Educating the creative citizen

Design education programs in the knowledge economy

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The shift in the last twenty years from an industrialised economy to a knowledge economy demands new modes of education in which individuals can effectively acquire 21st century competencies. This article builds on the findings and recommendations of a Knowledge Economy Market Development Mapping Study (KEMDMS), conducted in Queensland, Australia. The study was conducted to identify the value of design education programs from primary school through to the professional development level. This article considers the ability of design education as a framework to deliver on the 21st century competences required for the three defining features of the creative knowledge economy – Innovation, Transdisciplinarity and Networks. This is achieved by contextualising key findings from the KEMDMS, including current design education initiatives, and outlining the current and future challenges faced. From this, this article focuses on the role of the tertiary education sector as the central actor in the creative economy in the development of generic design/design education capabilities. Through the unpacking of the study's three key observation themes for change, a holistic design education framework is proposed, and further research directions are discussed.

Keywords: Knowledge economy, creative economy, design education, transdisciplinarity, networks, innovation

Education in the Age of Innovation

The impact of the globalisation and internationalisation of economies, along with the rapid development of information and communication technologies (ICT), has seen societies over the last twenty years transition away from a 'smoke-stack' industry focus towards a knowledge intensive and creative organisational focus, in which ideas and knowledge function as commodities (Anderson, 2008). A consequence of this transition has been the transformation of the workforce, from labour intensive into flexible, decentralised, networked and multi-skilled. It has become imperative for individuals and organisations to continuously evolve, learn, create and apply knowledge – to participate in "lifelong learning" (Bentley 1998, p.81), in preparation for jobs and markets that do not yet exist. Landry's *The Creative City* (2008) and Florida's *Rise of the Creative Class* (2004) have stimulated rich discourse on the socio-cultural and economic implications of developing formal and informal intellectual infrastructures in cities to attract a new 'creative class' population. This transition necessitates new cross-public-sector strategies, systems and policies for educational innovation, and for education systems to strive for (1) autonomy, (2) responsibility and (3) creativity (Bentley,1998, pp.356-357). It demands increased attention to the identification and acquisition of the competences individuals need to actively and effectively participate in the knowledge economy (Gordon et al., 2009). These 21st century competences are generally characterised as being (1) transversal (i.e. not directly linked to one specific field but relevant to many); (2) multi-dimensional (i.e. including knowledge, skills and attitudes; and (3) associated with higher order skills and behaviours that represent the ability to embrace complex problems, unpredictable situations and ambiguity (Westera, 2001; OECD, 2005; Gordon et al., 2009)

Hearn and Bridgestock (2010) draw attention to three defining, and inextricably linked, features of the creative knowledge economy – innovation, transdisciplinarity and networks. Increasingly, economic growth is dependent on continued innovation and entrepreneurship right across the supply chain, from

production to consumption. As most economic activity is driven by consumption (60 to 70%), and this is increasingly of goods with cultural components (Lash & Urry, 1994), Hearn and Bridgestock (2010) suggest that "innovation occurs primarily at the intersection of three knowledge regimes: Scientific/Technical, Creative/Cultural, and Business" in which the third translates the new knowledge produced by the first two, into valued and therefore consumed commodities (2010, p. 96). This transdisciplinary knowledge is combined and generated by agents capable of learning and communicating new knowledge, who are organised via multi-pathed, complex, flexible, and social, scale-free networks (2010, p. 97).

Leveraging human capital for the creative knowledge economy requires the embedding of human resources into social and cultural capital networks. To do this, capabilities in innovation (which requires creativity education as well as entrepreneurship/business education), transdisciplinarity and networks must be developed. In addition, capability building in domain specific creativity in the scientific/technical and creative/cultural areas is essential. All educational interventions need to emulate this holistic dynamic.

This requires the questioning and unlearning of beliefs, values, assumptions and perceptions currently held by researchers, practitioners, and policymakers (Dede, 2010). It demands a new "landscape of learning" that understands the business climate and extends beyond teacher responsibility in the classroom, to address the pressing challenges of promoting active citizenship, developing employability, and tackling underachievement and social exclusion (Bentley, 1998). New education policy and modes that go beyond the current "back-to-basics" core secondary curriculum organised around the discrete disciplines of mathematics, science, English, and languages, need to be explored to cater for the 'missing middle' of the K-16 education pipeline (Carnevale & Desrochers, 2002). The generation of a "networked economy" (Seltzer & Bentley, 1999) dictates that education needs to focus on the connections between schools and society, relating learning to the challenges of adulthood, and giving young people exposure to a wide range of contexts, role models and experiences of genuine responsibility (Bentley, 1998). Education systems need to transition from the traditional "teacher-based approach" towards a "learning based approach"(Thomas & Brown 2011) in which generation 'P' (for participatory) (Jenkins 2006) students learn from the building of their own networked communities or 'collectives' based on shared interests and perspective, and assisted by digital technologies as a source of rich information and play. Future learning environments must focus on students proving that they can embrace the unknown - and through inquiry, embark on a process of re-creation (Thomas & Brown, 2011). These new models of education are demand-led, do-it-yourself, individualised modes of learning.

As the 21st century knowledge economy relies on the diffusion and use of knowledge, as well as its creation (Houghton & Sheenan, 2000), education systems must concentrate less on specialist skills and more on the development of adaptable people with broad-based problem solving skills, diversity of perspective, and social and inter-personal communication skills necessary for networking and communication. According to the Partnership for 21st Century Skills (2009), preparing students, workers and citizens to thrive in the global skills race (to ensure economic competitiveness), involves a focus on (1) learning and innovation skills (creativity/innovation, critical thinking/problem solving, communication/collaboration); (2) information, media and technology skills; and (3) life and career skills (flexibility/adaptability, initiative and self-direction, social/cross-cultural, productivity/accountability & leadership/responsibility), as well as mastery of core subjects and 21st century interdisciplinary themes. Burnette (1993) indicates that these graduate attributes "are all directly addressed through the different ways of thinking during design". Design is often viewed as the most appropriate tool in which we can better understand the processes of change and becoming capable of change-making (Kimbell & Perry, 2001). For the purposes of this research, design and 'design thinking' shall be defined as a theoretical "design practice and competence…used beyond the design context" (Johansson-Sköldberg, Woodilla, & Çetinkaya, 2013), which utilises a systematic human centred

approach to explore the definition of problems and synthesise solutions (Buchanan, 1992; Owen, 2007) in a cyclical framework encompassing inspiration, ideation, and implementation (Brown, 2008). Design as a discipline, and potential metadiscipline (Cope & Kalantzis, 2010, p. 587) has become a significant domain of activity, which demands the full attention of policy and decision makers (Chapman, 2002, p.1) and new educational practices.

This article expands on the findings of a *Knowledge Economy Market Development Mapping Study (KEMDMS)* (Wright, Davis & Bucolo, 2013) commissioned by Queensland Government Arts Queensland in response to a state government *Design Strategy 2020* focus to "build design knowledge and learning" for the 21st century knowledge economy in Queensland, Australia (Queensland Government Arts Queensland, 2009). The study was conducted to identify the scope and value of design education and research program activity from primary schools through to the professional design sector, and garner a direction for future prioritisation and funding to drive market development. For the purpose of this article, design education shall be defined as the teaching and learning pedagogy of 'design thinking', which promotes a holistic, creative and human centred, experimental methodology for the exploration of problems and synthesis of solutions.

This article does not seek to summarise the research study, but instead contextualises key findings including the significance of current design education initiatives, and current and future challenges faced. Design education as a framework for delivering the competencies required for the three defining features of the creative knowledge economy - Innovation, Transdisciplinarity and Networks – is also detailed and discussed. From this, the article then focuses on the role of the tertiary education sector as the central actor in this networked knowledge economy in the development of generic design/design education capabilities. Through the unpacking of the study's three key observation themes for imminent and necessary change, a holistic design education framework is proposed, and further research directions discussed.

International and National Design Education Initiatives

To better understand the nature of design education programs, the *KEMDMS* included a non-exhaustive review of literature and government and resource sector information to provide a summary of key international and national education initiatives. It was found that, increasingly, governments and international organisations are valuing design as a form of knowledge-based capital that can be used to promote innovation and growth (Patricinio & Bolton, 2011; OECD, 2012a) across all sectors, including education. The European Design Leadership Board (European Union, 2012) highlights six different areas for strategic design action towards growth and prosperity, including the education system, indicating a clear trend toward interdisciplinary collaborations between entrepreneurs, researchers and experts in design and intellectual property. To reflect this, tertiary business schools in the US, Europe and Asia have incorporated design into curricula, and in the UK and more recently in Australia, tertiary design faculties and research institutions are forming new programmes outside of traditional discourse towards new services and processes (Design Commission, 2011; Commonwealth of Australia, 2013)

The UK Design Commission's report, *Restarting Britain – Design Education and Growth*, recognises the benefits of design skillsets in providing a framework for critical and creative thinking and encouraging behaviours that unlock practical competences in non-academic students (Design Commission, 2011). However, despite a rich history in design education, reviews of its inclusion in the National Curriculum from 1988, highlight a lack of evidence-based research assessing its impact on national innovation and education systems. As subjects such as computer science, design and technology, and art have become optional appendices to the curriculum in England, Northern Ireland and Wales, this has prompted an unheeded call for an urgent re-evaluation of design education at all levels (Design Commission, 2011; Design Council, 2011).

A recent *Manifesto for the Creative Economy*, released by the UK charity Nesta, recognises that the UK education system has favoured STEM (Science, Technology, Engineering, and Maths) skills over a multi–disciplinary mix of STEAM (including Arts) skills, and has gravely neglected the extensive demand for digital skills (Bakhshi, Hargreaves, & Mateos-Garcia, 2013, p.7). It reiterates the recommendations of the UK Government's Creative Industries Council Skillset Skills Group for a more balanced multi-disciplinary approach to curriculum that fuses artistic interests, technological innovation and entrepreneurial energy (Creative Industries Council Skillset Skills Group, 2011). Scotland however, has maintained a strong commitment to creative education. The Curriculum For Excellence attempts to move towards a cross-curricular and inter-disciplinary approach, placing strong emphasis on enterprise and creativity, along with new forms of continuous assessment (Education Scotland, n.d). With a view to more effectively aligning higher education graduates with the expectation of the creative labour market, in November 2012 a pilot Creative Skillset 'Tick' Scheme funded by the UK Commission of Skills and Employment has resulted in the accreditation of 96 courses in areas such as publishing, computer graphics, advertising, film, media enterprise, and art and design (Bakhshi, Hargreaves, & Mateos-Garcia, 2013, p.103).

Finland is ranked as one of the top-performing countries for the quality of its educational system (OECDb, 2012), and has dramatically improved its global competitiveness since 2005. This is due to the high cultural value placed on design and creativity across all levels of education, industry and practice (Design Commission, 2011) and the social and professional status of teachers. The establishment of the first interdisciplinary university - Aalto University, Helsinki - demonstrates Finland's commitment to fostering interdisciplinary practice at all levels towards national innovation.

In the USA, a number of interesting primary and secondary level education initiatives are exploring interdisciplinary, online/blended teaching modes for personalised learning, integrating design across curricula (Design Commission, 2011, p. 43; Bakhshi, Hargreaves, & Mateos-Garcia, 2013, p.101). *Project H* is an example of using the non-profit sector as a point of engagement, with an objective to activate communities and build creative capital within public education, through design education (Design Commission, 2011, p. 43).

In the Asia Pacific region, Singapore, South Korea, Hong Kong and China are re-examining design education at all levels to ensure the delivery of a workforce for future industry innovation. In Singapore, children are exposed to design education programs in both primary and secondary schools, and 'Design and Technology' is a compulsory subject in lower secondary schools (2011, p.44; Education Commission, 2002; Heskett, 2003). For example, LEAD is a widely used educational platform includes interactive tutorials, games, exploration activities, and assessments in all subject areas, and allows teachers to create customised learning packages (Bakhshi, Hargreaves, & Mateos-Garcia, 2013, p.101).

Comparatively, Australia's educational activities to support the creative economy are limited. While it is well regarded as a high performing country economically, much of this has been attributed to an unsustainable mining sector boom. With the absence of a National Design Policy, Australia is reliant on the acknowledgement by the National Cultural Policy *Creative Australia* that design thinking is "a ubiquitous capability for innovation" (Commonwealth of Australia, 2013, p.90) and that there is a commitment to "ensuring the talent and entrepreneurial drive can be translated into further sustainable business and high skilled jobs" in the Asian century (2013, p.92). However, currently no policy document directly references how these generic skills, behaviours and mindsets will be cultivated through education for future sustainment.

Creative Australia acknowledges that creativity in schools is a vital 21st century skill to drive innovation and productivity (Commonwealth of Australia, 2013, p. 47) and that "creative thinking and design will play key roles in positioning young minds to be innovators" (2013, p.79). It also recognises that "an arts-rich education that starts at school helps young people think critically and develop a strong sense of

identity and self-esteem. It also assists develop future audiences, consumers and creators" (2013, p.77). Currently, design is not delivered as an Overall Performance (OP) Ranking Subject for university entry in schools as part of the National Curriculum. The new Australian Curriculum: The Arts, which will provide a universal arts education for lifelong learning for primary and secondary school students (through access to music, media arts, dance, drama, and visual arts) (2013, p.47), does not explicitly include design, however the new Queensland *Technology Studies* 2013 Senior Syllabus (commencing in 2014) does attempt to address this. Limited aspects of design exist within the syllabuses of Graphics, Visual Arts and in some schools, Industrial Technology and Design (formerly Manual Arts).

Although Australia rated significantly above the OECD average in the 2009 PISA assessments, if indeed "using creativity and design-based thinking to solve complex problems is a distinctive Australian strength that can help meet the emerging challenges of this century" (Australian Government, 2012, p.8), a design-led culture in Australia must be established. This can be achieved by introducing design awareness at a school level and by providing incentives for students and teachers to build innovative pedagogical frameworks that are open, cross- and trans-disciplinary, collaborative learning networks. For this to occur, additionally, the current social and professional status of teachers must change (Hattie, 2010).

Design Education Research Activity

The *KEMDMS* (Wright, Davis & Bucolo, 2013) was conducted as an initial phase with the aim of building momentum for future academic research. Following the review of international and national design programs, and a mapping of information detailing the Queensland education landscape, key targeted stakeholders representing design professionals, government, academia and school teachers statewide, were encouraged to participate in an online survey to gather program information and participant perceptions. This yielded a total of 40 responses (28% response rate) representing all stakeholder groups. Following on from the survey, two focus groups and an in-depth interview involving 15 self-selected survey participants, were conducted to discuss more pointed issues surrounding design education. These were audio recorded and thematically analysed to identify key themes.

The study identified unique challenges in developing educational strategies that can be easily transferred, shared and disseminated across primary/secondary schools. This included regional dissemination via digital technologies in an effort to tackle social exclusion and increase secondary and tertiary enrolment figures, pertinent for effective economic and innovation growth. The study also found that there are no specific known undergraduate strategic design or design leadership courses, or transdisciplinary programs offered.

In addition, the study highlighted 54 curriculum independent (tertiary and National Curriculum) design education/research programs (refer, Appendix 1, Table 4), 14 of which were offered at a regional location (Wright, Davis & Bucolo, 2013, p.31-32). Building on these findings, Table 1 has been created to illustrate the extent to which curriculum independent design education/research activities in Queensland, Australia, deliver on educational objectives. In this table, consideration is given to how these programs deliver on the aforementioned 21st century competences required in domain specific creativity in the scientific/technical and creative/cultural areas, as well as in innovation, transdisciplinarity and networks. This assessment has been made by the authors, based on detailed information on the varying nature and duration of these programs provided by survey participants and outlined in Appendix 1 of the *KEMDMS* (2013, pp. 62-84). Further explanation about how design education delivers the required competences, is provided in the following section 'Design Education in the New Economy'.

	EDUCATIONAL OBJECTIVES				
PROGRAM	**Domain Specific Design Education**	**Creativity Education**	**Enterprise Education**	**Trans-disciplinarity**	**Social networks/ Embeddedness**
Australian Space Design Competition	⊙	⊙	⊙	⊙	⊙
F1 in Schools Program	⊙	⊙	⊙	⊙	⊙
Gold Coast Digital Manufacturing Marine Challenge	⊙	⊙	⊙	⊙	⊙
Unlimited: Designing for the Asia Pacific	⊙	⊙	⊙	⊙	⊙
goDesign Travelling Workshop Program for Regional Secondary Students	⊙	⊙	⊙		⊙
The Edge	⊙	⊙		⊙	⊙
Designing Futures	⊙	⊙		⊙	⊙
Design Minds	⊙	⊙		⊙	⊙
Pimpama State Secondary College	⊙	⊙		⊙	⊙
RACQ Technology Challenge, Maryborough	⊙	⊙		⊙	⊙
Cardboard Chair Pressure Test	⊙	⊙		⊙	
Second Skin	⊙	⊙		⊙	
QLD-Smithsonian (Cooper-Hewitt) Design Museum Fellowship Program	⊙	⊙		⊙	
Year of Creativity	⊙	⊙		⊙	
QLD Academy for Creative Industries (QACI)	⊙	⊙			
QLD Art Teachers Association (QATA) In-service Day Conference	⊙	⊙			
Explore University Day and/or Camp - goDesign Express Program	⊙	⊙			
Asia Pacific Design Library	⊙	⊙			
DATTA 2012 National Conference	⊙	⊙			
Design Thinking in School	⊙	⊙			
Giddy Widdle	⊙	⊙			
Grey Street 2020 goDesign Express Workshop Program	⊙	⊙			
Vibrant City	⊙	⊙			
Widening Participation - goDesign Express Program	⊙	⊙			
Sit-Art 60 Chair Design Challenge	⊙	⊙			⊙
Homegrown 2011: 'life in the slow lane' Exhibition and Workshop Program	⊙	⊙			⊙
KGSC Art + Design School of Excellence	⊙	⊙			⊙
Living City	⊙	⊙			⊙
Design Integration Workshop	⊙		⊙		
Optimism	⊙		⊙		
Centre for Subtropical Design	⊙			⊙	⊙
APDL[1] Lecture Series	⊙			⊙	
Design Futures Hothouse Conference	⊙			⊙	

[1] ADPL - Asia Pacific Design Library, State Library Queensland

PROGRAM	EDUCATIONAL OBJECTIVES				
	Domain Specific Design Education	**Creativity Education**	**Enterprise Education**	**Trans-disciplinarity**	**Social networks/ Embeddedness**
The Window Project	⊙				⊙
The Stitchery Collective	⊙				
KGSC Engineering Technology School of Excellence	⊙				
AGDA Annual CPD Program	⊙				
AIA Annual CPD Program	⊙				
AILA Annual CPD Program	⊙				
Creative Business Benchmarker	⊙				
Design Awareness Talks	⊙				
DIA Accredited Designer™	⊙				
DIA Annual CPD Program	⊙				
Experience 2012 National Architecture Conference	⊙				
Urban Design Alliance Forums	⊙				
Creative[3]		⊙	⊙	⊙	⊙
CCI ARC Centre of Excellence for Creative Industries & Innovation		⊙	⊙		
Out of the Box Festival (OOTB)		⊙			
QAGOMA Children's Art Centre Program		⊙			
Origami		⊙		⊙	
Flood of Ideas – School of Ideas Competition		⊙		⊙	
TEDx Brisbane			⊙	⊙	⊙
Ulysses: Transforming Business Through Design			⊙	⊙	⊙
Design Integration Workshop Program			⊙		

Table 1: Extent to which curriculum independent design education and research activities in Queensland, Australia, deliver on the creative economy educational objectives.

It is evident from the table, that the vast majority of design education/research activities directly reference domain-specific creativity for scientific/technical or creative/cultural development, and over half are utilised for creativity education. Less than half the programs (21) represent truly transdisciplinary activities involving the intersection of two or more of the three Scientific/Technical, Creative/Cultural, and Business knowledge realms. Of these, half were professional development programs and the remainder were delivered in primary/secondary schools. The utilisation of face-to-face or online embedded social networks, which include collaborators outside the core discipline domain, could be better facilitated in design education programs (20), however it can be argued that as a human-centred practice, all design activities rely on this capability. Distinctively, it is evident that many design education activities fail to effectively integrate enterprise education. This represents an area for future development.

Evidence of the Value of Design Education and Research

In reviewing the outcomes of the *KEMDMS*, evidence of program success varied dramatically, from anecdotal accounts through to rigorous documented activities, including web presence and publications. It was found that design education and research programs in Queensland have had beneficial impacts.

Moreover, the findings demonstrate that the involvement of various stakeholders in these programs has been a catalyst for change in the following ways:

- Providing professional development, inspiration and reinvigoration for teachers
- Motivating school students to aspire to gain tertiary qualifications
- Involving community in school and university activities
- Realising the importance of design exposure in rural areas
- Realising the importance of self-directed and life-long learning
- Providing professional development, inspiration and reinvigoration for professional designers
- Inspiring new enquiry-based and industry-based learning, and teamwork in the classroom
- Changing business strategy
- Inspiring school wide curriculum and pedagogical frameworks
- Realising the impact of design research on regional positioning within a global context

In addition, a number of common themes emerged from the qualitative statements made by participants in regards to the benefits of design education and research programs in Queensland. Building on this work, the themes have been summarised alongside the 21st century competencies for the creative knowledge economy (Table 2*).* Refer also to Appendix 2 Table 5 for examples of the qualitative statements relating to each of these themes (Wright, Davis & Bucolo, 2013, pp.33-39).

Design Education and Research Program Benefit	**21st Century Competency**
Inspiring active citizenship, leadership, responsibility and advocacy to evolve business and address global challenges	Transdisciplinarity Innovation (Entrepreneurship/business education)
Involving, strengthening and creating vibrant, creative communities through youth and community engagement in decision making for future development	Domain-specific design education Social Networks Innovation (Creativity education) Innovation (Entrepreneurship/business education)
Transformative, purposeful, authentic and engaging learning environments providing new experiences, networks and career pathways	Transdisciplinarity Domain-specific design education Social Networks Innovation (Creativity education) Innovation (Entrepreneurship/business education)
Valuing process, learning-by-doing, communication and collaboration, over definitive outcomes	Domain-specific design education Innovation (Creativity education) Social Networks
Creating broader social, cultural, environmental and political awareness and understanding	Transdisciplinarity Social Networks
Providing tools for positive thinking, critical reflection and developing curiosity and attitudes towards lifelong learning	Transdisciplinarity
Building empathy, confidence, motivation and social inclusion through engagement around knowledge application	Domain-specific design education Transdisciplinarity Social Networks

Table 2: Benefits of Design Education and Research Programs

Design Education in the New Economy

Whilst there has been considerable discourse on the role of education systems in the creative knowledge economy (see for example Araya & Peters, 2010), this article centres specifically on the consideration of a design as a framework, to deliver 21st century competencies required for the three defining features of the creative knowledge economy – Innovation, Transdisciplinarity and Networks.

We live in an era of participatory culture (Haythornthwaite, 2009), in which there are "growing numbers of people who are Designers by persuasion but not profession" (Cope and Kalantzis, 2010, p.597). An "epochal shift in the balance of agency" (2010, p.590), influenced by economic, social and technological change, means that consumers have shifted from citizens of compliance, to "prosumers" (Toffler, 1980), and traditional delineations between the sciences, the humanities and design are being blurred, creating

new hybrid professions and knowledge. Design can be viewed as "a fundamental category of meaning making" and therefore conceived of as a metadiscipline, in which the principles and practices of design become a central concern to every discipline (Cope and Kalantzis, 2010, p.597). To facilitate this, new educational practices must be implemented.

In order to create social and economic value, designers utilise skills and knowledge from four domains of science and technology, design, art and hermeneutics (Roos, 2012), as well as business. Consequently, a design framework for education aligns well to a transdisciplinary approach. Nicolescu (2002; 2005, p.143) proposes that transdisciplinarity transcends disciplinarity and uses collections of methods and their associated bodies of knowledge as required by the pursuit of the broader goal, concerning itself with what is *between* the disciplines, *across* the disciplines and *beyond* the disciplines. It is a new type of integral intelligence, "founded upon the equilibrium between mind, body and feelings" (2005, p.155). If a design framework is utilised as a vehicle for transdisciplinarity however, it assumes that the differentiating designerly practice of 'framing' or "the creation of a (novel) standpoint from which a problematic situation can be tackled" (Dorst, 2011, p.525), is inherent as a generic competency in a social network. It recognises that designers, building upon induction, problem solving and analytical reasoning, add additional value to knowledge production by exercising an 'open' and complex productive reasoning pattern of 'Abduction-2'. This is focused on only the end value to be achieved without knowing the 'how' or the 'what', and therefore reliant on both the creation of a 'working principle' and a 'thing' (object, service, system) in parallel (2011, p.525).

Hearn and Bridgstock (2010, p.102) argue that the core of the creative knowledge economy is innovation, which they define as the formation of new knowledge, subsequently converted into valued products, services or processes. As such, this requires both creativity and business/enterprise education. Creativity education is understood as being "little c" capabilities involved in problem solving and identification, such as synthesis of existing knowledge (McWilliam, 2008; Robinson, 2007). Entrepreneurship training requires the theoretical knowledge and practical skills to set up and run a business, and related to business growth, marketing, and management. In addition, qualities or behaviours such as entrepreneurial drive, competitiveness, optimism, risk-taking, flexibility and leadership, need to be cultivated. Capacity building is optimised when the social nature of creativity is emphasised, and domain-specificity and authenticity is maximised in learning and assessment tasks, encouraging transferability to the workplace (Hearn & Bridgstock, 2010, p. 104-105). These skills, behaviours and mindsets correlate well to the benefits of design education programs outlined in Table 2. Utilising the definition of design as the link between creativity and innovation, as provided by the *Cox Review of Creativity in Business* (Cox, 2005, p.2), it is evident that design education will deliver on the 21st century competencies demanded by innovation, however this may involve a more concerted effort in integrating enterprise education.

In regards to networks, it is evident that due to evolving digital technologies, future citizens will be hyper-connected and engaged with embedded social networks as a natural extension to the everyday. Whilst there is an understanding about the network mechanisms that are responsible for generating social capital, and the nature of connections in networks, there is little documentation about the nature of individual relationships in the social network, and therefore the skills and abilities required to develop and manage social networks for innovation (Hearn & Bridgstock, 2010, p.108). Design, by nature, is human-centred, project-based and work-integrated. As such, it offers opportunities for students to better understand the implications of working in a hyper-inter-connected world. It also enables them to develop an awareness of the ingredients required for successful innovation, including the skills of communication, teamwork, and interpersonal skills, in both face-to-face and online relationships.

It is clear that many current design education programs seek to unite industry (including peak bodies), academia and schools in accordance with The National Education Agreement that "recognises that high-quality schooling supported by strong community engagement is central to Australia's future prosperity

and social cohesion" (Commonwealth of Australia, 2013, p.77). Moreover, it is apparent that all stakeholders rely on the tertiary education sector as a point of intersection and congruence for design education, as it plays an important role in facilitating the connections between education (schools, higher education and vocational education/training), theory (academia), and practice (design industry) (Wright, Davis and Bucolo, 2013). The tertiary education sector, therefore, has a central role to play in not only leading research in the knowledge area of social networking capability, but also in furthering the development of a design framework for the creative economy and generic design/design education capabilities.

Managing the needs of stakeholders across sectors and disciplines is complex and to date little attention has been paid to the role of each education stakeholder in the delivery of 21st century competencies. Figure 1 illustrates the current relationship between stakeholders in the Australian Education System (Australian Government, n.d). Clear methods or processes for managing and implementing a design education framework across (and between) sectors, disciplines and stakeholders, are urgently needed.

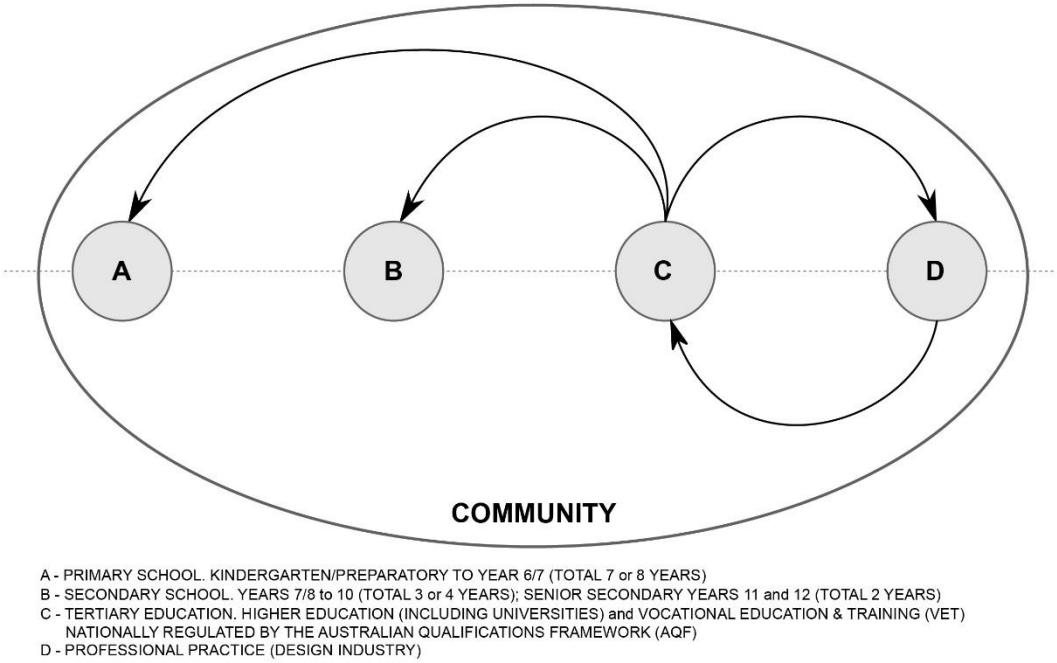

Figure 1: Understanding community, government and industry connections.

Utilising the key observation themes from the *Knowledge Economy Market Development Mapping Study*, the following section unpacks three areas where change is imminent and necessary (i) upskilling and training educators, (ii) learning beyond the classroom, and (iii) responsibility and accountability.

Upskilling and Training Educators

The rigid and unwieldy discipline-based department/faculty structures of universities and their associated funding models, make it difficult for transdisciplinary initiatives to be institutionally mandated, planned, delivered and assessed. In addition to this, the differing perspectives and languages maintained by different disciplines, is not conducive to cross-disciplinary communication or collaboration (Hearn and Bridgstock, 2010, pp.106-107). Similarly, the use or implementation of design or design thinking as a school-wide pedagogical framework has not been widely tested because current National Curriculum benchmarks seek to promote individual performance and discipline content

specification, limit autonomous innovative curriculum development by teachers, and negate the broader requirements that are needed for a holistic educational experience. This makes it difficult for teachers to see the relationship between the current benchmarks and the benefits for the student.

Preparing creative citizens for the 21st century will require educators at all levels to provide both face-to-face and online programs which not only provide solid disciplinary grounding in the three key knowledge realms in parallel, but also navigate the peculiarities of disciplinary dialogue. It will require educators to be cognisant of the workings of the labour market and the broader characteristics of the creative knowledge economy (Hearn and Bridgstock, 2010). Educators will also be required to shift their attention from "content delivery to capacity building, from supplying curriculum to co-creating curriculum, from supplying education to navigating learning networks" and to shift student attention from "their own individual performance to their capacity to learn through their own networks – to connect, access information and forge relationships in and through dynamic and productive teams" (McWilliam and Haukka, 2008, p. 23). No longer is a risk-minimising, student-protective environment and formulaic approach conducive to learning for optimising creative capacity.

For this shift to occur, educators at all levels and from all disciplinary backgrounds, will need to develop the necessary professional capacities to be able to embed the theories and practices of design, with a greater focus on enterprise education, in pedagogy. Professional development programs run by the government, cultural institutions or tertiary education institutions, in consultation with peak industry bodies, will be necessary to facilitate engagement with design and entrepreneurship at a curriculum level in, and beyond the classroom, as well as through online community networks in regional areas.

Changes to tertiary pedagogies for primary and secondary teacher training will be required to ensure the theories and practices of design are incorporated. Integrating design thinking across subject areas in primary and secondary education requires the development of new regimes for authentic assessment of creative capacity.

In all, it is proposed that, with policy and institutional support for the development of design education, stakeholder buy-in, innovative funding models, and institutional reorganisation, this shift can be achieved through four stages of implementation - (Stage 1) new models of engagement, (Stage 2) changes to tertiary pedagogies (Stage 3) government and peak body support, and (Stage 4) new assessment methods. Table 3 illustrates each stage, including stakeholder requirements and level of involvement. The stages can be implemented independently or simultaneously. Fostering an open and transparent model of development is important, to help to ensure engagement with broad stakeholder networks.

STAGE	**INCLUDES**	**STAKEHOLDER INVOLVEMENT**
Stage 1: New models of engagement	New models of engagement between education sectors in potential disciplines of business, science, education, design and creative industries need to be investigated and led by the tertiary sector.	Tertiary sector, focusing on the trialling of methods through which transdisciplinary practice can be embedded into future programs, including teacher training.
Stage 2: Government and peak body support	Governments, with the support of the peak industry bodies, need to participate in the development of new models of engagement. Government and industry backing will provide an avenue for better access to the professional design industry, and authentic learning opportunities	Relevant local and state governments. Peak bodies such as (but not limited to) – Design Institute of Australia (DIA), Australian Graphic Designers Association (AGDA), Australian Institute of Architects (AIA) and the Interior Design Educators Association (IDEA).

STAGE	INCLUDES	STAKEHOLDER INVOLVEMENT
Stage 3: Changes to tertiary pedagogies	Changes to tertiary pedagogies for primary and secondary teacher training will ultimately be required to include design. Changes to tertiary pedagogies for transdisciplinary practice Demonstrating to teachers that design-based learning does not require extra work.	Tertiary sector, focusing on teaching university-wide programs and evolving these to ensure 'design' and transdisciplinary practice is embedded and forms a critical part of the teacher training process
Stage 4: New assessment methods	Integration of design thinking across subject areas in primary and secondary education and transdisciplinary practice will require the development of new regimes for authentic assessment for creative capacity building, in order for educators to feel comfortable using this mode of learning.	As illustrated in Figure 1, this will involve collaboration between the primary, secondary and tertiary education sectors and possibly industry/community.

Table 3: Upskilling and training educators – stages of implementation

Learning Beyond the Classroom

This article considers the emergence of a "new landscape of learning" (Bentley, 1998), embracing a process of meaning making in "*learning to become*" which considers "social, distributed and networked dimensions" and the "broader economic and technological landscape" in which the learning occurs (Brown, 2010, p. xi-xii). The future learning model must be flexible, adaptable, scalable, inclusive and collaborative.

A holistic design framework provides challenges and opportunities to develop creative and innovative methods to facilitate stakeholder engagement. It requires educators, in facilitating the development of social network capabilities for innovation, to provide appropriate scaffolding for individuals and teams to practice behaviours, which optimise team performance. Expanding networks and increasing the transdisciplinary nature of education across all levels is reflective of current changes occurring in the design industry. New models of engagement between the secondary and tertiary education sectors provide an opportunity to expand dialogue and disciplinary engagements between business, education, science, design and the creative sectors in both areas of research and practice.

Figure 2 details a proposal for a learning environment model. This model provides a graphical distillation of the three key qualities outlined earlier - (1) Innovation, (2) Networks and (3) Transdisciplinarity, as well as sub elements within each of these qualities. In this model, the learning environment is variable because learning can occur in authentic contexts off campus, or in the traditional classroom. Further, by focusing the model on the 'environment' and not on other factors, it can be scaled and applied to various learning contexts. This model can be applied across all levels of education including primary, secondary, and tertiary as well as professional development.

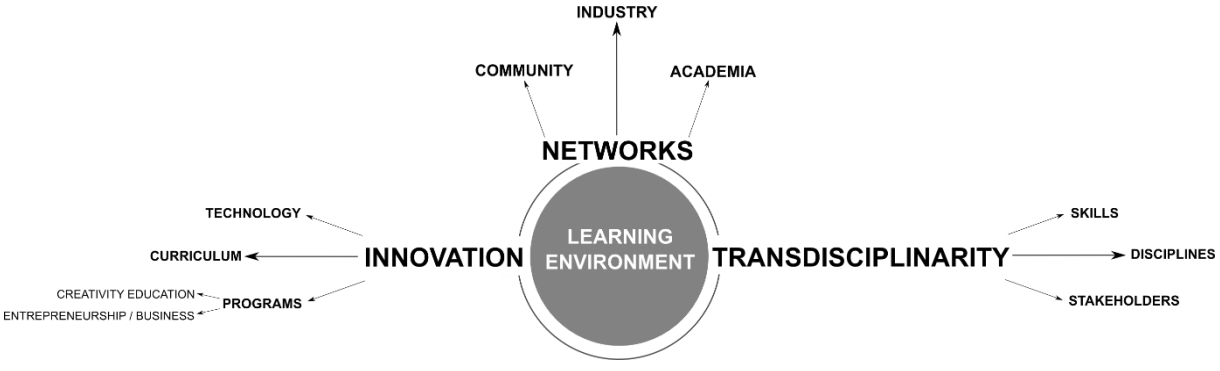

Figure 2: Learning environment model

Responsibility and Accountability

In this time of significant social change and "shift in the balance of agency", design theory and practices are acquiring greater social significance and larger imperatives (Cope & Kalantzis, 2010, p. 593), increasing the scope of negotiation and approaches, which anticipate indefinite possibilities (2010, 595). Therefore, the fundamentals of design, as well as the scope of everyday professional practices, need to be reconsidered. Not only do designers need to bring the skills and knowledge from four domains of science and technology, design, art and hermeneutics, and "master an art of human engagement based on ethics and care" (Friedman, 2012, p.146), they also require an acute understanding of the economy and business practices. Designers need these skills in order to participate effectively in transdisciplinary knowledge production. This also brings with it a required rethink about design education at all levels.

Moving forward, it is important to identify the supporters of this transition (to a knowledge economy that is rich in creative potential), and to identify who is responsible and accountable to enact this cultural change. Without policy support to prioritise design education, at all levels, as a critical economic imperative and educational objective, funding issues in the current economic climate present challenges. However, it is evident that advocates and stakeholders are committed to ongoing development of programs. Figure 3, provides a visual representation of the engagement, funding and documentation opportunities and potential sources in relation to the model profiled in Figure 2. In terms of responsibility and accountability, ultimately, this would be determined by the various agencies through which funding is sourced. Moreover, for the model proposed in Figure 2 to be successful, all stakeholders must be equally invested in the program across each level (i) funding, (ii) documentation and (iii) engagement.

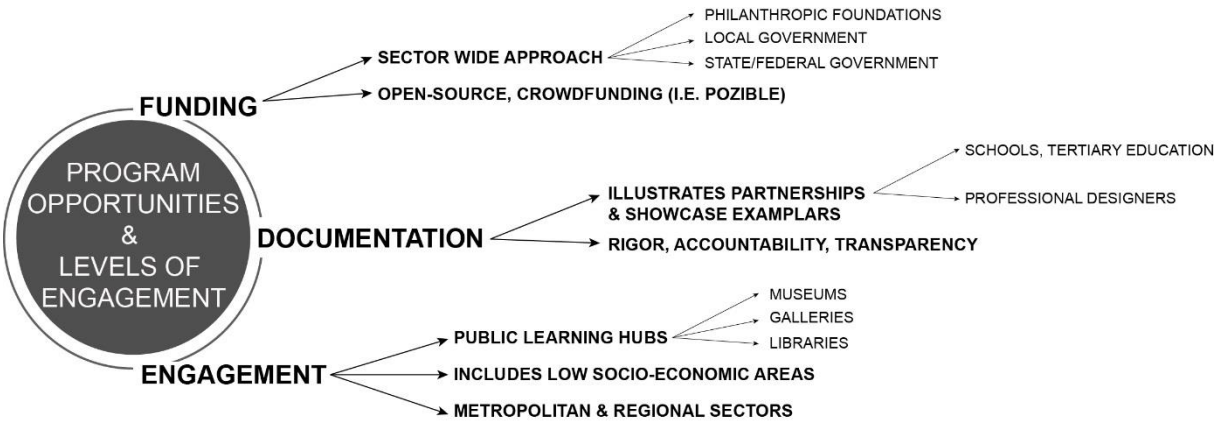

Figure 3: Program opportunities and levels of engagement

Concluding Remarks and Future Research

Demand for new modes of education that facilitate the development of 21st century competencies has never been greater. New economic systems, founded on knowledge and creativity as commodities, will continue to shape the evolution of industrialised and technological systems, as well as the way in which information is disseminated and exchanged. Globalisation and the rapid diffusion of advanced technologies have forever changed traditional practices. Therefore, methods and practices of teaching and learning must also be rethought and redesigned.

A review of literature makes clear that there are many international examples of embedded design educational practice, however, the uptake of this approach in Australia, is limited. It is evident given future global challenges (sustainability, inclusive design and globalisation) that Australia must look to other developed nations for examples of innovative educational practices. In seeking to foster an innovative, prosperous and advanced nation that is capable of meeting global economic imperatives, generic design capabilities must be embedded at all levels of education, including professional

development. Consequently, educators must be up-skilled in creativity and enterprise education and the transdiciplinary navigation of embedded social networks, and professionals must also engage in on-going (life long) learning that fosters the continuous development of critical, reflexive and networked creative and entrepreneurial capacities. The tertiary education sector is a key stakeholder in steering the development of generic design/design education capabilities.

In a bid to meet these challenges, the authors outlined a holistic design education framework that can be used as a guide to deliver 21st century competencies. This includes a learning environment model (Figure 2) that provides an outline of the challenges and opportunities for developing innovative methods to facilitate stakeholder engagement. Specifically, the model centres on the distillation of the three key qualities of the creative economy (1) Innovation, (2) Networks and (3) Transdisciplinarity – each of which demand the facilitation and development of creative capacities necessary for 21st century competency (see also Table 2). The success of this model is dependent on its scalability and transferability to other contexts and disciplines.

The next stage of this research will involve further development of Table 1. This process will involve expanding the study to provide detailed mapping of international design education programs against the 21st century competences required in domain specific creativity in the scientific/technical and creative/cultural areas, as well as in innovation, transdisciplinarity and networks. While, this article and the research study that preceded it, has been primarily focused on the value of design education as a framework for delivering the competencies required for the creative knowledge economy, further research is required to provide an objective view on the possible shortcomings of a design framework as a driver of economic growth. It is anticipated that this future research will provide new insights and knowledge surrounding the application of design education programs on a global level. Providing a detailed understanding of the conditions and requirements for future design education programs is an important first step in fostering the global educational change that is needed for future productivity and social innovation in the creative economy.

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Appendix 1

Table 4: Curriculum independent design education/research activities in Queensland, Australia (adapted from Wright, Davis & Bucolo, 2013, p.31-32)

	LEVEL OF ENGAGEMENT				
PROGRAM	**Primary**	**Secondary**	**Tertiary**	**Post-grad/ research**	**Industry/ CPD**
Asia Pacific Design Library (APDL)	⊙	⊙	⊙	⊙	⊙
Design Minds	⊙	⊙	⊙	❁	⊙
Second Skin	⊙	⊙	⊙	❁	
QLD Art Teachers Association (QATA) In-service Day Conference	⊙	⊙	⊙		⊙
Unlimited: Designing for the Asia Pacific	⊙	⊙	⊙		⊙
The Stitchery Collective	⊙	⊙	⊙		
Designing Futures	⊙	⊙		❁	⊙
QAGOMA Children's Art Centre Program	⊙=	⊙=			⊙=
Explore University Day and/or Camp - goDesign Express Program	⊙	⊙			
F1 in Schools Program	⊙=	⊙=			
Flood of Ideas – School of Ideas Competition	⊙	⊙			
Year of Creativity	⊙	⊙			
Origami	⊙	⊙			
Gold Coast Digital Manufacturing Marine Challenge	⊙=	⊙=			
QLD-Smithsonian (Cooper-Hewitt) Design Museum Fellowship Program	⊙=	⊙=			
RACQ Technology Challenge, Maryborough	⊙=	⊙=			
Giddy Widdle	⊙=				
Design Awareness Talks	⊙				
Design Thinking in School	⊙				
Out of the Box Festival (OOTB)	⊙				
The Edge		⊙	⊙	⊙	⊙
KGSC Art + Design School of Excellence		⊙	⊙	⊙	
KGSC Engineering Technology School of Excellence		⊙	⊙	⊙	
DATTA 2012 National Conference		⊙=	⊙=	⊙=	
Living City		⊙	⊙		⊙
Homegrown 2011: 'life in the slow lane' Exhibition and Workshop Program		⊙	⊙		⊙
Sit-Art 60 Chair Design Challenge		⊙	⊙		⊙
Grey Street 2020 goDesign Express Workshop Program		⊙	⊙		
goDesign Travelling Workshop Program for Regional Secondary Students		⊙=		❁	
Pimpama State Secondary College		⊙=			
Australian Space Design Competition		⊙=			
Cardboard Chair Pressure Test		⊙			
Vibrant City		⊙			
QLD Academy for Creative Industries (QACI)		⊙			
Widening Participation - goDesign Express Program		⊙			
Design Futures Hothouse Conference			⊙	⊙	⊙
The Window Project			⊙		
CCI ARC Centre of Excellence for Creative Industries & Innovation				⊙	
Centre for Subtropical Design				⊙	
Creative Business Benchmarker				⊙	
Design Integration Workshop					⊙
Design Integration Workshop Program					⊙=
DIA Accredited Designer™					⊙

	LEVEL OF ENGAGEMENT				
PROGRAM	**Primary**	**Secondary**	**Tertiary**	**Post-grad/ research**	**Industry/ CPD**
DIA Annual CPD Program					⊙=
Experience 2012 National Architecture Conference					⊙
Optimism					⊙
TEDx Brisbane					⊙
Ulysses: Transforming Business Through Design					⊙
Urban Design Alliance Forums					⊙
Creative[3]					⊙
AGDA Annual CPD Program					⊙
AIA Annual CPD Program					⊙=
AILA Annual CPD program					⊙=
APDL[2] Lecture Series					⊙

֍ *Designing Futures*, *Design Minds*, *Second Skin* and *goDesign* are linked to research programs and/or projects. Dissemination of work surrounding these activities is currently in development and/or press.

⊙= Program offered at a regional location (For the purposes of this study a regional location will be noted as a location outside the greater Brisbane metropolitan area which includes the Logan, Redland, Moreton Bay and Ipswich local government areas).

[2] ADPL - Asia Pacific Design Library, State Library Queensland

Appendix 2

Design Education & Research Program Benefit	**Participant Feedback**
Inspiring active citizenship, leadership, responsibility and advocacy to evolve business and address global challenges	*We are a new convert. We've been at it a year. We haven't made a single product. But what we have done is change our thinking. And we are working from the ground up, with a designer as part of our team, to really add value so that manufacturing can continue in Australia. Keith Yamashita from SY Partners made a wonderful statement about designers and CEOs. He said they are actually the same thing. "They vision the future that does not yet exist and they remove the obstacles until it can". Let's do it together.* (CEO Participant, *Ulysses: Transforming Business through Design*, National Design Policy Forum, 2012) *Because of the mining and rise in population, the council is doing a lot of work to refurbish the town and streets, so now the council is looking for new ideas for the town to become more of a community. With the things we've learnt we can go home, use design, and go to the council and say "we could do this", and then that could lead to a future job as well.* (Student Participant, *goDesign*, Chinchilla, 2010)
Involving, strengthening and creating vibrant, creative communities through youth and community engagement in decision making for future development	*The three days participation in the Living City program was one of the experiences that opened my mind. I worked (in) a team to discuss ideas in areas of interior design and architecture in order to make our city a better place to live. I learnt not only about designing but also to explore the sites and to develop thoughts on environmental and social issues.* (Student Participant, *Living City*, 2010)
Transformative, purposeful, authentic and engaging learning environments providing new experiences, networks and career pathways	*The program exposes students to a range of professions, life roles and active citizenship involving leadership, sensitivity, responsiveness and advocacy. Students learn that responsibility is an essentially creative endeavour and is empowering. Participation in Living City has intrinsically motivated students by validating the artistic process as a purposeful and transformative cultural practice. Students have found tangible and practical applications for their aesthetic skills in the service of communities. Professional pathways have been revealed to students, informing their choices and directing more accurately their inquiries in their own art practice. Teaching in the classroom has become more enquiry based whereby students use aesthetic and artistic processes to construct knowledge for themselves. I have implemented the genre of resolved proposal drawing as a thinking and design tool to synthesise research and development.* (Art & Design Teacher, *Living City*, 2010) *Within the current school system, there is no subject that allows students to explore, and unite these areas of study. Due to the experiences Living City gave me, I am keenly interested in studying Urban Design. And I am now aware of the university courses available and the potential work/career options available.* (Student Participant, *Living City*, 2010)
Valuing process, learning-by-doing, communication and collaboration, over definitive outcomes	*Participation in 'Generation' has provided a model of best practice for teaching the creative process, design and problem solving. 'Generation' has invoked deep questioning of the relevance of learning processes and curriculum.* (Teacher Participant, *Unlimited Generation* and *Learning by Design Workshop*, 2010) *Designing is not all about the end product. Designing is looking at solving problems of the world. Visual, verbal, and writing thinking. Interacting and sharing ideas.* (Student Participant, *Generation Workshop*, 2010)
Creating broader social, cultural, environmental and political awareness and understanding	*It has provided me practical experience, looking into how a project works, with its concepts and elements, as well as trying out for myself to look at things in a design way, to design for others. I've enjoyed discussing the social and psychological elements of designing and enjoyed putting meaning into a work. How it affects people's mood, how it chooses its customers and attracts specific types of people. It has showed me a more complex and deeper understanding of society which I didn't think was involved in retail and hospitality…* (Student Participant, *Sit-Art 60 Chair Challenge*, 2012)
Providing tools for positive thinking, critical reflection and developing curiosity and attitudes towards lifelong learning	*I think overall, the goDesign workshop was very beneficial for rural settings. What it provides for student is a multitude of elements that can contribute to their life, and allows secondary students to think more and seek more.* (Tertiary Student Facilitator, *goDesign*, Chinchilla, 2010) *The activities have given me a different way of thinking because it shows that nothing is impossible, if you have a mind block you can come back and you will work out a way to do it.* (Student Participant, *goDesign*, Chinchilla, 2010)
Building empathy, confidence, motivation and social inclusion through engagement around knowledge application	*The Middle School Design-All-Day program provided a laboratory to test the effectiveness of design approaches, as well as the 'futures' framework. It was clear that with the activities framed in an appropriate and engaging way, students worked with confidence and responded imaginatively to these quite challenging themes. Again, the opportunity to work with design mentors provided an authentic context. Success was measured by the effectiveness of teamwork and the quality of the ideas generated in a comparatively short time rather than by the usual 'performance' values. This was a model that could be applied in our practice in many other contexts.* (Teacher, *Designing Futures*, 2011)

Table 5: Benefits of Curriculum Independent Design Education and Research Programs in Queensland, Australia (adapted from Wright, Davis & Bucolo, 2013, p.33-39)