What if teachers had the tools to understand and enhance the creative thinking of students?

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The economic and social well-being of Australia is based on its citizens' ability to adapt and create knowledge and products in response to societal needs. The fruits of creativity enrich our culture and improve the quality of our lives, both individually and collectively. This paper presents a rationale for a theoretical framework for Distributed Creativity in classrooms that might be used to explore and define forms of complementarity among students to support production of creative ideas or products; and investigate ways in which Distributed Creativity can be used by researchers and educators to study and optimise student creative potential. The Distributed Creativity framework is predicated on the transformational potential of digital technologies to afford students the capacity to work collaboratively and engage in what has been termed mini-c creativity.

Background

The economic and social well-being of Australia is based on its citizens' ability to adapt and create knowledge and products in response to societal needs. Schools should play a major role in ensuring students acquire the necessary social, cognitive and affective skills to be Australia's creative problem-solvers in the Asian Century (Commonwealth of Australia, 2012). As argued by Chubb (2015) we should focus less on 'future-proofing' and more on 'future-priming' to prepare young people to respond creatively to future challenges and opportunities. Pink (2005) notes that creative thinking is increasingly necessary to accomplish goals in our complex, interconnected world and suggests that a new paradigm for schools is needed to allow students to experience the richness of creative thinking and learning which is not afforded them in the current education climate of high- stakes testing and scripted curricula. Pink states

> today, the defining skills of the previous era - the 'left brain' capabilities that powered the Information Age are necessary but no longer sufficient. And the capabilities we once disdained or thought frivolous – the 'right brain' qualities of inventiveness, empathy, joyfulness and meaning - increasingly will determine who flourishes and who flounders (p. 3).

Mishra, Koehler and Henriksen (2011) argue for transformative learning, focused on "trans-disciplinary thinking" (cognitive skills that cross disciplines) and new technologies, to create contexts where creative thinking thrives. The Australian Curriculum recognises the importance of facilitating cross-disciplinary capabilities by including suggestions for links between specific learning areas, Cross-curriculum Priorities and seven General Capabilities underpinning all learning areas: Literacy; Numeracy; Information and Communication Technology capability; critical and creative thinking; personal and social capability; ethical behaviour; and intercultural understanding. The General Capabilities encompass the knowledge, skills, behaviours and dispositions that, together with curriculum content in each learning area and the cross-curriculum priorities, will assist students to live and work successfully in the

twenty-first century. They play a significant role in realising the goals set out in the Melbourne Declaration on Educational Goals for Young Australians (MCEETYA 2008) that all young people in Australia should be supported to become successful learners, confident and creative individuals, and active and informed citizens" (Australian Curriculum Assessment and Reporting Authority, 2011).

Creative thinking has received recent attention from both educators and psychologists and there is a consensus that the development of creative thinking by students is critical for long-term sustainability (Runco, 2007).

However, even though creativity has been seen to be increasingly significant in education in the latter part of the 20th century and the first decade of the 21st century (Craft, 2008), and despite the consensus view that each of us possesses creative potential, and that the benefits of fulfilling creative potentials accrue to both individuals and society (Runco, 2007), "researchers, psychologists, educators and policy makers still talk about creativity in very generic and fuzzy terms" (Mishra, Henriksen, & MSU Deep Play Research Group, 2012, p. 20).

None the less, internationally considerable work has been done since the turn of the century to provide guidance for educators with respect to creativity in classrooms. For example, the National Advisory Committee on Creative and Cultural Education (NACCCE, 1999) in the UK, convened by Sir Ken Robinson, synthesised empirical research evidence and concluded that 'creative learning' involves children experiencing innovation in the classroom, control over activities and their evolution, together with a sense of relevance and ownership of their learning, and that these four features are also characteristics of creative teaching (Jeffrey & Woods, 2003). Further, NACCCE recognised the need for guidance on creative teaching and learning which resulted in the Qualifications and Curriculum Authority undertaking a number of years of work to innovate curriculum, learning and pedagogy in the UK, informed by the definition of creativity presented in the NACCCE Report, and the cultural framing of creativity as a democratic concept. NACCCE saw creativity as "imaginative activity, fashioned so as to produce outcomes that are original and of value" (NACCCE, 1999, p. 29). Their democratic approach to creativity, and the linking of creativity to culture, viewed creative learning as empowerment in and beyond the classroom, which was a significant shift away from the prevailing view of creativity as only accessible to the gifted (Jeffrey & Craft, 2004; Sefton-Green, 2008).

In recent years, there are several distinguishable discourses observable in the research literature with respect to creative learning. Banaji, Burn and Buckingham (2006) have succinctly synthesised nine of these: the creative genius rhetoric that emphasizes extraordinary creativity in a range of domains; the democratic and political rhetoric where creativity offers empowerment; the notion of creativity as ubiquitous in which creativity is pervasive; creativity as social good where it is essential to a 'good life'; the rhetoric which emphasizes the economic imperative of creativity for individuals and countries; the approaches that emphasize play which is viewed as the foundation of adult creativity; the approaches focussing specifically on creativity as a form of cognition; the discourse around creativity and new technologies that emphasize the affordances of new technologies for creativity; and lastly the creative classroom discourse that draws connections between individual and collective creativity in classrooms.

However, the global drive for accountability and to raise standards creates an unmistakeable tension with the current thinking in terms of creative learning, where there is a commitment to nurturing ingenuity, flexibility, and generative capability (Craft, 2008). In reality there are significant challenges for educators seeking to frame and develop creativity in schools, arising from almost irreconcilable underpinning discourses that determine how creativity is envisioned and enacted in classrooms (Craft, 2008).

Numerous questions are generated by the research literature on creativity including: How is it that some people are considered creative while others are not? Is creativity simply a cluster of cognitive skills (Guilford, 1950) or is it more than that? Is creativity domain-specific or domain-general? Is it dependent upon social and environmental conditions? How might information and communication technologies (ICT) assist children to develop and demonstrate creative thinking? All of these questions are worthy of study and have received periodic attention in one form or another in the past five decades by psychologists, sociologists and educational researchers.

Although the 'fuzziness' about the construct of creativity may be due to its complexity or the lack of a consistent definition (Sternberg, 1999), it has been argued that a more pressing problem for educators is the creation of a workable framework which can be used to help students develop their creative thinking potential (Mishra et al., 2012). Further, many researchers have noted that schools are generally structured to maintain rigid discipline boundaries (Robinson, 2003) but this is contrary to how extraordinary thinkers operate (Root-Bernstein & Root- Bernstein, 2004) as "most creative people do not view their work as confined to their discipline, but rather are inspired and elevated by connections within and between other disciplines" (Mishra et al., 2012, p. 19). The Australian Curriculum embraces General Capabilities that necessitate teachers working in a trans-disciplinary mode, but does not provide a flexible framework teachers can use to scaffold creative thinkers and learners. A creativity framework is essential for educators who are seeking pedagogical approaches that provide their students with the greatest probability of realising their creative potential (Gardner, 1997).

The fruits of creativity enrich our culture and improve the quality of all our lives. This paper explores the concept of

creative minds in interaction, as opposed to creative minds in isolation from each other – from the *person-solo* to the *person-plus*. This is an important shift of focus in an age when networked collaboration for innovation is becoming central to how we live and work (DIISRTE, 2009). It takes the creative classroom discourse that draws connections between individual and collective creativity in classrooms and specifically addresses the question "what if education departments, schools and individual teachers had the confidence, capabilities and resources to optimise student creative potential?" It proposes a theoretical framework for *Distributed Creativity* in classrooms that can be used by researchers and educators to study and optimise student creative potential. The *Distributed Creativity* framework, we propose, provides a necessary link in the curriculum to classroom chain that will assist educators to create and evaluate innovative frontiers of teaching and learning in 21st century classrooms..

Creativity

Proctor (1999) and Proctor and Burnett (2002) concluded that, as with intelligence, many difficulties associated with research into creativity stem from the absence of an agreed definition. Creativity means different things to different people and confusion arising from failure to make the meaning explicit impedes communication. It is of paramount importance to formulate a clear and defensible definition of the construct upon which to base research and teaching. Hence, Distributed Creativity as proposed in this paper, inescapably deals with students, classrooms and learning and understands creativity to be the capacity of students to solve problems, or to devise ideas and products in collaboration, that are considered both novel and valuable by their teachers and peers. This definition confers a purposeful, everyday dimension to creative thinking which views it as a way of behaving towards particular tasks. Further, Gauntlett (2011, p. 218) describes everyday creativity as "a process which brings together at least one active human mind, and the material or digital world, in the activity of making something which is novel in that context, and is a process which evokes a feeling of joy".

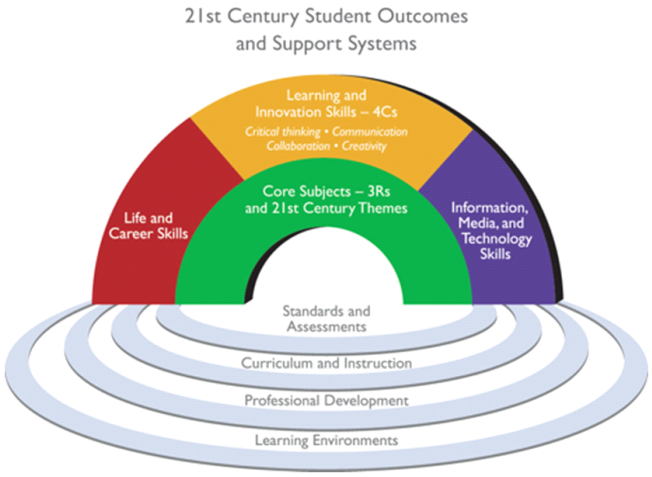
Research has only recently started to encompass the processes involved in creativity. Previous research has mostly sought to develop assessment measures to identify creative individuals. The most active areas of research have included personality traits of creative people; the relationship between intelligence and creative abilities; and the effects of various interventions on divergent ideation. Research has explored the lives of extraordinary individuals (Gardner, 1993a, 1997; Runco, 2007; Sternberg, 2002). Though this work adds to our understanding of the creative processes of outstandingly creative individuals, termed Big-C creativity, it fails to provide a coherent set of generalisations and a framework to underpin classroom research and pedagogy appropriate to the age and level of development of students. Our purpose in this paper is to articulate a theoretical framework to support the development of creative thinking in school students. The framework will describe the interaction among individual (personal student traits), domain (subject or content area) and context (both human and physical elements) and be based on the conjecture that meaningful, culturally valued creativity is distributed among individuals within a social context such as a classroom. However, the framework will necessarily view the creative process in classrooms in line with definitions of everyday creativity (Gauntlett, 2011) or what has been recently termed "little-c" or "mini-c" creativity, as opposed to "Big-C" (Beghetto & Kaufman, 2007; Runco, 2007). Both Big-C and little-c creativity rely on field judgments of novelty, appropriateness, and impact to validate the claim that the end products or artefacts are indeed creative. "Mini-c" creativity described by Beghetto and Kaufman (2007), however, highlights the important relationship between learning and creativity; the process of being and becoming creative. This dimension of creativity is therefore most appropriate when describing the developing creative thinking of school students. We contend that a theoretical framework is needed to allow researchers to examine the relationship between creativity and classroom learning, and the development of higher forms of creative expression. Such a framework should assist teachers to properly encourage and support mini-c creativity so that it can evolve into further creative pursuits that support a lifetime of creative learning and expression. The framework should support the development of pedagogical approaches that effectively enhance student creative thinking processes (mini-c creativity) in 21st century classrooms.

A systems perspective on creativity

In parallel with the increased attention that ICT has received in global education initiatives, the 4Cs are considered by many educators as essential knowledge and skills for every child to ensure they are prepared for the rigours of higher education, career challenges and a globally competitive workforce in the 21st century (Partnership for 21st Century Skills, 2011). The Partnership for 21st Century Skills (P21), an initiative of the US Department of Education, has created a conceptual framework (Figure 1) for 21st century learning.

The framework presents a systems perspective on 21st century teaching and learning that combines a focus on 21st century student outcomes (depicted by the arches) integrating a combination of specific skills, content knowledge, expertise and literacies, with innovative support structures (depicted by the radiating bands under the arches) to help students master the multi-dimensional abilities required of them in the 21st century. Creativity is clearly indicated in Figure 1, and widely accepted in the literature and schooling policy and curriculum documents from around the world, as a required 21st century student outcome from schooling (Australian Curriculum Assessment and Reporting Authority, 2011). However, what is

Figure 1. **Framework for 21st Century Learning**



not clear in the literature is the way the four skill sets (Life and career skills, 3Rs, ICT skills, 4Cs) interact and are integrated in classroom teaching and learning contexts. Educators and researchers are increasingly interested for example in the possible transformative role ICT might play in attaining the learning and innovation skills depicted in the arches of Figure 1.

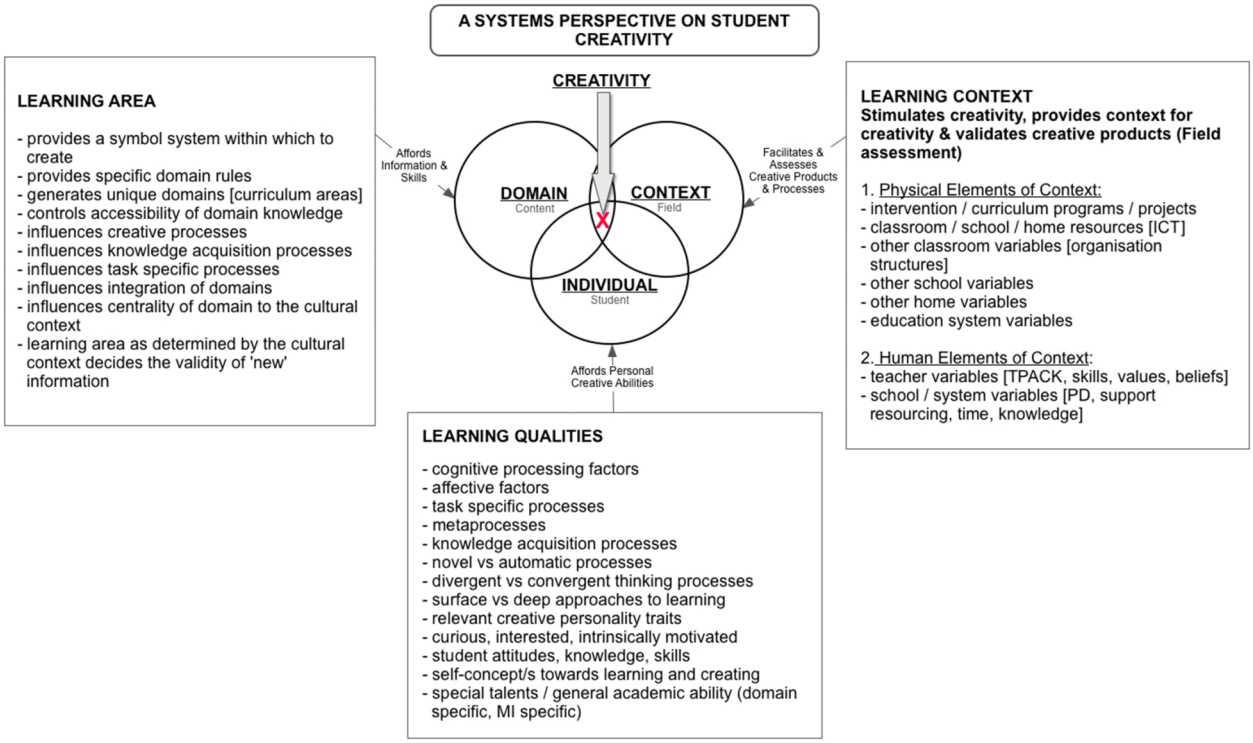
In the latter part of the 20th century, researchers proposed various systems perspectives for the study of creativity

(Csikszentmihalyi, 1999). Such systems perspectives, or confluence approaches to the study of creativity, are based on the hypothesis that multiple components must converge for creativity to occur (Amabile, 1996; Csikszentmihalyi, 1996; Gardner, 1993b; Sternberg, 1996; Sternberg & Lubert, 1996). Csikszentmihalyi (1999) for example, highlights the interaction of the individual, the *domain*, and *field* as necessary to produce novel solutions. He argues that an individual draws on information in a specific domain or symbol system and transforms or extends this information through personal cognitive processes, personality traits, and motivation. The field consists of other individuals within a domain or context who evaluate and select novel ideas which they view as worthy extensions of the domain and which should be preserved and transmitted to other individuals, now and into the future.

In order to enhance and measure student creativity effectively, educators need a conceptual model that differentiates between important cognitive, dispositional and behavioural characteristics of the individual, and which also illustrates the interplay between these individual characteristics and the domain within which they are brought to bear, as well as the context (field) in which the individual is operating.

Figure 2 depicts a theoretical model, based on the creativity literature and an understanding of 21st century classrooms, which might guide educators and researchers in relation to enhancing and measuring mini-c student creativity. The model is not static as it represents a relational system where a change to one part of the system affects the other parts. It illustrates the interrelationship between the three major components (Individual, Domain and Context) with indicative specific creativity variables that should be considered. Further, the model will evolve as our understanding of the impact of constantly evolving digital devices on creativity develops.

Figure 2. **A Systems Perspective for Student Creativity in Classrooms**



The model depicted in Figure 2 identifies the main dependent variables in each of the three major components (Individual, Domain and Context) that are predicted to impact on school student creativity. These variables have been gleaned from the accumulated literature on creativity and are specific to learning contexts where students operate within, and manipulate the symbol system of a particular domain, all within a describable/observable learning context. Further, the model recognises that the students bring to bear their individual learner qualities to each learning task in order to create an innovative response that is validated by others (teachers, peers, parents/caregivers) who are also part of the context (field). Educators could use the model in order to plan appropriate, tailored learning activities for students, where for example they might be required to use their iPads and other digital technologies (laptops, desktops, wifi, apps etc) that are part of the classroom context, to create novel products in a specific learning area or a combination of learning areas. Researchers might use the model to develop observation tools and measurement instruments. Each of the three variable clusters (Learning Area, Learning Qualities, and Learning Context) could be the focus of classroom observations where students are expected to use digital technologies to create a novel response in collaboration with others, both within and beyond the physical classroom.

Assumptions upon which the systems model for student creativity in classrooms is based

This theoretical model is predicated on four assumptions. The first is that creativity research is a valid and valuable enterprise. Just as genetic variation gives rise to biological evolution, creativity engenders cultural evolution. Understanding creativity is a practical base upon which to build a sustainable Australian society in the Asian Century (Commonwealth of Australia, 2012). "Using creativity and design-based thinking to solve complex problems is a distinctive Australian strength that can help to meet the emerging challenges of this century" (Commonwealth of Australia, 2012, p. 2).

The second assumption is that creativity is not a personal dimension that resides solely within some exceptional individuals. The discoveries of any great creator, such as Einstein, would have been much less without his accumulated prior knowledge; without the intellectual and social network that stimulated his thinking; without the physical elements or tools he had available in his context at the time; and without the cultural mechanisms that recognised the value of his innovations. "To say that the theory of relativity was created by Einstein is like saying that it is the spark that is responsible for the fire. The spark is necessary, but without air and tinder there would be no flame" (Csikszentmihalyi, 1996, p. 7).

A comprehensive theoretical model of creativity in 21st century classrooms should include a study of the domain (a set of symbols, rules and procedures) and the context in which the individual student is operating.

The third assumption is that creativity arises from the interaction between a person and a particular sociocultural context. This implies a study of creativity as a system, asking not what is creativity, but more importantly, where is creativity? Csikszentmihalyi (1996), Gardner (1993b, 1997), Feldman, Csikszentmihalyi and Gardner (1994), and Perkins (1992) all concluded that an artefact can be termed "creative" only when it is delivered to field experts who give it their approval for recognition in a cultural domain. Thus, a combination of personal traits is not the determinant of whether a person is considered creative. What counts is whether or not the novel process or product is accepted for inclusion in the domain. Hence, the traits of personal creativity may help generate a novel idea or product, but the innovation will not be included in, nor bring about a cultural evolution to the domain, unless it is recognised as valuable by the culture. Primary students who are learning how to write or draw or invent, are probably not at the stage where their creations are going to be novel or useful to anyone else but themselves. Beghetto and Kaufman (2007) assert that people cannot normally be creative in a field without truly learning the field. Thus, they propose the construct of "mini-c" creativity to describe a process by which creativity develops; by which a person becomes creative. Mini-c creativity highlights the importance of skilled others (i.e., teachers) recognising the value of introducing novices (i.e., students) to the socially negotiated conventions, standards and existing knowledge of a domain. They maintain mini-c creativity is "its own unique process and merits its own unique standards that provide creativity researchers and educators with a new way of thinking about how creativity can be studied, understood and (ultimately) cultivated" (p. 77). The theoretical model for student creativity proposed in Figure 2 accepts the assertion that mini-c creativity offers the capacity for developing an understanding of how students discover and apply new insights and under what conditions such insights might develop into little-c and perhaps even Big-C creativity.

Finally, Perkins (1992) related the system model for creativity to learning in classrooms. He described the activity in most classrooms as "person-centric" where it is the "person-solo" who is expected to possess the knowledge, skill and creativity to complete tasks. This mode of operation – non-collaborative and without any physical and information tools - is rare in the modern world of work and life. People function in "person-plus" modes, using numerous physical and information resources, as well as interactions with other people to communicate and collaborate, frequently on a global level through social media. The person-plus concept implies both a team of people and a group of physical supports for cognition. Pea, Perkins, Salomon and others have investigated what they have termed "distributed intelligence" or "distributed cognition"

or even "social creativity" (Fischer, 2000, 2004; Salomon, 1993; Watson, 2007). They all argue that human cognition at its richest almost always occurs in ways that are physically, socially and symbolically distributed.

Digital technologies and creativity

Evidence suggests that students' creative thinking can be facilitated and even significantly enhanced when they work collaboratively with access to appropriate digital technologies (Batham, Jamieson-Proctor, & Albion, 2014; Jamieson-Proctor & Larkin, 2012; Proctor, 1999; Proctor & Burnett, 2002).

The *Australian Curriculum: Technologies* (v8.1) (Australian Curriculum, 2016) encompasses two distinct but related subjects:

(1) Design and Technologies, in which students use design thinking and technologies to generate and produce designed solutions for authentic needs and opportunities; and

(2) Digital Technologies, in which students use computational thinking and information systems to define, design and implement digital solutions.

The overarching key idea in the *Australian Curriculum: Technologies* is 'creating preferred futures', placing creativity and innovation at the heart of the learning area. Its rationale states:

By applying their knowledge and practical skills and processes when using technologies and other resources to **create** innovative solutions, independently and collaboratively, they [students] develop knowledge, understanding and skills to respond **creatively** to current and future needs. The practical nature of the Technologies learning area engages students in critical and **creative** thinking, including understanding interrelationships in systems when solving complex problems. A systematic approach to experimentation, problem-solving, prototyping and evaluation instils in students the value of planning and reviewing processes to realise ideas. (Australian Curriculum, 2016)

The *Australian Curriculum:* Technologies aims to develop the knowledge, understanding and skills to ensure that, individually and collaboratively, students:

- investigate, design, plan, manage, **create** and evaluate solutions;
- are **creative**, innovative and enterprising when using traditional, contemporary and emerging technologies, and understand how technologies have developed over time;
- engage confidently with and responsibly select and manipulate appropriate technologies – materials, data, systems, components, tools and equipment – when designing and **creating** solutions; and
- critique, analyse and evaluate problems, needs or opportunities to identify and **create** solutions. (Australian Curriculum, 2016) The overarching key idea, rationale and aims of the *Australian Curriculum: Technologies* repeatedly foreground creativity; as evidenced by the bolding in the direct quotations above. There is obviously an expectation that teachers from Foundation to Year 10 in all Australian schools will provide students with opportunities and resources, including digital tools, with which to express and enhance their creativity. The inclusion of 'design thinking' among the other key ideas in the curriculum should encourage teachers to engage students in the design cycle of investigating needs in their context, generating possible solutions, selecting and implementing a solution, and evaluating its effects as foundation for further rounds of the cycle. Although design and creativity are not synonymous they are closely related and immersion in the design cycle will provide students with opportunities for creativity in which the products have the characteristics of creative output, novelty and utility in context, that clearly match the requirements of everyday creativity (Gauntlett, 2011; NACCCE, 1999). In recent years all developed countries have witnessed a surge in the availability and appropriation of powerful, and more and more mobile, digital technologies in classrooms. It has been suggested by many researchers that a lack of both technical knowledge and pedagogical knowledge has contributed to a limited success with digital technologies in classrooms (Batham et al., 2014; Cuban, 2000, 2001). While the uses of ICT to support and promote creativity have been described, reviewed and theorised in a number of research studies, and a conceptual framework for creativity and ICT in primary classrooms has been proposed (Loveless, Burton, & Turvey, 2006), the understanding and implementation by educators of the practicalities of enhancing creativity with ICT need further explication. A theoretical framework for creativity in 21st century, technology-rich classrooms should take account of the literature with respect to creativity, particularly mini-c creativity (Beghetto & Kaufman, 2007), and describe the interaction between individual, domain and context, so that ICT might be used to support creativity through encouraging learners to make curriculum connections, develop personal creative abilities and dispositions, create meaning, collaborate and communicate.

Summary

The current climate in Australian schools is favourable for creativity as evidenced by the expectations in the *Australian Curriculum: Technologies*, but teachers and researchers require the theoretical tools with which to critically analyse the affordances of ICT to promote substantial creative experiences for students. Teachers also require practical approaches to including creativity that remove the burden of recognition by domain experts imposed by the prevailing understanding of Big-C creativity. The ideas around everyday creativity

(Gauntlett, 2011) and mini-c creativity (Beghetto & Kaufmann, 2007) can liberate teachers and students from the constraints of Big-C creativity and a focus on design can provide a practical approach to creative work in the classroom. So in seeking to answer the question "what if education departments, schools and individual teachers had the confidence, capabilities and resources to optimise student creative potential?" we have proposed a theoretical framework for *Distributed Creativity* in classrooms for educators to optimise student creative potential (Figure 2). We believe the *Distributed Creativity* framework provides a substantial link in the curriculum to classroom chain that will assist educators to better understand and enhance the creative thinking of students in 21st century classrooms.

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