Transdisciplinary Principles for Creativity: Exploring the Enabling Conditions for Creativity in Educational Design

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Many researchers have explored creativity in education across a variety of disciplinary practices, but very little attention has been given to exploring the nature of *transdisciplinary* creativity. This article takes the view that teaching creativity across and between disciplines requires fresh thinking about the enabling conditions that allow transdisciplinary creative emergence to take place. It offers a range of principles that may assist others offering creative educational experiences across disciplines, fields and industries – as well as examples of how these principles have taken shape within the context of a world-first transdisciplinary degree in Creative Intelligence.

INTRODUCTION

Recently, a Harvard colloquium of academics (and industry leaders whose businesses rely on creativity,) attempted to understand the complex nature of flourishing creative practices within organisations. The symposium's most significant insight was that "one doesn't manage creativity. One manages <u>for</u> creativity" (Amabile & Khaire) This elegant addition of a single three-letter word is like a portal into the complex world of creative practice and provides deep insight into the very nature of creativity. The disarming provocation to a certain type of rule-driven technocratic manager is that creativity cannot be forced, it must be coaxed. It is not a linear production line process that simply requires predictable incentives to induce demand-driven output through a line manager and their direct reports. Delivery is not that simple, tangible or repeatable.

Using the lens of complexity theory, creativity exists in a non-linear, complex, somewhat unpredictable system – a complex adaptive system (CAS) that exists across many domains (Holland, 2006). It relies on the combination of so many seen and unseen forces, and in the case of collaborative transdisciplinary creativity – the experiences and knowledge of a diverse group of individuals. Creative ideas are emergent properties within an extremely complex individual brain (interacting with other equally complex brains) which manifest within a complex, adaptive system known as an organisation or society. In this system, outcomes are hard to predict or control (and neither should you want to predict them entirely, because if you did you'd be robbing creative practice of originality, which defines creative thinking). True emergence – discovery or novel ideas – cannot be spurted out of a machine-like system. Organisations cannot simply <u>manage</u> emergence, they have to manage <u>for</u> emergence. Their systems for enabling emergence – both hidden and apparent – must allow some freedom for change and creativity.

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Taking this notion from management theory to complexity theory and transposing it next into the field of education produces a fascinating new insight. Our education system is riddled with traditional constrictive design that is heavily managed and administratively overburdened. In a tertiary environment we (as educators) have linear systems and protocols and rules galore to contend with – often exhaustively. These are not systems designed for educators – they are designed for managers. We have to teach in factory-style lecture tutorial formats so that timetabling administrators have easier systems to administrate. We can often spend more time on reporting on teaching and learning than actually delivering it. Moreover – diverging from this "business as usual" model requires bravery and the system encourages complacency, enforced as it is by the dead hand of the past. How then can education be creative? If our systems are not teacher-centric, they are even less student-centric, and therefore struggle to deliver the enabling conditions for creativity in the learning environments our educational institutions traditionally construct.

Even our most well-cited, internationally endorsed educational theories fail those who are hoping to promote free-thinking, free-flowing creative emergence within learning. For example, in the most widely accepted theory of curriculum design we have the notion of constructive alignment (read constrictive alignment), where an expert designs a learning activity or course where they are expected to know the exact outcomes (Biggs, 1999). The theory goes that we can "construct" a course so that it "aligns" with our intended subject learning objectives. At its most basic, the so-called "expert" is seeking a reproduction of their expertise. And therefore, there is a very real danger that the curriculum designer hopes that their student will be able to mirror their knowledge (the closer the better) rather than create new, original, emergent understandings. Conventionally, students will be assessed according to how closely they have come to expectations of what constitutes discovered knowledge – aka the status quo. Constructive alignment, at its most fundamental, is too regimental to allow for the new or novel to emerge.

The challenge of teaching a creative course is that it is much easier to write a curriculum for knowns than it is to design for unknown outcomes. There are risks involved in educating for unknowns – especially when the teachers themselves do not know what kind of information or creative product will emerge. (And neither would they want to know, because at its essence creative thinking should surprise and delight its audience – it should emerge as fresh and new.) When it comes to designing a curriculum for creative practice across disciplines, or what we will call creative intelligence, truly creative outcomes should always be unexpected.

Yet designing for the unexpected is a little paradoxical. As mentioned, the outcome should be unexpected or original. It goes without saying that the stories we all like to read or watch on our screens should never be predictable. Yet originality only seems to be a requirement of our terminal degrees (PhDs) not tertiary or even secondary education. It seems that the unpredictability of emergence can be a threat within an overly rigorously "aligned" curriculum – where student expectations have been thoroughly mapped in advance, as have methods and processes for achieving the desired result. It is much easier to expect a result than to await a surprise that may or may not achieve the required goals and standards.

So how do you design a curriculum for being or becoming creative? Or create environments that allow students to surprise and delight their teachers or guides? How do you create a course that doesn't rely too heavily on the predictable knowledge that

is being "delivered" – but rather allows for unexpected creative "emergence" of the learner to take place?

This is the subject of this article, and it is a far more complex subject than it appears. Simplicity involves the use of prescriptive textbook methods – and as such it amounts to reductionism. The facts can be remembered or understood; the knowledge can be deconstructed, analysed, synthesised and evaluated, to use just a few of the hierarchical verbs associated with learning (Anderson et al., 2001). But textbooks don't usually allow for unknowns to emerge – they deal only with known quantities, because knowledge and expertise are their commodity and currency. A curriculum for unknowns places the currency in the hands of learners. It turns students into producers of knowledge, not simply consumers of knowledge.

Whilst these are ideas that have been touted in various places by creative pioneers in education, there has been little experimentation to date to bring to life some of our theoretical understanding of what a full curriculum for being and becoming creative might look like. Moreover, there is a veritable dearth of research into the enabling conditions required for creative emergence to take place in a transdisciplinary learning environment, which this article attempts.

Transdisciplinary creativity is particularly complex as it involves different types of creativity. (Is the creativity of a novelist the same as the creativity of a scientist or lawyer? Where and how and when is the most creative work attempted within these individual disciplines?) And quite apart from the differing types of creativity, we have to allow for a confluence of different ontologies and epistemologies from the different disciplinary perspectives – not to mention the ability of students and staff to communicate these differences appropriately. Placing individuals from a diverse range of disciplinary domains together on a creative project (let's say to solve a social problem) requires students to tackle their own unknown unknowns and known unknowns – as well as trespassing on the unknowns of other fields (Kerwin, 1993).

Even understanding how individual creative emergence takes place is akin to tackling the great mysteries of human consciousness (quite apart from team creativity). It has been said that "what happens in the 'dark' spaces [during the incubation phase of creativity] defies ordinary analysis and evokes the original mystery shrouding the work of genius. One feels almost the need to turn to mysticism, to invoke the voice of the Muse as an explanation" (Csikszentmihalyi, 1996). So, the mystery of creativity itself – let alone transdisciplinary creativity – is in itself incredibly opaque.

This article draws inspiration from principles tried and tested in a world-first curriculum in creative intelligence – the Bachelor of Creative Intelligence and Innovation (BCII) at the University of Technology Sydney. This is a future-facing degree that combines with 25 other degrees to respond to the urgent need for more creative change-makers and leaders across all of our disciplines, industries and fields. In outlining some of the principles that we have used to encourage creative emergence to take place, we hope we provide inspiration for other educators to design their own curriculums for being, not just knowing (Barnett, 2004).

Principle 1: Curate experiences to help knowledges combine
New discoveries, world changing discoveries, will come from the intersections of disciplines, not from within them (Johansson, 2004).

Universities tend to separate knowledge out into different faculties and departments. Governments identify distinctly different Fields of Research (FoR) codes to distribute

research funding. Indeed, the very notion of codifying or structuring knowledge into different domains is the product of industrial age thinking that required the commoditisation of knowledge within the convenient layering of organisational design.

Yet even individual disciplines segment knowledges for convenience of efficient delivery. For example, someone studying anthropology might study economic anthropology one semester, then religious anthropology or political anthropology the next. (And this still takes place in spite of the introduction of transactional anthropology, which claims that these fields cannot exist independently – that politics and economics don't take place only in political institutions or in traditional economic domains but in everyday life and transactions.

Re-designing a curriculum that allows for knowledges to collude and combine and sometimes even collide becomes an imperative if we wish to see transdisciplinary creativity flourish. Moreover, designing a place of confluence has to be intentional. (In the past, our innovators who "trans-gressed" into another disciplinary domain were unintentionally "trans-disciplinary." We are attempting to design for a more regular happenstance of transdisciplinary innovators. If it has been witnessed and successfully trialled in a classroom context, then we can rest assured that graduates will know that they can reproduce similar transdisciplinary processes in their respective fields on completion of their degrees.

Students need to see the results of transdisciplinary teamwork – not only in their teams but in the work of others – so that they can be inspired by the potential of crossing boundaries and feel confident in trespassing onto the expertise of others. "You cannot be it if you cannot see it" – if it isn't available and accessible while we are students, how will this type of collaborative creativity that is so desperately needed exist out in the world to solve some of our most complex problems – those that need the combined intelligence of many fields. But the danger is that our organisations continue with their 19th Century traditions, perpetuating their silos and knowledge as we know it. There is less chance of making new discoveries and imagining better futures for ourselves and our planet if our educators cannot re-imagine the possibilities of a truly liberating creative education.

Significantly, students recognise the power of transdisciplinary creative thinking to solve some of society's biggest problems. Below is some anonymous student feedback from the BCII cohort on the student experience of transdisciplinary creativity.

"When each discipline came and unlocked each thought, suggesting ways of deconstructing the world around us, this was radical. This was exciting. Thinking differently wasn't about obscurity or ambiguity, but about rerouting the direction of our creative energy"

"I found this subject extremely thought provoking…. It was an incredible experience being in teams consisting of several disciplines." (Student Feedback, summer school 2014)

Principle 2: Encourage creative leaps and connected thinking
Steve Jobs once said: 'Creativity is just connecting things. When you ask creative people how they did something, they feel a little guilty because they didn't really do it, they just saw something. It seemed obvious to them after a while. That's because they were able to connect experiences they've had and synthesize new things' (Wolf, 1996).

Others have written about the importance of associative thinking in any creative process (Benedek, Könen, & Neubauer, 2012), and it would seem that the ability to

connect ideas is integral to transdisciplinary creative processes simply because of the need to connect our fields of enquiry. The idea of invention often comes from associative thinking – by looking at the ideas of others and seeing how yours can connect or leapfrog these to create original work. More recently, methods like TRIZ or morphological mapping specifically require inventors and designers to map existing fields against other fields, thereby leveraging associative creativity to create new ideas.

Steve Johnston suggests that opportunities should be created for ideas to collide – for slow hunches from more than one individual – to connect. That way someone's hunch can be combined with someone else's slow-forming hunch to create a breakthrough. The coffee house in the Age of the Enlightenment or the Parisian salons of modernism provided a space for ideas to "mingle and swap and create new forms." Moreover, "the great driver of scientific discovery has been the historic increase in connectivity" (Johnson, 2010). The ability to stumble serendipitously on another piece of information or idea that might complete ours has increased exponentially in this digital age, according to Johnson.

One product innovation site, Aulive, allows inventors to search for inventions that will prompt other inventions. For instance, you can search a verb such as "move" and then an element such as "liquid" and come up with at least 48 inventions that have done just that to inspire your own. According to Aulive's creator, Simon deWulf, this allows us to "tap the global brain."

In the BCII we have attempted to create an Enlightenment coffee house that allows for ideas to tap the "adjacent possible." An enabling environment that understands that "chance favours the connected mind" (Pasteur, 1854). We ask students to bring ideas that they've workshopped into an "Ideas Arena" where we start with one idea and then ask students to "catch" that idea with another. With each student bringing five ideas of their own into the collaborative lecture theatre, we end up with over 1500 ideas with the potential to make "adjacent" links. A highlight of the first ever winter school in this degree, this exercise serves to expose the connected nature of thinking as it emerges, live in a room, as well as helping students to understand the power of their cohort's "group brain."

"I found it quite amazing that such creative and original insights were formed in an incredibly small amount of time." (Bachelor of Social Inquiry / BCII)

"Identifying the myriad possible solutions that exist has been a most notable highlight." (Student Feedback Survey, summer school 2014)

Principle 3: The environment must hold an agnostic (and respectful) attitude to theories, methods and practices

One of the most obvious enabling conditions for collaborative transdisciplinary creativity is the need not just for respect, but for curiosity and appreciation of other ways of thinking and being – the ability not just to accept, but to embrace other epistemologies, ontologies, practices and perspectives. Many institutions (in university and industry environments) are now adopting design thinking as a creative methodology that combines with other disciplines or provides a dominant disciplinary perspective. However, design thinking is more cross-disciplinary than transdisciplinary, in the sense that design is actually *imposed* rather than integrated into a range of disciplinary approaches. Resisting the easy option – the repeatable formula that processes the imagination in standardised "steps" – creative intelligence becomes a way of protecting the rights of every discipline

to contribute to the flow of any creative process in an authentically interactive and responsive fashion.

A case in point follows: One of our industry partners in the BCII, Accenture, ran a two-day hackathon on Smart Cities and offered to take our students through their human-centred design process. Knowing that we shouldn't privilege only design-led innovation, we decided to open out the brief. Instead of a challenge around human-centred Design we wrote a creative brief titled *Human-centred Everything* to increase the divergence of academic input (human-centred law, human or patient-centred health, etc). By opening the challenge out in such a way, we were able to provoke staff to think, evolve, understand and interpret in ways they hadn't before, and increase opportunities for making connections and joining dots for more diverse and inclusive and therefore more original student ideas. By increasing, not decreasing the potential fields of reference and inspiration a kind of "possibillionism" emerges from the various ways to think about the human endeavor.

Principle 4: Include creative constraints to contain the creative process and challenge it

Whilst transdisciplinarity provides many diverse fields of enquiry, there is a danger that students (and staff) will get lost in an oceanic field of knowledge and lose faith in how to progress their ideas. With transdisciplinary creativity, therefore, it becomes very important to teach the importance of creative constraints early on and help students understand the methods, practices, frameworks and processes that will help to contain their journey of discovery – potentially across any and every discipline – making sure that the journey doesn't continue indefinitely in an unbounded fashion. Students have to know how to start, how to develop their ideas and how to define the outcomes of their projects.

An understanding of creative constraints starts early in the BCII. Students go on an algorithmic walk, for example, where they set their own parameters for how they will proceed on this journey. They design their journey through the city using a personal algorithm and a variety of steps that they have designed. (Here is one such algorithm: I will leave the gates of the university and walk as far as I can in the direction of the long hand of my clock, look up until I see a bird, then turn and walk in any direction I like until I see someone in a black shirt, which will then allow me to retrace my steps, whilst singing the national anthem!)

Students are then introduced to a series of frameworks for understanding and containing a creative practice – for example, the Gamestorming framework (Gray, Brown, & Macanufo, 2010), which considers the divergent, emergent and convergent phases of any creative process. By the fourth year, students are familiar with the notion that they should not unquestioningly adopt a creative methodology such as design thinking but create their own. The creative constraints have broadened out, too. For example, they are assessed on their industry projects according to how they have plotted their journey of discovery, constraints and all. All they have to evidence when presenting the research design for their projects is evidence of five "reality checkpoints" including *exploratory, generative, experimental, adaptive* and *analytical* phases – in any order and with repetitive points and "double loop learning" as required (Argyris, 1991).

Principle 5: Encourage students to slow down their thinking

As with all creative practice, in transdisciplinary creativity it becomes important to slow down the creative problem-solving process. The mind has an instinct to close the gap between a problem and solution as not knowing causes cognitive dissonance and a sense of unease. Yet this very gap is where the most fertile thinking will happen in a transdisciplinary creative journey. Einstein reportedly said, "if I had an hour to solve a problem I'd spend 55 minutes thinking about the problem and five minutes thinking about the solutions." Slowing down the thinking process in a transdisciplinary problem-solving context becomes even more important when there are so many angles and perspectives to acknowledge and pursue and learn from – so many potential methods and theories and practices that will help "problematize" the problem space – to use an expression from cultural studies.

Yet every seasoned creative practitioner has had the experience of creative insights striking like lightning and had the confidence to know that the idea or concept that sometimes strikes first is the right one to back because they have "internalised" the criteria of their field. As one expert on creativity writes: "Those individuals who keep doing creative work are those who succeed in internalising the field's criteria of judgement to the extent that they can give feedback to themselves, without having to wait to hear from experts" (Csikszentmihalyi, 1996).

But what happens when there is no field? When we are crossing between fields, as we are in a transdisciplinary creative process? When we are treading where angels dare to tread?

One of the important aspects to transdisciplinary creative processes is that we have to produce practitioners who are capable of treading often enough to understand those hunches – intuitive ways of working that can only gain effectiveness through successful practice. For this we require a revolution – a quorum of people who are experienced enough to understand what good looks like. People who have succeeded in "internalising the field's criteria" when the field is broader than anything that they have seen previously.

Principle 6: Teach students to ask better questions

"Facing up to the importance of questioning should cause a revolution in education" (Root-Bernstein, 2008)

Questions have many roles in all phases of a creative process and can be usefully deployed in transdisciplinary creativity if they can be written for the appropriate moment – as an aid to discovery. In the divergent phase of creativity, they serve to open up a world of possibilities, including many red herrings and rabbit holes and moonshot ideas that will never work but are worth creating in abundance. They can be used as a creative warm up exercise. As an ice-breaking activity. In the BCII we work with "catalytic questions" in this phase, ensuring that questions are plentiful and spontaneous and charged with curiosity (Gregerson, 2013).

Then, in the emergent phase of a creative process questions can be used to allow ideas to intersect and interconnect. They can be used to walk ideas between disciplines; to interrogate and extend received methods, practices and techniques. In the final convergent phases of any transdisciplinary creative process they can be used to cull creative outcomes and findings or decide on paths forward. Throughout the process, but preferably mostly at the convergent (end of cycle phase), they can also unveil weak or soggy thinking and promote criticality and analysis.

In the BCII we have explored questioning as a way to explore passions as well as creative leaps. In one assessment we open up what we call an 'Ideas Arena' and showcase ideas at the cutting edge of our disciplines, curated by staff. We then ask students to curate their own five ideas that fascinate them. Borrowing from the work of *A More Beautiful Question (Berger, 2014)*, in the first assessment our students ever do they are requested to write a "beautiful question" to interrogate their idea. They then take that question for a walk (in order to demonstrate a creative leap – to develop creative muscles through practice as well as creative confidence – and to understand their role in pushing ideas and coming up with original approaches and dimensions to knowledge). Once they have written their five beautiful questions, we ask them to take those questions "for a walk" by doing a "what if scenario," "thought experiment" or "speculative research proposal" on the initial question. This exercise, in turn, helps to map the fascinating diversity inherent in transdisciplinary creative practice, as well as the many emergent fields that are ripe for discovery – not to mention, it also socialises ideas and showcases the incredible talent in the room, which in itself makes learning contagious.

Principle 7: Overcome the curse of knowledge

Transdisciplinary thinking involves the whole being and potentially the whole kingdom of knowledge: it insists that you "trans"-port or "trans"-it into another discipline. This transcendental crossing of boundaries can be terrifying – especially for academics who have long sat within a single field, taught in that field, researched into specific categories within that field and therefore learned to structure their thought in particular ways that privilege certain ways of being. It is very easy to feel the comfort of the podium of expertise, but within the BCII we like to teach that knowledge is provisional – and is changing more rapidly than any of us can imagine. Moreover, we would have no curious confluence or intersection of knowledge if we did not allow for our disciplines to cross and intersect and combine in interesting ways. One of the challenges in creating a curriculum that fosters transdisciplinary creativity, then, is to empower staff to overcome what has been described by Elizabeth Newton as the "curse of knowledge" (Wieman, 2007).

The notion that knowledge can be a curse is the result of an experiment where Newton set up a game, asking for people to play one of two roles – that of a "tapper" or that of a "listener." The tapper was instructed to tap out the rhythm of a tune that they would both know well (such as Star-Spangled Banner) on a table. The listener then had to guess the song. Interestingly, the tapper assumed that the listener would have a 50% chance of guessing correctly – the knowledge was so embedded in their heads that it seemed impossible that another person wouldn't hear it. However, in experimental conditions only around 2.5% of the songs were guessed correctly. This revelation gains impact when we think of transdisciplinary learning and teaching. Academics who know their knowledge well often assume that others will know it, too. Communication (read teaching, also) can be challenging. In an insight accredited to George Bernard Shaw, "the single biggest problem in communication is the illusion that it has taken place." When communicating across fields, that illusion is in danger of becoming even more illusory. Failure to communicate can therefore be a "curse" for knowledge that is transitioning across fields.

One way to overcome the curse of knowledge and the void created by an off-balance in information between expert and novice, is to leverage the power of the naïve mindset. It is a well observed paradox that the naïve perspective can lead to novel observations.

Certainly, when we take students from 25 different disciplines and ask them to trial methods from other disciplines, we are exploiting this capacity to innocently enjoy "trespassing" into another field, perhaps in a way that is uncommon. It is an enjoyable process for our first years, who take a set of almost 40 diverse disciplinary method cards and observe their city as they conduct observational research through these disciplinary lenses.

Once students have conducted their research using unfamiliar methods, they often gain unusual insights that an expert in the field might fail to spot, and therefore this naïve perspective can lead to a type of experience that is really helpful in any creative investigation. Certainly, in the context of the students described, the beginner's mindset liberates student thinking and allows creativity to emerge. This so-called "beginner's mindset" is described as Shoshin by the Zen Buddhists, and by others in business as an excellent way to counteract the "overconfidence bias" of experts (Oosterling, 2011).

Principle 8: Walk the talk

When teaching transdisciplinary creative thinking, it is important not to privilege a single discipline's approach to learning activities or assessment. Transdisciplinarity requires enabling conditions that allow students to respond adaptively and diversely to challenges. And as there are so few transdisciplinary degrees, the educational paradigm is innovative by default. Educators have to be creative to teach their students how to do the same. They have to walk the talk – a challenge that is far too great for many more static educational organisations that pride themselves on their regular, repeatable efficiencies.

For example, in the BCII we run no standard lecture tutorial factory format delivery of subjects. Instead, we run think tanks and hackathons, sponsored inventions, Dragon's Dens and CV roasting sessions – not to mention Think Different Days that explore paradigm shifts across disciplines, as well as debates (that are more like creative quarrels) and many maker sessions – such as prototyping, parsing exercises and even a session on playdough capitalism to bring knowledge of systems to life. Students have also co-created and delivered their own learning experiences (BYO-e or Bring Your Own Education) to demonstrate that they are not just consumers of knowledge but producers of it.

Transdisciplinary assessment activities should also be open, allowing students to deliver to their strengths – and require an intrinsically creative response – regardless of the person's discipline. Students in the BCII are involved in deep discovery and invention, problem-solving and complexity. Assessments encourage them to explore dozens of creative methods from across disciplines, make conceptual leaps, take methods for walks, explore futures thinking methodologies, or question assumptions to gain radical new ideas and insights. Assessments require students to lead us through their *straw man proposals* or future scenarios. They're challenged with unrestricted blue-sky thinking, as well as by tightly-constructed industry briefs. The trick is to curate a diverse set of tools, practices, contexts and systems to investigate, produce and communicate transdisciplinary ideas and discoveries – and to communicate the assessment briefs in the most inspirational way, to create a sense of contagion and commitment – to raise the stakes and allow students to believe that anything is possible.

"Just the best, it doesn't feel like traditional learning at all - in fact I feel like I learn better. This innovative classroom style and teaching approach should be implemented across the university. I love it." (SFS, 2015)

Principle 9: Embed the mindsets and heartsets of creative thinking

As well as being developed by creative people with creative mindsets and heartsets, it should encourage the building of those in its students. These are qualities of being, not just knowing, as discussed above. The qualities of *being* creative are many, but a few key qualities are listed below.

Fearlessness and the ability to take risks

Students have to feel comfortable that they can get things wrong and fail. In the BCII we celebrate failure with a taxonomy of mistakes that have driven innovation historically from across the disciplines – think of Columbus discovering the Americas, Flemming discovering penicillin, Percy Spencer's discovery of the microwave oven or Spencer Silver's discovery of post-it notes. This storytelling session essentially radiates from a taxonomy of 'mistake-ism' that begins with whether the mistake was intentional or not. Then looks at strategic misrepresentation, problematization, fuzzy logic, comedy etc, for intentional mistakes. And for unintentional mistakes, it looks at whether the outcome was good, bad or indifferent. Obviously, in some fields mistakes are more critical than in others. A mistake in architecture will often stand for a hundred years or more and the only thing you can do is grow vines to disguise it – a mistake for a surgeon could be life-threatening – and whilst a product designer will rarely kill someone with their mistakes, they can be responsible for too much trash in our landfills.

Thomas Edison said this on failure: "I have not failed. I've just found 10,000 ways that won't work," suggesting that failure is an overly-maligned yet necessary by-product of discovery. We can learn equally well from correct and incorrect information – and indeed, some people learn best from making mistakes. And not only do humans learn from their mistakes, but so too do our machines.

Many students on arrival at university have withstood school systems that discourage risk-taking and encourage formulaic learning that allows them to 'game the system,' so an introduction to mistake-ism in first year is a useful way to detox the expectation that students always have to be right. October 13th every year is celebrated as International Failure Day. In the BCII we encourage students to celebrate this day in an appropriate and creative fashion with purpose and joy! It is a mindset that absolutely has to be strengthened for any creative person because fear of failure has the power to stop the beautiful risk of learning (Biesta, 2015) and the possibility of unencumbered discovery. It is this risky, playful self that begins to slowly self-destruct and wither from the time that students leave primary school.

"I felt I was thinking more freely and more wholeheartedly than I have since I was a young, insatiable child." (Media Arts Production / BCII student)

Cultivating mavericks

Related to the notion of fearlessness is the mindset and heartset that celebrates and seeks out difference. Transdisciplinary creativity requires not only different types of knowledge but also different types of people: individuals who are prepared to stand out and be different and know that being a maverick can work to their advantage (and whilst standing out as individuals, also work well collaboratively). Yet thinking differently can make a creative person something of a laughing stock when the world is tipped towards received wisdom and an epistemological status quo that most people believe is immovably solid. Google was considered a laughable idea at the outset, and Twitter was considered stupid, as famous examples. Thomas Watson, president of IBM was famously quoted as having said, "I think there is a world market for maybe five computers" in 1943. Any creative

curriculum has to be able to challenge this failure of the imagination. In the BCII we ran an entire winter school on the failure of the human imagination to tackle a post-monetary future that privileged gifting and sharing and peer2peer economic principles of the new economy. We worked with the popular adage attributed to Fredric Jameson that "someone once said that it is easier to imagine the end of the world than to imagine the end of capitalism." If we cannot imagine a better future then we certainly cannot create one, and sometimes it takes visionaries who are prepared to be laughed at to enable such positive change.

The ability to tackle unknowns and feel comfortable not knowing
One of the interesting states of consciousness for any creative practitioner is the practice of not knowing – of waiting for a discovery, stewing or incubating ideas before breakthroughs occur. Essentially, the creative practitioner is in a state of not knowing (and unknowing has been described by one mystic as the only way to get a glimpse into the nature of God (Wolters, 2018) – indeed, this state of unknowing is complex and challenging and hearkens back to the millennia of creative practice before the Enlightenment, which predominantly took place through the religious arts.)

Not knowing the mysteries of the universe, and not knowing the solutions to some of the world's most complex problems are states that are feared by many. Yet a creative mindset is able to manage extreme opposites (Csikszentmihalyi, 1996) – even able to balance knowing with not knowing. Transdisciplinary creativity is particularly curious because there are many different types of unknowns depending on the disciplines that are collaborating. And when students come from 25 different core degrees to work together in a transdisciplinary space, as they do in the BCII, we cannot teach traditional disciplinary knowledge – so instead we teach "unknowing" – or how to navigate unknowns. We have designed an ignorance map based on Ann Kerwin's taxonomy of unknowns (Kerwin, 1993) and designed a brief that allows students to explore different types of not knowing – be it the unknown unknowns, known unknowns, misknowns, taboo knowledge, etc, of their fields. We ask students to look at how greater awareness of ignorance can prompt discovery: how ignorance can work as a muse.

Principle 10: Encourage students to be change-makers and rule-breakers
If education is an intergenerational social contract, it is a responsibility for educators to drive for positive change – to enable students to be the change that they wish to see, and thereby fulfil the changes that academics hope to see. (Because if our idealism cannot thrive in the academy, then where else can it hope to be privileged?)

Transdisciplinary creative thinking is all about change-making – from engaging a range of disciplinary creative methods to solve social and environmental problems to understanding complexity, systems thinking, future thinking and social impact.

All positive change-making is a creative process – positive change has to be imagined, researched, trialled, articulated, designed, analysed and then actioned. And the fact that change-making is a continually adaptive process makes it continually creative. Given the insight that creative thinking allows people to find more meaning in their work (Csikszentmihalyi, 1996), the opportunity to continually create change is essentially an invitation to a world of constant thriving. Nurturing the natural idealism associated with the creative process is one of the wonderful challenges for someone designing a creative curriculum. It also intersects beautifully with the raison d'etre of the university today and it's imperative to act for the public good.

"The true highlight of the subject was… the thinking up of ideas to change a culture, a society and revolutionise our time." (Student feedback)

SUMMARY

In a re-structuring of Bloom's Hierarchy, creativity is described as a pinnacle of human learning (Anderson et al., 2001). Yet it is often neglected in curriculum design. Moreover, whilst there have been significant studies of creativity as a discipline, and within certain disciplines, little research has been done exploring the nature of creativity in a transdisciplinary context. Yet many of our future discoveries are said to emerge from between disciplines, not just within them.

This case study from the Bachelor of Creative Intelligence and Innovation explores some of the principles that enable transdisciplinary creative practices and discoveries to flourish in a curriculum that privileges creative thinking, critical thinking, problem-solving, future-thinking, complexity, invention, entrepreneurship and social entrepreneurship across fields.

It can be argued that such a curriculum has never been so important due to the very connected nature of our problems in a "post-normal" networked, complex, dynamic world – and the need for collaboration between disciplines to tackle global shared human problems is enormous (Dorst, 2015).

Moreover, with a growing focus on teaching innovation in educational institutions around the world and a demand for more creative graduates, the ability to learn creative thinking skills across every discipline is increasing. Added to this is the urgent demand for greater collaborative creativity within our workplaces.

In a world where students are expected to be tackling up to 17 jobs across 5 completely different fields in what is often described as "portfolio careers" (Chartered Accountants Australia and New Zealand, 2017), the ability to teach students to think creatively across disciplines could well become a moral and political imperative. In this context, further exploration of transdisciplinary creative practice becomes even more compelling.

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