the process of designing a hand-held universal mobile telecommunication device, 'who, 'what', 'where', 'when' 'how', and 'why' are looked at. Four illogical assumption combinations are bought into the equation: (1) television; (2) mobile phone; (3) digital camera; and (4) fan. The forced amalgamation of these factors resulted in a design benefit: when at a live event, one can slide open the hand-held UMTD 'Omnifan', to display the live telecast (or another event) on a medium sized screen. The benefits include, being engrossed in the ambience of the live event, digitally viewing the telecast with multiple camera angles with commentary, ability to take a photograph record of the event, and send and receive telephone calls. The design is narrow, compact, and fits into a purse or jacket pocket. The design minimises the amount of devices taken to an event.

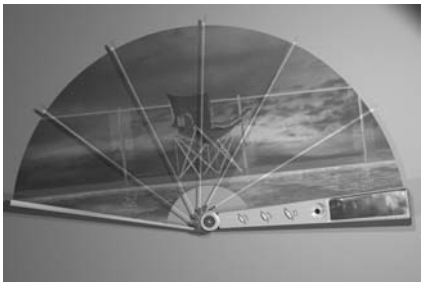

Figure 5. 'Omnifan' hand-held UMTD by Liam Whitehouse

8.5 Case Study 5: Motor vehicle for rural China

As China has the fastest growing economy in the world, there was a need to design a motor vehicle for China's emerging transport market. Demographics and social requirements were studied carefully. As a result, a vehicle, '2NFS (No Need for Speed)' was designed to fulfil the needs of farmers and workers in rural China, where sealed roads are a luxury and a vehicle has to cater to all people. As a response to research, the vehicle was designed to drive from the back like a motorbike or a tuk-tuk. This means the driver over looks the cargo, and can keep an eye on their load. The vehicle can also be used as a market stall. The motor vehicle has many freight areas, some lockable, and can carry large quantities of various goods, such as people, boxes of chickens, pigs, grain sacks, and bamboo. The vehicle is light; fuel efficient; simple and robust; easy to repair locally, without the requirement of manuals; has good ground clearance and suspension; is cheap to manufacture; and has a long life expectancy. It is adaptable to the terrain, ruts in the road, dust and dirt, and minimises negative impact on the environment. The vehicle sits three passengers comfortably (with more standing), with both front seats folding down into compartments to allow for greater cargo space. If required, the freight area can be modified to add more seating.

Figure 6. '2NFS' Chinese motor vehicle by Magnus Goransson

8.6 Case Study 6: Airport retail outlet

A modularised airport retail outlet 'Norwegian Knit Wear', was designed which when closed to the public, was easily and effortlessly lockable by closing in on itself to securely house its products. The retail outlet's visual display is present whether the outlet is open or closed. The retail space caters for unique and interesting produce.

Figure 7. Norwegian knit wear airport retail outlet by Hege Lande

8.7 Case Study 7: Gold Coast Hospital community health information centre

A request was made for submissions to fit out the Medicine and Oral Health public space within the new $25 million Griffith University Medicine facility on the Gold Coast. The space was designed to be information rich, welcoming, relaxing, friendly, empowering, and easy to interpret and locate. The building is located on a lower floor with no windows. The design takes visitors minds away from where they are and to ease apprehension related to visiting a medical centre. To achieve this, a sky panel was housed above the ceiling cut-out, giving the appearance of a blue sky and clouds floating above the building. The cleanliness of the 'medical procedure white' walls not only complement the floating sky, but produce reflective qualities required where this is no natural light. Furniture for the centre was purposely designed to be modular, contemporary and inviting; catering for all ages and disabilities. To save space, each furniture piece is economical in size, designed to serve more than one purpose. Dedicated pathways were assigned, to cater for wheelchair access in the confined space. Digital posters, touch screens, videos, pamphlets, books, and resources are easily accessed. The feeling of ease was maintained.

Figure 8. Medicine and oral health centre by Brent Philp & Vincent Cheng

9. Conclusion

Teaching processes have often been thought of as static processes, as a series of instructions laid down in lesson plans and manuals, to be repeated exactly the same way every time. In order for superior processes to occur, one needs to incorporate a built-in ability to thrive on change. The key to excellent teaching processes lies in the ability to inject continuous innovation into the design process. It is no longer enough to instill innovation only at the design stage, which leaves the execution as mechanical. Students in today's changing environment need to pull critical concepts of process improvement, technology enhancement, innovation and creativity into a single framework: a holistic concept enabling students to perform optimally in activities that typically require fresh thinking. So rather than teaching what you did better yesterday, do something new today.

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