The Significance of Creativity in Our Lives

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Abstract

This article explores the significance of creativity in our lives. It underlines the point that creativity gives satisfaction in our day by day living and in breakthroughs that change our lives. In a multitude of ways we cannot live without it. Synthesising instances of innovation in fields as diverse as medical research, haute cuisine, fragrance manufacture, business, science, storytelling and surrealist art, the article alerts readers to the pivotal role of creativity in education. The specific technique of synectics is outlined to give an example of encouraging creative thinking. With its scaffold of richly formed analogies, the technique expands perspectives on problem- solving to motivate and facilitate innovative achievement.

***Keywords*:** Creativity; satisfaction; problem solving; scientific discoveries; cultivation.

The best educators have always aimed to foster the skills needed to perform non-routine tasks, to teach for life not for school.

"… for life, not for school. All of life, as seen by the Organisation for Economic Co-operation and Development" (OECD, Pisa, 2012: 30) is problem-solving. While life is also about reveries and play, it is the readiness and capacity for thinking about the non-routine and the non-formulaic aspects of life that we need to practise. Students, then, are at school to hone the skills needed for their living day by day – "problem solving, adapting, learning ... daring to try out new things and always being ready to learn from mistakes". These are the skills they need to acquire, in order to live in a world that is unpredictable. That life, then, is about creativity. The premise and goal of this paper is to underline the point that one cannot live without creativity. The mind might be perceived as "an endlessly shifting chain of connections" (Greene, 2012), imagining all sorts of possibilities. Harnessing this to creative productivity- meaning novel and valuable- needs to be the goal of all educators and all learners, whether in a school or in a workplace. The paper itself also attempts to build many chains of connections, exploring the significance of creativity across disciplines, and how best we can elicit such connections for lifelong benefit.

In fact the OECD's concern was expressed in a metaphor heard more than eighty years ago:

> "Many schools are like little islands set apart from the mainland of life by a deep moat of convention and tradition. Across the moat there is a drawbridge which is lowered at certain periods during the day in order that the part-time inhabitants may cross over to the island in the morning and go back to the mainland at night. Why do these young people go out to the island? They go there in order to learn how to live on the mainland." (Carr, 1942:34 in McGaw, 1991)

With echoes from Carr's words, the Pisa report stated that: "...today's 15 year olds are the Robinson Crusoes of a future that remains largely unknown to us" (OECD, 2012:28). The island of the classroom must be a microcosm to equip us for what is beyond, in constantly changing societies. The classroom in fact needs a drawbridge of relevance, innovation and challenge that stays down permanently, to connect it to that world outside. To respond to the challenges and complexities of our twenty-first century, the Australian Curriculum states that we should encourage young people:

> "... to be creative, innovative, enterprising and adaptable, with the motivation, confidence and skills to use critical and creative thinking purposefully." (General Capabilities, Australian Curriculum, 2012)

Challenge

While creativity means having original ideas that have value, implementing them and persuading others of their worth indicates successful change or innovation. In relation to this, Daniel Pink (2012) has emphasized the need for us to motivate our students, to "sell" them the challenge of conveying their ideas and persuading others. Thus, we need to encourage our learners to think creatively in solving real-world problems, through authentic learning experiences that will connect them to the world beyond the school gate. In this way they start to think about solutions that will make a difference. Seeing the gaps is the beginning of problem-solving and the beginning of a creative thinking path to finding solutions and to convincing others.

Problem-solving in diverse fields is the crucible for the creative product. The writer, for example, can "transform" life experiences with the "alchemy of fiction" (Forsyth, 2014), and that fiction needs to appear more "true" than facts. A combination of both analysis and intuition engages the reader, who takes a leap of faith as the story is told through a "series of events which is driven by the protagonist's attempt to resolve a source of conflict" or to solve a problem.

Whether scientific discoveries or poetic inspiration… the common thread is that we cannot live without creativity. Analysis is essential to deconstruct what is before us, but synthesis will allow for making the links that construct a new meaningfulness. To be creative we need the fundamental knowledge in a particular domain, which we break apart and put back together into a new synthesis, transforming the raw materials, or known facts, so that something new emerges.

The Australian Curriculum recommends that both creative and critical thinking be encouraged across all subject areas. This is in fact a key way to assess differences in learners' individual achievement. Thus, challenging and engaging students to aim for their maximal achievement is expected to become more of a daily reality and routine. The New South Wales Board of Studies (2012) has defined creativity as:

> "… *generating an idea* which is new to the individual, *seeing existing situations in a new way*, identifying alternative explanations, *seeing links*, and *finding new ways to apply ideas to generate* a positive outcome."

Schools, then, are for life-long learning and learning for life; whatever the field, creativity is pivotal to life's achievements (Renzulli; Forster, 2012). Creativity is about ideas that bring about changes for the better. If "ideas are the raw material of change," as Geldof (2013) urged in helping to solve humanitarian issues, then for meaningful change to occur we had better focus on producing ideas imbued with passion, with perseverance and with a problem-solving purpose. In solving problems of poverty, imagining new possible solutions is a question of survival and well-being. This requires perseverance, such as that of Magali Malherbe (Dumoulin, 2014), who through camps and projects and raising funds has tried to solve the problems faced by more than 800 orphans and adolescents in South Africa. We can look at problems again with a new frame of reference and hit upon something that "no-one else has imagined" (Greene, 2012:8), as an expert might, but with the original eye of a novice:

> "To move forward society needs geniuses–those rare individuals whose flashes of insight and imagination change the way we live and see the world." (Caulkin, 2000)

Transformation and association

Why we cannot live without creativity is very evident through the inventiveness we see in diverse fields. Whether it is technology or the Tour de France, the design of a chair or a Chanel fragrance, slow cooking or slow travel, it is about our mind's digestion of the raw ingredients and how they are transformed into new components that nourish even more. Achievement in the culinary world, for example, means that master chefs produce different combinations, and traditional dishes are appropriated –as an artist or a writer might–to create new recipes for success. For culinary

creativity, one has to think like a chef (Colicchio, 2000), maintaining the passion, the dedication and the mindful cooking that transforms, with care, the best ingredients into purest culinary perfection– "cooking as alchemy" (Glynn, 2004).

In this way, too, inventive and evocative fragrances evolve. Coco Chanel's perseverance, in combination with technical expertise and imagining what was possible, put her at the forefront of innovation. Finding a niche in the market, and fulfilling the needs of potential consumers required an independent spirit. Sating the senses is necessarily one of life's needs. When a new fragrance or a new master chef invention is created, its surprise element comes from the unexpected marrying of distinct perfumes or flavours, such as ginger and mandarin zest. Depending on the cultural context, the exotic nature of such products appeals also to the imagination. Via their fragrances or flavours, these creations actually "make sense", through their connection with our personal connotations. This is a strategy available to educators, that is, to use the students' personal connotations or what occurs to them from their background as a valid response and tool for their learning. In this way we differentiate their learning. A product, of course, can be life-changing or simply lifestyle enhancing. The original transformation from raw materials is key to all creativity.

The analogy of slow cooking, perhaps a digestive cogitation, has in fact been utilised by Sir Ken Robinson to parallel the notion of slowing down our learning and thinking, so that we have time to make links, to step back and look at problems in new ways, and to come up with new strategies and perspectives. As in other fields, optimal learning and performance require more than close observation. The concept of slow thinking has parallels in the work of Kahneman (2011) who encourages thinking that is slow enough to allow for analysis and making connections, rather than accepting the quick, straightforward, spoon-fed answer– again an attitude we need to encourage in our school learners.

The slow cultivation of ideas to fruition, and the need for connectedness, remind us also of "slow cities" as they face environmental challenges and build more parklands for quiet contemplation. Indeed, slow travellers – learners in an unfamiliar setting – who take time to marvel rather than adopting the tourist checklist approach, might be a useful metaphor for the creative thinker. Contemplation while seated on a park bench in the Jardin du Luxembourg in Paris, for example, might be more of an achievement than zigzagging across the city, as a dragonfly skims the surface of a lake, failing to accumulate any depth of experience. When we train students to adopt these attitudes and in-depth approaches to their own endeavours, we give them the prerequisites for being creative achievers beyond the school walls. By way of example, Laurent Aron (2014), from the Ferrandi Culinary School, encourages teachers to use creative thinking techniques such as the "cadavre exquis" ("exquisite corpse"), which depends on new associations derived from previous sketches or phrases passed on by another student. Used both in art and in writing, this strategy specifically aims to elicit risk-taking and originality, which necessarily go hand in hand. The expertise plus the novice effect can equate to innovation.

Cultivation as a metaphor for learning (Seeley and Brown, 2011) emphasises that the imagination is the most important tool in a continually changing world; cultivation implies that we keep learning, growing and putting out exploratory feelers for new understandings. The founder of the "exquisite corpse" technique, André Breton, was also the leader of the surrealist movement. In the 1930s he often met others in French cafés, to collaborate and to encourage imagination. In surrealism's earlier days, one of the members of the surrealist "tribe" was Salvador Dali; he was renowned for juxtaposing unexpected objects and concepts. His groundbreaking painting *À la recherchée de la quatrième dimension* (1979), for example, is considered an example of Dali's curiosity that puts out mindful "roots" to utilise what has gone before in art history, along with antenna-like "shoots" to seek out and make sense of future possibilities (Descharnes and Néret, 2003).[1] If we consider, for example, Poincaré's (1902) mathematical imagining of the fourth dimension, and its relevance to Dali's work, we can see that art facilitates "chains of connections", linking different phenomena and traversing disciplines – an approach that is valuable in uncertain times.

Anticipation and uncertainty

The ability to cope with uncertainty and to withhold judgment are qualities needed for the creative understanding of changing times. This "tolerance of ambiguity" is considered to be a distinguishing characteristic of creative thinkers (Piirto, 2011).

In order to become tolerant of ambiguity we need to be aware of "anticipatory assumptions" (Miller, 2014), which entails embracing complexity and imagining possibilities, rather than over-reliance on previous patterns. In this way creativity is again seen as vital, because it alters, with a metacognitive lens:

- What we see;
- What we imagine;
- What we resist;
- What we preserve;
- What we want to preserve;
- What changes; and
- What the conditions of change are (Miller, 2014).

Along similar lines, Popper (1957) discussed historicism, which assumes that the ability to make historical predictions is possible if we have a grasp of historical "patterns" ('rhythms' , 'laws' or the 'trends'). However, in the growth of human knowledge "we cannot anticipate today what we shall only know tomorrow". Educators need to encourage the connection-making attitude of openness, uncertainty and seeking to find out. Similarly in the sporting arena, larger-than-life characters intrigue us with their prowess that leads to breakthroughs.

In the Tour de France cycling event, for example, as reported in the Paris newspaper, *Le Figaro* (7th July, 2014), the cyclists must be attuned into thinking of all sorts of possible ways to overcome adversity: "...dans le Tour il faudra savoir attraper toutes les possibilités. By shifting gears mentally, the innovator makes a paradigm shift to come to grips with the problems of change itself.

Seeming predictability informs our everyday breakfast scenarios, which are full of disguised breakthroughs from past inventiveness. The everyday patterning of our lives belies the inherent innovations of which we are unaware. Sitting down on a *chair,* at the *table* and eating cereal from a *bowl* with a *spoon*, to sip carrot and celery *juice* through a *straw* and a *skim piccolo latte* from a specially sized *glass* is to experience creativity (a mélange of nutrients) at breakfast. All of these objects and products have been synthesized from things that were there before but not envisaged for their potential usefulness or pleasure– all filling a gap or a need of some sort.

Turning to the *newspaper* at the breakfast table we pause at the page that encourages us to draw on "genuine heroes" and to try to make them household names, emulating their goal-setting and aspirations. Such great achievers might include the Australian molecular biologist Elizabeth Blackburn, who won the Nobel Prize for her discovery of telomerase, an enzyme which may assist in combatting cancer. Another potential hero is John O' Sullivan, the electrical engineer who with his team created the technology that made *wi-fi* possible.

Whether they are everyday or long-lasting heroes, "...true heroes have legacies greater than the trinkets of their victories" (SMH, July 20, 2014:16). Their role is to raise hopes, to encourage perseverance and to gain social recognition for unparalleled achievement. They draw their success from combining "analysis and feeling", with "rigour and improvisation" in taking a chance (Bégaudeau , *Le Monde*, 2014:2).[2] The creative product of their inspiration and their imagination makes the difference, and to encourage this in our children we can teach them a sense of wonder at human ingenuity.

Risk-taking

By adopting learning approaches that require students to develop an inquiring attitude, to pose problems and find solutions, rather than over-reliance on rote routine, we can encourage the curiosity and perseverance that will help students to look beyond the textbook and beyond the *google* search, to synthesise a new solution. Thus, students step from the island to the mainland shore of life. There, an invested self may acquire the perspective of the "outlier" who takes risks and who pitches against the odds, embodying the true spirit of innovation. Without creative thinking and its inherent motivation we are left with predictability and lack of growth; it is a surface (or "dragonfly") approach to experience:

> "... poets would give up striving for perfection and write commercial jingles …. Physicists would stop doing basic research and join industrial laboratories where the conditions are better and the expectations more predictable." (Csikszentmihalyi, 1996).

Anticipatory theory suggests that we utilise past experience while at the same time attempting to shift in an unforeseen way; we continue to "rethink our view of the unknown" yet with the courage to go beyond the "tried and true" (De Botton, 2009).

Transforming information into a new product or outcome is more about experimenting than predicting. Creative ideas can be "thought experiments within one person's mind" (Marshall, 2013). Forsyth's description of the writing process parallels this thinking; she suggests that we start with a character image that raises a question or poses a problem, and we "visualise steps to a door at the end, where the subconscious tells us what is on the other side". The purpose in writing, as Forsyth sees it, is to "pin down the ephemera of your life", ultimately a sense-making activity. Surely this has valuable parallels for all learners, in their pursuit of wisdom synthesized from their diverse and perhaps disjointed experiences in life-long changing circumstances.

Innovative leadership

An Australian leader at one time expressed the view, as an ex-Prime Minister, that "leadership has always been about two main things: imagination and courage" (Keating, 2011). Having the vision as well as being able to take political risks and persevere to put that vision into action, turns the true innovator into being both the "ideas person" and the "can-do person" who work in collaboration.

The intrinsic motivation and self-direction of creativity points to the importance of integrating creative thinking into learning opportunities, as well as into opportunities for leadership. Professional learning needs to mirror the innovation that educators want to see in classrooms. To have teachers collaborate and imagine alternative classroom provisions to challenge their students is essential for change.

> "Leaders must tap the imagination of employees at all ranks and ask inspiring questions. They also need to help their organizations incorporate diverse perspectives, which spur creative insights, and facilitate creative collaboration by, for instance, harnessing new technologies. The participants share tactics for enabling discoveries, as well as thoughts on how to bring process to bear on creativity without straitjacketing it." (Amabile and Mukti, 2008)

Creativity has been nominated as the number one leadership competency, according to an IBM survey of fifteen hundred CEOs (Dyer, Gregerson and Christensen, 2012). Our tradition of "follow the leader" thinking has tended to inculcate a model of leadership which does not seek out or reward innovative thinking. Rather, we should concern ourselves with being "inspired by the leader". Professor Young (2014), Vice-Chancellor of the Australian National University, in his address to the Press Club, indicated that if Australians, as global citizens, are going to be truly innovative and continue to make contributions (such as the cochlear ear implant or penicillin discovery), they need to champion an innovative spirit instead of complacency.

If innovation is allowed to drive industry closer links will be developed between higher education and research and development in industry. It is ideas and their application that make a difference and that bring about changes for the better.

Purpose, passion and perseverance

For a creative idea to have impact, however, persistence, passion, purposeful problem-solving and self-direction all need to coincide for real performance. Investment of ourselves (Cropley and Cropley, 2000: 4), as is evident in a poet's passion, and a sense of "flow" (Csikszentmihalyi, 1996), are the benefits and requirements of creative thinking. Flow has been described as a "state of peak performance when the group is in sync and creative ideas are flowing" (Sawyer in Gaggioli, 2014). Creative productivity benefits both producer and consumer:

> "Students work on a problem or issue that the teacher and students see as connected to their personal experiences or contemporary public situations. They explore these connections in ways that create personal meaning. Students are involved in an effort to influence an audience *beyond their classroom*, for example, by communicating knowledge to others, advocating solutions to social problems, providing assistance to people, or creating performances or products with utilitarian or aesthetic value." (Newmann, King and Carmichael, 2007)

Thus, true innovation is encouraged so that ideas do not stay inert. They have influence beyond the classroom or the workplace. For girls it might be particularly important to be independent in their thinking – to be psychologically non-conformist, like the impressionist painter Berthe Morisot, for example – and for boys to be more imaginative. In this way we encourage our visionaries and innovators (Kerr, 2014). Conjecture, exploration and following one's imagination all need to become the order of the day.

While businesses are recognizing the power of creative thinking, the school gate seems to be shutting out the entrepreneurial thinking needed to open out to the market place and humanity. The Australian Curriculum is addressing this disjunction. If teachers are unsure how to teach entrepreneurship, then that sense of going beyond, of connecting classroom thinking to the outside world needs considerable development. Only if teachers are willing to do this will our students become the truly inventive and insightful achievers they should be.

Collaboration

An analogy drawn from science is useful in considering the importance of the culture that supports the creative process: "...a single element alone is inert but contact with other elements generates a reaction and leads to transformation" (Grégoire, 2014). Of relevance to the educator in a classroom, or to leaders in an office, is the idea that reframing, or taking a new perspective – like changing bike gears – plus the opportunity for collegiality or group work, allow for "interactive sense-making" or "collective intelligence" (Miller, 2014).

This is similar in some ways to the mass coordination of insects, although they lack the human ability to pose problems and to search for solutions.

> "Creativity exists in all human beings and in animals even insects – all constantly innovating things … they have the power and force to create something new from something old." (Viola, 2014)

It is collaboration that facilitates the fruition of "game-changing" ideas, whether in health issues, such as the recent findings on the multi-drug tolerance of tuberculosis bacteria , or in other fields, for example the 18th century mathematical paradigm shift in interpreting negative numbers (Grégoire, 2014).

There is in addition a much-needed focus, as expressed in Goethe's words, that "in the realm of ideas everything depends on enthusiasm… in the real world all rests on perseverance". While often it is the individual who pursues a valuable line of invention in designing and engineering, it is more often the case that a whole team or a "swarm" is needed. Collaboration is fundamental to production:

> "Those who change the game to fit changing circumstances are curious, they collaborate with individual purpose like the bee within the swarm." (Ben-Meir, 2012)

Innovation

It is important not to confuse creativity with innovation. As Marshall states:

> "... the main difference between creativity and innovation is the focus. Creativity is about unleashing the potential of the mind to conceive new ideas." (Marshall, 2013)

In the twenty-first century, dependent as many of us have become on seeking progress and ease of living, it does not make sense to live without a telephone, a car or a computer. Referring to Jonathan Ive, head of design with the Apple company, Arlidge states:

> "We use Jonathan Ive's products to help us to eat, drink and sleep; to work, travel, read, listen and watch; to shop, chat, date...Many of us spend more time with his screens than with our families. Some of us like his screens more than we like our families.... With just a tiny white box with a scroll wheel, he put 1000 songs in our pocket...." (Arlidge, 2014: 17)

"A thousand songs in our pocket" is indeed the tune of innovation. To be innovative one has to wonder, one has to collaborate, one has to generate and connect ideas and be prepared to act on them and try them out. Innovation, then, results from ideas plus their application (Anthony, 2012).

> "Without the likes of Alexander Graham Bell, Henry Ford and Jack Kilby and Robert Noyce (inventors of the integrated circuit), we would not have telephones, cars or computers – the defining innovations of the modern world." (Caulkin, 2000)

Technology as a tool is the ultimate maker of connections, and what better example than Martin Cooper's cell-phone innovation? The cell-phone brings into our lives all the elements of imagination that one might wish for: it is wireless, portable, compact and expandable.

For true innovation, imagination and ideas are fundamental. The essential qualities of an innovator, according to Wagner (2012: 16) are:

- Curiosity;
- Collaboration;
- Associative or integrative thinking; and
- A bias toward action and experimentation.

According to Gail Kelly (2014), the CEO of Wespac, a major Australian bank, businesses globally are aiming to embrace "...innovation, imagination and creativity", considered to be essential for the "new knowledge economy". To this end, the bank launched a $100 million educational scholarship program to help research students to grow the technological and creative skills considered crucial for future development. The learner, then, would do well to think like an entrepreneur, acquiring the twin creative characteristics of risk-taking and initiative.

Imagination

> "Educators want to give us all the information so it is absolutely clear… if we give people too much information we create an information overload which becomes a very negative thing… A kind of pollution we have to separate it out." (Viola, 2014)

Information overload leaves little room for imagination or for inquiry. Entrepreneurship, however, though generally seen as a business attitude, is also a creative thinking attitude integral to high performance. It is dependent on a sense that:

> "... the present order is an unreliable and cowardly indicator of the possible. The absence of certain practices and products is deemed by entrepreneurs as neither right nor inevitable but merely evidence of the conformity and lack of imagination of the herd." (De Botton, 2009)

The words of De Botton reiterate the dilemma to which the philosopher and scientist, Popper (1957) referred as "poverty of imagination":

> "The historicist continuously upbraids those who cannot imagine a change in their little world, yet it seems (s)he can't imagine a change in the conditions of change."

The Australian Industries Group considers that in the field of engineering, the process of invention and construction is quintessentially innovative. This model of course, has parallels with Osborne and Parnes' creative problem-solving approach, or with any research process. The purpose of such a model is to encourage the kind of thinking and skill-sets in science, technology, engineering and mathematics that will meet "... the emerging challenge of developing an economy for the twenty-first century":

ASK–IMAGINE–PLAN–-CREATE–IMPLEMENT.

Of interest, of course, is that curiosity, imagination, creativity and action are all embraced within this five-fold model. Robinson (2009), who views creativity as "applied imagination", has developed a classroom tool that embodies this model:

SEE-THINK-WONDER

This process could easily be applied to a work of art, to environmental phenomena or to an experiment to facilitate curiosity and associations. It in fact mirrors the scientific method and keeps alive the essential component of imagination.

Then again, the sequence could be reversed:

WONDER-SEE-THINK

This technique would have us form images prior to being influenced by our preconceptions. It recalls, in part, Sartre's (1940) preoccupation with the part that imagination plays in our experience of the world and in our understanding of phenomena. Imagination influences our responses to the world and even our sense of freedom.

Such direct models are needed to teach creativity in an explicit manner, combining expertise, imagination and purposeful depth of problem–solving. Problems will never go away, or we would already be well on our way to utopia, but we can alleviate them and we can dispel some of them. Why, then, would we want to live without creativity, the very goal of which is to find imaginative solutions?

Wonder

We are reminded of the acute observation skills of Sir David Attenborough, and his wonder, awe, curiosity, passion and reverence as he responds to the natural world. In the field, his awe is contagious. He observes closely, as a scientist would; patiently he waits, watches, collects, analyses and synthesizes information. His approach allows us to appreciate and to make sense of extraordinary natural phenomena. By way of example, we could consider the mimicry of a native Australian bird, the lyrebird, as something extraordinary in our environment. It picks up sounds from its surroundings - whether a chainsaw, a kookaburra, the click of a camera or a car alarm – and puts them in a vocal

"Dropbox" to access later, when needed. The lyrebird's vocal mimicry appears to be randomly assembled, with no attempt to select and to utter particular sounds in particular contexts That is where creativity is so significant in our lives; it works out what we might need in a given situation and comes up with multiple ideas sorted for their relevance and contextual meaning. Using the lyrebird's mimicry as a metaphor, we might make a creative leap to the idea of fusion music. We are reminded, through thinkers such as Attenborough, to return to wonder, to the power of the imagination that makes connections:

> "... reverence for all that is unlike us and exceeds us … we must make a particular effort of empathy and imagination to understand … a natural environment that is uniquely unpredictable, other and beyond us." (De Botton, 2009: 192)

Because it is "beyond us" we must harness the skill of anticipation, that openness to experience which does not dichotomise choices, beliefs and solutions but is prepared to wait and see and pursue Miller, 2014). Openness to experience is embodied in theatre and jazz improvisations. Indeed, to be inventive is the hallmark of musicians such as David Gray, considered by some to be the new Bob Dylan (Vincent, 2014). He had to deliberately embrace inventiveness and collaboration to generate in his music his so-called "creative crackle", the intangible edge, the appeal. A music fusion or hybrid exemplifies the need to imagine what is not audibly there but is possible, if we can grasp it through making connections, with a concomitant sense of aesthetics. Working in this way we can help learners "... respond to our enthusiasms by investigating the naive question of why and how we have been moved." (Alain de Botton, 2009)

The creative person remains alert to possibilities, resists closure and rejects over-reliance on ready-made formulae. Our social interactions are perhaps the ultimate form of connection-making. Over time we may find that the same old elements newly arranged are never really the same old elements. As Popper (1957) suggested, "novelty cannot be causally or rationally explained but only intuitively grasped." Synthesis in fact transforms and transcends what was there before.

Interdisciplinary ventures (crossing boundaries) and inspiration

The Australian writer Forsyth makes a literary paradigm shift as she transforms the fairytale genre by working on similarities and differences, analysing and then synthesising them into a new kind of fairytale – a metacognitive exploration. This transformation begins, however, with inspiration, which she describes as "lightning in a jar" (Forsyth, 2014) – perhaps something brewed, distilled and full of surprises.

Making connections across diverse fields inspires us to find ways to make a difference (Robinson, 2009). An "integral part of giftedness" is a greater facility in seeing links or in making connections (Cropley and Cropley, 2000: 4). If we are to match student needs we must encourage and promote opportunities for creativity to emerge, and we must recognize creativity as an essential component of learning for a future which "belongs to those who learn more skills and combine them in creative ways" (Greene, 2012: 64). We need both depth of knowledge and a new synthesis.

High order skills have always been at a premium, though now perhaps we are more aware of the idea that they are essential to living (Hannon, 2012); along with this awareness there is a renewed need to view education as a "totality" rather than an island away from the mainland of living, and compartmentalized into separated knowledge bytes. Hence the need for a cross-curricular perspective that demands collaborative learning. Novel ideas are pooled for purposeful problem-solving and innovation, leading eventually to real achievement on a global scale. . The outcomes may be a matter of freedom from famine, or for the more privileged, a matter of fashion. Whether the result be life-enhancement or luxury, Francesco Cista, the creative director at Calvin Klein fashions, has emphasised the importance of the creative "cutting edge":

> "To keep ourselves relevant we must innovate, we must challenge ourselves, we must take risks." (Smith, 2014: 38)

Teachers who encourage thinking capabilities through crossing subject boundaries and opening the classroom portals as a bridge to the outside world, are thereby enhancing their students' learning experiences to include the possibilities of innovation. Likewise, teachers who put cross-boundary thinking on the agenda, at both formal and informal meetings, are increasing their own professional learning, thus enabling them to widen the options available to them in meeting their students' differing needs. The *watercooler conversations* in the workplace expand from the banal and straight-forward to *watercolour conversations,* where learning boundaries are indistinct and where they expand to cloud-filled horizons or outcomes. Blurred lines, uncertainty and new perspectives are to be expected, though perhaps not in any predictable direction. It is out of this ambiguous blur that we construct a meaning. As the photographic artist Bill Henson (2004) suggests, "Shadows can animate the speculative capacity in the viewer…what you can't see in the photo has the great capacity to transmit information". A vital characteristic of creative thinkers is their tolerance of ambiguity and their willingness to accept what is unconventional or uncertain. This is what discovery learning – across disciplines – needs to encourage. .

Connections and revelation

Creativity's ability to reveal a new perspective is well exemplified in the public discussion of a sculpture selected for an open space in the city of Sydney. A seventy-five metre high steel sculpture, *Cloud Arch,* designed by Ishigami, an artist and architect from the Harvard Graduate School of Design, "...seems languidly to lasso the sky itself" (Farrelly, 2014), and symbolizes the connectedness of the city to the wider world, to the concept of "cloud computing" and to freedom itself.

The writer Elizabeth Farrelly (2014), asks what, "in a post-industrial, post-modern, post-coherent multiculture – is public art supposed to do?" Now that we bring such diverse backgrounds and world views to understanding art, and all other types of expression, the artists' creative problem-solving efforts are possibly stretched even more tightly; they have to "delve deeper, foraging for whatever is universal in human experience and welding it somehow to the local." (Farrelly, 2014).

> "This changes the game. No longer is it sufficient for a sculptor to master material, space and composition, with a dash of symbolism. Today's artist must grapple with the psyche. Contemporary urban sculptors must enhance urban space in a way that resonates with us all, stitching our wildly diverse backgrounds into a new view of Sydney – or of life." (Farrelly, 2014: 10)

What changes the game are the innovations brought about by great creative thinkers who applied their imaginations; however, now the wider context –the sands of time and space – are possibly shifting more than ever before.

Another Sydney public artwork, which consists of suspended empty birdcages, elicits a nostalgia for what is not there, some subtle mystery through "forgotten birdsongs that float over Angel Place, as though the birds have flown without their voices" (Farrelly, 2014: 10). An unexpected feature in the heart of the city gives tourists and locals alike a reminder of the pleasure we gain from using our imagination to grasp what is not there. As Cropley (2000) has noted, in making meaning in our lives "it is the derivation from what already exists that yields surprise." Connecting the seemingly unconnected gives rise to a new way of seeing things.

These are attitudes we would want all learners to adopt: risk-taking and crossing boundaries. The same may be said of surrealist art; it shows us that we do not always have to agree, that knowledge can be uncertain. We can make our own associations and enjoy the surprise from new and unexpected links. (Sternberg, 2003b). This is intrinsically motivating for the learner (Amabile and Hennessy, 1998), hence it needs to be incorporated in day by day learning so that learners are encouraged to go well beyond the classroom door.

> "The beautiful and dangerous part of being human is that we can change and changing our minds is important." (Viola, 2014)

While interpreting surrealists' images is about grasping the juxtaposition of unexpected objects or scenes or ideas to transform what is there, Viola (1977-2014), the pioneer of video art, in a recent interview has drawn attention to the nature of transformation itself:

> "... one of the most important things in human beings' existence. Transformation is a power – a very deep and necessary power- that is constantly working under the radar screen very slowly and building a new human being." (Viola, 2014)

Like the queues outside the Musée Marmottan waiting to see Monet's ground-breaking *Soleil Levant,* people are looking for what is new and they will find what they need (Viola, 2014).- They recognize such achievements for their novelty, their rarity and their call to the imagination. We need our learners to make connections and to thirst for more, "...to discover something new that has not been thought about before" (Viola, 2014).

Productivity and practicality

> "Conventional instruction usually presents knowledge as given, when it should encourage a view of knowledge as the product of creative effort." (Perkins in Costa, 2001:295)

This paper has delineated the concept of creativity as a process which transforms knowledge into a new product or outcome that is original and valuable; this is brought about through imagination purposefully applied to solving a problem.

As stated earlier, education best serves if it is "for life not for school". Expertise is essential; however, it must be transformed through imagination into a novel response to solve a problem. This is the real drawbridge from the island of school to the mainland of living.

Synectics, a tool to encourage creative thinking and to synthesise opposites

The process known as synectics can be used to assist in shifting one's perspective and to solve problems in creative ways (Gordon and Poze, 1980; Forster, 1996; 1998).[3] To think creatively, one

> "... reflects on a problem … generates multiple original ideas that seem disconnected … thinks of one thing in terms of another …." (Ennis,1985, in Perkins 1995)

Creative thinking connects opposites that then contribute to a new understanding. Creativity and its significance can be further understood through antonyms: bright/dull, exciting/boring, colourful/drab. The clash of opposites jolts us into paying attention: the mundane, the tedious, the trivial, the everyday, the passé, - is this how we want to live, or do we want to live creatively? If all of life is about problem-solving, then an intelligent response requires our being able to think creatively, to hurdle over obstacles, to tackle problems that have no "ready-made solution".

The synectics technique gives a scaffold to encourage ideas through comparing one thing to another and exploring that analogy. It gives perspective to problem-solving by changing perspective. It has been used in the advertising, art and design worlds as well as in the classroom across different subject areas. The following example describes a teaching unit which used synectics in a high school English class. One of the students remarked that she did not know she was allowed to think like that (Forster, 2006).

Synectics Example Unit: Studying the novel, *Briar Rose,* in matriculation year:

Suggestions for teaching strategies:

- Students formed "Jigsaw" cooperative learning groups to discuss Plot, Theme, Characterisation and Context;
- Each group was given 3 questions based on Bloom's questioning; and
- The whole class made analogies using synectics (see also Weaver and Prince, 1990):

1. Start with an analogy for survivor: - A survivor is like a … - *Tall wall;* - Fight for life; - Island; - Soldier; - Developing country; - Fire; - Insect in a web; and - Animal in the wild.	2. Suggest many descriptors for one of the analogies *tall wall*: - transparent; - brittle; - mute; - see-through; - fragile; - concrete; - challenging; - strong; - fearful; - difficult; - developing country; - perspective; - never-ending; and - barrier.	3. Put together words that do not usually go together, that do not gel, a compressed conflict …like an oxymoron: - *solid difficulty;* - *never-ending island;* - *different perspective;* - *transparent barrier;* - *concrete insect in a web;* - *brittle perspective;* - *never-ending concrete;* - *brittle developing country;* - *fragile strength;* - *transparent wild animal;* - *fearful fire;* - *mute barrier.*

4. Apply this compressed conflict to the original topic. Being a survivor is about *fragile strength*…..

As a very specific tool, synectics, through the making of connections, a richness and complexity emerge in the creative outcomes of students' thinking. It allows the sort of new perspectives needed to live in a world with our own "fragile strength". Rich and complex creative ideas emerge and are applied to produce innovative outcomes.

Notes:

[1] Mais ce qui est le plus aimable en Dali ce sont ses racines et ses antennes . Racines plongées profondément sous terre où elles vont à la recherche de tout ce que l'homme a pu produire de " succulent" en quarante siècles de peinture, d'architecture et de sculpture. Antennes dirigées vers l'avenir qu'elles hument, prévoient et comprennent avec une foudroyante rapidité. Il ne sera jamais assez dit que Dali est un esprit d'une curiosité insatiable. Toutes les découvertes, toutes les inventions retentissent dans son œuvre et y apparaissent sous une forme à peine transposée (Descharnes et Néret, 2003 :8).

[2] ... ce qui anime tout grand sportif, c'est, à équidistance de la raison et de la superstition, l'instinct. L'instinct est ce subtil mélange d'analyse et de ressenti, de rigueur et d'improvisation (Bégaudeau, 2014: 2).

[3] For more information on synectics and other creative thinking strategies see:
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Jill Forster, with a Ph.D. in policy and practice in educational psychology, has extensively advised on the formulation and implementation of state government policy on gifted education and contributed to the Ministerial Advisory Committee on Quality Teaching. She has taught at the primary, secondary and tertiary levels, has coordinated a state-wide mentor program for underachieving students and provided On-line Mentoring in professional learning courses on differentiation. Her background in creativity has led her to advisory work on the General Capabilities of the Australian Curriculum.

At the University of Sydney she has worked extensively as a Research Fellow in Quality Teaching and Differentiation and as a Lecturer in the Master of Education and Bachelor of Education courses in Gifted Education that she wrote for the faculty. A joint research project with the University of Connecticut investigated the more creative and metacognitive approaches to mathematics in the primary school. Other research has included evaluation of the effectiveness of differentiation initiatives, of on-line professional learning opportunities for Languages teachers and research projects in the area of Science, Technology, Engineering and Mathematics (STEM).

Ongoing action research in schools involves her in a mentoring/coaching role for teachers who are implementing innovative teaching strategies to differentiate instruction. Creative thinking has been her focus for articles, research, a special workshop and symposium at the 2012 Australasian Conference on Gifted Education and recent keynotes at Principals' Conferences.

Publications include a book of poetry, *Lullabies* and education books and articles such as,

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