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Creativity-based assessment and neural understandings

A discussion and case study analysis

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Abstract

Purpose – Enabling entrepreneurial creativity is a key aim of UK Government; however, there is a dearth of constructively aligned models of teaching and assessment. This paper aims to introduce design-based pedagogies and to highlight cognitive approaches that develop innovative mindsets; it seeks to indicate their propensity for adoption in entrepreneurship education.

Design/methodology/approach – A literature review plus empirical evidence from pedagogical approaches developed through the extended collaboration of specialists in creative design, financial management and brain-related occupational therapy inform this paper.

Findings – Neuroimaging studies challenge the thesis that learning for creative output is entirely algorithmic; diverse ideas occur when the brain's right cortex has opportunity to bring its findings to the fore, usually via "relaxed cognition". Design-based entrepreneurship pedagogies embed these concepts.

Research limitations/implications – The paper offers initial insights into how these understandings can be applied in transdisciplinary entrepreneurship-education contexts.

Practical implications – Predicable assessment outcomes equal predictable students; which needs more working practices, behaviours and cultural environments that encourage innovation. Any educational environment that excludes these understandings is inherently flawed.

Social implications – The case study/project "Free time is thinking time" implies that traditional 9-5 working practices are inappropriate for creative mindsets.

Originality/value – This paper links emerging bodies of evidence; it provides a first response to calls for a more creative enterprise curriculum and offers constructively aligned assessment.

Keywords Assessment, Neurology, Entrepreneurialism, United Kingdom

Paper type Research paper

Introduction

As enabling entrepreneurial creativity is a key aim of UK Government (Brown *et al.*, 2008; Prisk, 2010), this discourse develops an embryonic area of research (Penaluna and Penaluna, 2009) and suggests a means by which entrepreneurship educators can effectively evaluate and assess creative capacity in the context of entrepreneurship. It has been argued that there are few models of good practice and that there is a dearth of literature to guide the development of assessment systems (Pittaway *et al.*, 2009). However, Carey and Matlay's (2008) study into assessment strategies within the creative disciplines suggests a propensity for transferability into more generic

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enterprise education. Their introductory foray into this area concludes that, "Assessment techniques, specifically the assessment of ideas, could be transferred to the teaching of enterprise and entrepreneurship" (Carey and Matlay, 2008, p. 11). Taking into account that the Global Education Initiative has called for people who "think outside of the box" (GEI, 2009, p. 12) and that business school entrepreneurship educators have called for a paradigm shift for educators to develop right brain entrepreneurial (creative) skills, as well as left brain analytical skills (Chia, 1996, Kirby, 2003, Nieuwenhuizen and Groenewald, 2004), we see that "whole brain" techniques that develop both right and left-brain "joined up" cognitive approaches are needed (Bragg, 2005; Brodie and Laing, 2007; Herrmann, 1996; Pink, 2008).

Whole brain processes are integral to the teaching styles employed within disciplines generally categorized under the umbrella of "design", a subset of the creative industries art and design disciplines, where cognition styles develop innovative solutions and lead creative/conceptual development. Testing assumptions and assuring that the "visionary" has an idea that can be realized and sustained, is conversely, the more comfortable and well-established domain of business education. In this paper we claim that there is potential for better integration of the two mindsets, as is evidenced in what the advertising industry calls "Diagonal thinking" (IPA, 2009). It therefore follows that enterprise and entrepreneurship educators need to consider the pedagogical implications inherent in these approaches, ones that have served creative arts education for the past century or more (Clews, 2007). Moreover, it is generally understood that institutional environments tend to kill rather than nurture creativity (Amabile, 1998), yet the recent CMI/NESTA (2009) report "Innovation for the recovery: enhancing innovative working practices" (p. 3) considers creativity to be "critical to success ... often a requisite for survival", proposing that we need to adopt "the right working practices". The call is echoed by influential management thinkers such as Charles Handy (2010, p. 36) who observes that, "Creativity is now the key requirement for any organisation ... creativity gives an organisation its critical edge".

As it is the remit of entrepreneurship educators to develop educational frameworks that are based in highly institutionalised environments, and are constrained by guidelines that have to respond to predictive and process-driven course validation frameworks, we see some first hurdles. "Creativity and predictability are an anathema to one another and the dichotomy has highlighted significant challenges to this way of thinking" (Penaluna and Penaluna, 2009, p. 718). See also Jackson *et al.* (2006). Therefore, in a landscape where clear theoretical foundations are needed (Pittaway and Cope, 2006), we postulate that the nature and type of thinking inherent in creative industries education needs to be better understood by entrepreneurship educators.

Background and context

The Cox Review of Creativity in Business (2005) spearheaded a new chain of thought in the UK and is evolving in an international context. At the UK Competitiveness Summit (2006), Cox acknowledged the contribution that design can make across all levels of business, from management strategies to issues of communication. Concurrently, in September 2005, a team of lecturers launched a new type of advertising degree at Swansea Metropolitan University; one that encompassed business and marketing skills in the context of a creative art and design environment. This partnership

between a business school and a faculty of art and design has led much of the thinking discussed here.

This team became involved in a NESTA/ADM-HEA project (Clews, 2007) whose findings indicated that arts educational environments have significant resonance with the aspirations of enterprise education and that "traditional" pedagogies for delivering business acumen for the creative sector are inappropriate (Kellet, 2006; Leadbeater and Oakley, 2001; Penaluna and Penaluna, 2005; Rae, 2004; Raffo *et al.*, 2000). Notably, NESTA (2009) responded by launching a bespoke educational "toolkit" for enterprising creatives.

Most pertinent to this discussion are the following conclusions from the report:

- "Art, design, media, architecture and performing arts share core characteristics in their pedagogies … the learning is occupational … characterised as practice-based because much of the learning is situated in practice-like situations where students learn-by-doing in situations that replicate real-world situations" (Clews, 2007, p. 10).
- In 15 student focus groups' aspirations, "45 per cent anticipated that they will start a business or work as freelancers in their industry sector" (Clews, 2007, p. 8).
- "Graduate prospects" of April 2006 indicated a low 2.1 per cent of graduates who entered self employment with six months of graduating but that within that figure, 9.3 per cent of design graduates are self employed within the same period (www.prospects.co.uk in Clews (2007, p. 8).

Our paper will take the reader through our arguments in an evolving narrative. First we will overview our methods, then move on to consider the discipline of design, making comparisons between the aims and educational constructs of design with those of the emerging entrepreneurship pedagogical landscape. This will be followed by a short review of an established design-based assessment method and the neurological understandings that underpin it. Finally, we will introduce a case study that illustrates the development of students' bilateral brain processes. This is intended to help the reader locate the thinking within a practical project-based educational environment, and to provide opportunity to consider ways and means by which the theoretical model could be adapted to their own educational environments.

Methodology

In a paradigm of transdisciplinary discussion (Ramsden, 2008), we have drawn together the extended experiences of three educators; a creative from the design disciplines, an ex-banker/enterprise manager and an occupational therapist specializing in brain disorders and injury. As knowledge about hemispheric functionality has come almost exclusively from "Once-normal individuals, whose brains have been damaged by a stroke, missile wound, an accident or a tumour" (Gardner, 1982, p. 280), a primary aim of the paper is to offer the reader an insight into the understanding gained through this extended collaboration, one which has emerged during 25 years of preparing students for "creative" entrepreneurship opportunities. The paper takes a heuristic approach (Gigerenzer and Todd, 1999), as knowledge is becoming increasingly accessible through new and emerging media

(Pink, 2008). Our text also responds to calls for "practical papers" with exemplars that educators can adapt and take forward, by using pedagogic approaches from the BA (Hons) Design for Advertising programme at Swansea Metropolitan University as its fulcrum. The findings are underpinned by an extended literature review that incorporates design, creativity, cognitive neurology, and enterprise research, further informed by national and international educational and alumni networks. Penaluna and Penaluna have developed creativity enabling strategies in the curriculum that have been guided by Coates' expertise in neurological understandings - gained from her training of colleagues and working directly with patients with brain disorders and injury. These approaches have also been considered in the context of recommendations from stakeholders within and beyond the entrepreneurship agenda, specifically those who wish to enhance individual creative capacity (Cox, 2005; DCMS, 2008; de Bono, 1996; Florida, 2002; Florida and Goodnight, 2005; GEI, 2009; Herrmann, 1996, McWilliam, 2008, NESTA, 2003). 'Constructively Aligned' assessment (Biggs, 2003) being a primary goal, the approaches have also taken into account national quality assurance guidelines – through direct dialogue with the UK's Quality Assurance Agency (QAA).

Understanding design, what is it and how might it inform entrepreneurship education?

As our arguments are based on an understanding that many parallels can be drawn between design education and the emergent demands of enterprise education (Penaluna and Penaluna, 2009), our discussion is less about the ontological perspective of the authors, and more about the perspective of an entire discipline.

Primarily we wish to emphasise that design is characterised as a problem-solving tool; it is "working out a solution for any specific problem in diverse contexts" (Simon (1981; in Lau, 2009, p. 154). Unlike the fine artist, whose intrinsic and personal desires feed their creativity, the designer has to respond to problems, problems that are frequently introduced by others, yet may need re-referencing and redefining before they can be solved. Those who employ the designer make their initial proposals based on their own understanding of the problem, setting the required problem-solving tasks as design "briefs". To illustrate this process, a furniture designer may have to develop a new chair for a market that exhibits a preference for stylistic traits, or it could be that the current product range does not respond to needs of a certain community, maybe those with a specified disability. Alternatively, an advertising designer may have to develop an ad campaign that discourages an identified behavioural problem such as binge drinking, a typographical designer make sense of a complex set of figures in a company report or produce a poster to inform commuters of bus times in a simple and digestible manner. Whatever the task, it is directed toward a solution in the given context; it responds to the needs of identified stakeholders.

Curiosity based learning, where the lecturer leads the students to develop their own questions about the subject is a traditional way of developing this trait, and has already been the subject of some discussion (see Penaluna and Penaluna, 2005; Penaluna and Penaluna, 2008). An important task from the design educator's perspective is to develop the student's instincts, so that they can respond intuitively and promptly to the challenging and fast-paced commercial environment.

So, thus far we have clarified that design education aims to develop problem solvers who are motivated by instinct and challenge, who work in a primarily business environment and address issues that respond to needs of identified stakeholders.

To continue our argument, there are further parallels between design and entrepreneurship that we should take into account. When considering entrepreneurial capacity, Drucker (1999) notes that to understand and exploit something, you must first have some prior knowledge to build on. As "the essence of design education is ... to establish their (students) reservoirs of experience ... fostering creative thinking processes for originality and novelty" (Simon (1981; in Lau, 2009, p. 155), this requirement compares well. Moreover, the design descriptor clearly connects knowledge and creativity. We can also draw the conclusion that memory and recollection are important factors, as the more diverse the recollection or observation, the more diverse the range of connections that can be drawn on to solve a problem. Traditional education systems advance the conscious or "ordinary memory", Design tests the "intelligent memory" (Gordon and Berger, 2003). It considers what the subconscious has recorded, what assumptions have been made and what sensory perceptions have been involved.

Importantly, Dr Barry Gordon, a specialist in memory and language disorders in the discipline of cognitive neurology, considers creativity to be firmly rooted in "Intelligent memory", because the broader and more random the connection, the more innovative the solution found. "Your mind finds something in common between elements that don't normally go together. A connection takes a leap into a whole new area ... The longest and most unusual of these leaps are the creative ones" (Gordon and Berger, 2003, p. 158). Gordon advocates that if you wish to "Find some creative ideas, you need to keep in mind several lessons from creative people ... those who regularly and deliberately seek out new connections" (Gordon and Berger, 2003, p. 162).

In a final comparison, any issues of communication, especially in those with persuasive intentions, the development of a hermeneutical approach is important. Automotive designers imagine what it might be like to be driving the car, what reactions might it illicit and will it get the desired attention? Most pertinent to this debate, advertising designers will ask, how do I get into the mindset of that consumer? How will I get their attention and what triggers will raise their desire for my product or service? What creative connections can I make between my target market and the offering that I wish to promote?

Design's expertise clearly has much to offer the enterprise agenda; hence the way the educator sets out to develop these mindsets is our next focus of enquiry.

Introducing design education's cognitive approaches

Amabile (1983) determined that identifying creativity in the individual is reliant on three primary factors:

(1) Do they have the appropriate technical and contextual knowledge and expertise?

(2) Are they able to exhibit creative thinking strategies / capacity?

(3) Are they motivated?

As knowledge and expertise is primarily the domain of the subject specialist, we will focus on her second and third points in our discussions.

Duncan (1998; in Kirby, 2006, p. 4) noted that creative people were often perceived in business as "a pain in the neck", disrupting "the established order by asking questions and experimenting with new ways of doing things". There is a view that such cognitive abilities often "alienate others" (Sinetar (1985; in Kirby, 2006, p. 3) and lead to barriers in discourse. The same might be said of creatives in educational environments, as their desire to know "why" is a key motivational aspect and their challenges toward "experts" are not always welcomed. Some consider this a child-like quality and naive (Löbler, 2005), yet such abilities are central to developing creative capacity, and, if handled appropriately, can enhance learning. However, when it comes to assessment, it is not unusual to find these somewhat awkward and creative attributes are often sidelined in favour of more traditional and less confrontational or more quantifiable performance standards (Kirby, 2006) yet, Dyson's vacuum cleaner, hand dryer and ball-wheeled wheelbarrows and associated products exemplify these abilities to challenge the norm. Moreover, Neils Bohr, the Nobel Laureate whose challenges to his professor about alternative approaches to measuring height with a barometer (for example hanging it from a rooftop with a rope) led him to initially fail an academic examination. Boar typifies the mindset – because he did not wish to "simply spit back what is expected" (Loubard and Mouchiroud, 2003, p. 127). Such students continue to seek out loopholes and exploit them whenever possible. The premise here is that they should receive full credit if they are successful, even if they "outwit" the educator. This was recognised by Bohr's subsequent assessor, Ernest Rutherford, who after an appeal passed the work.

It can therefore be argued that educators need to embrace "difficult students" and to continuously challenge their own understandings. If an educator has a predetermined idea of the outcome that they wish to elicit from the student, they will most likely be reliant on their own pre-stored knowledge, which they will anticipate being found through algorithmic or pre-established procedures. Knowledge of these procedures, along with anticipated outcomes, could potentially limit the student's creative solution(s) and the educator therefore has to be reflexive and adaptable to change in order to effectively mentor them. The reader should ask themselves what truly creative new ideas or concepts are entirely predictable, does not their uniqueness make them creative?

As we are comparing and contrasting pedagogical styles, it is important to note that design students are actively encouraged to challenge the questions they are set, so that they can redefine the limits of the box within which they are expected to respond. This challenging normally commences at the launch of a new project or brief where students are encouraged to test boundaries by asking three to five "why" questions about their task. It is not uncommon for lecturing staff to feel challenged by the subsequent level of questioning, yet it is an acknowledged and well established procedure, responding to the Art and Design Subject Benchmark Statement to "display resourcefulness" (QAA, 2008, p. 3), and to "Make connections between intention, process, outcome, context and methods of dissemination" (QAA, 2008, p. 11).

A short review of the design-based assessment model

We have made the argument that academic tradition might inhibit creative output. Prematurely pondering over (potentially) key minutiae and taking a view that robustness equals detailed interrogation of the facts, then testing these against other academics' texts and thinking, is positivistic and predictable. Such positivism enables clearly definable outcomes, ones that can easily be measured and assessed. Conversely, the creative design premise requires the educator to reassess what targets and goals are appropriate to an environment where, nothing is ever "right" in the sense that it can be forecast. So, in order to be assessable, the outcomes have to be set within a context. Mirroring the workplace, the student has to meet the requirements of a predetermined "brief", typically a problem-based scenario. The educator prepares these briefs so that they incrementally combine to respond to overall module, course and programme outcome statements.

Constructivist paradigms such as these require us to build on discovery and to continuously evolve and develop our knowledge skills and attitudes accordingly. The premises of curiosity-raising and subsequent discovery of solutions are central to our arguments. Entrepreneurial minds work differently; they set interim targets and readjust their goals reflexively (Penaluna and Penaluna, 2006) . . . "Entrepreneurs don't need all the answers to act . . . (they) dive in and improvise as soon as problems arise . . . They plug holes and quickly change strategies as events unfold" (Bhide, 1999, p. 58) . . . "Good business plans . . . discuss people, opportunity, and context as a moving target" (Sahlman, 1999, p. 43).

Those who mentor and coach creatives understand that creative outputs are dependant on the development of divergent thinking strategies; ways of assisting enlightenment through the production of as many alternative solutions as possible (Gomez, 2007). This divergent thinking stage is deemed to be the most critical aspect of creativity. It is when any found information is recorded and absorbed, even if links appear tenuous and or inappropriate, they are recorded and remain unchallenged. This stage is often visualised as a cone that sucks all potentially relevant information into its core, it is an established technique in the design industry and can be applied to any creative thought process.

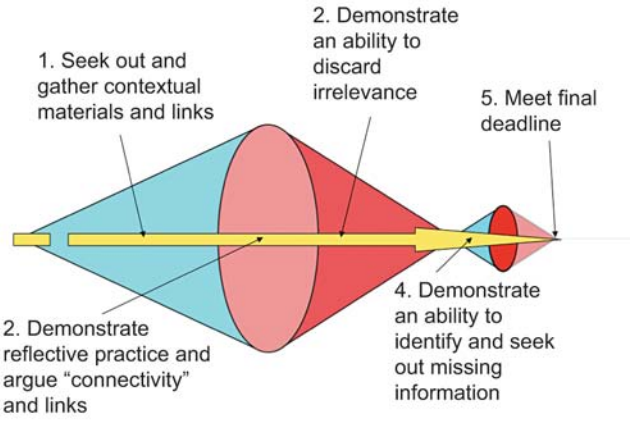
Following a period of digestion in the mind, there follows a period of convergent analysis and evaluation of the data collected. This requires the creative to discard or remove elements or findings that are not considered to be of value. "Premature articulation" is avoided as this has a tendency to discount and discard before the subconscious can evaluate. The process of elimination, where the findings are considered and acted on, is when holes or gaps in knowledge are discovered, hence it is common to see the divergent thinking strategy repeated in a more focussed way, as the student now knows what they need to know in contexts within which they were previously unfamiliar.

As illustrated in Figure 1, this understanding can provide a useful vehicle for formative assessment of process, as opposed to purely summative outcomes.

Neurological understandings and theoretical model

If, alongside their students, entrepreneurship educators continuously seek out fuller and more comprehensive levels of understanding, they will enhance and develop their

The student will be able to:



An overview of the model

The blue cones indicate divergent thinking (R Brain) – when research and an "open minded" approach to the identified problem is required. At this point it is important to consider any knowledge that is potentially useful and to record all observations, however abstracted or inappropriate they may appear at this juncture. The central ellipse represents time to muse over, absorb and digest the findings. The red cones indicate analytic/algorithmic (L Brain) convergent thinking, where an increasingly solution-based focus is required. Through this process it is likely that new problems or shortfalls in information are identified, thus another period of divergent (R Brain) thinking is required (second blue cone) to discover "what you need to know, but didn't realize at the outset". If a timescale is involved, the deadline is the final goal.

Only two sets of cones are indicated here, though there may be considerably more in a problem-driven enterprise. Identifying and effectively managing this process, with proportionate allocation of time to each stage, is considered key to the development of creative solutions to problems. Specifically, if the first periods of divergent thinking and reflection are not given a sufficient time allocation, the source "material" from which to solve a problem will be limited to the students personal prior experiences and the "new unknown" cannot be taken into consideration.

The model has been used both in individual and group work. It permits "drop in" assessment points, e.g. what is the body of research prior to reflection (stage 1, blue cone)? It is normally employed alongside multiple/consecutive projects. The shifting and changing of deadlines can also be facilitated using the model, thus a more flexible adaptable learning environment can be redesigned and appropriately assessed.

Please note that the authors make no claim to this model being new. It is merely an adaptation of design educators' "modus operandi".

Source: Penaluna and Penaluna (2009)

Figure 1.
Framework of the "Design-based enterprise assessment model"

own ability to develop knowledge that aids comprehension. Once in a while a light bulb moment of a new idea or connection suddenly comes to mind. Cognitive psychologists term this an "aha" moment, and it has been the subject of significant research. It is a neurological process that design educators are not only cognisant of, but one that they actively employ in course development.

As discussed previously, this understanding is reliant on the knowledge that there are two differing types of thought process, having a creative idea and then developing the capacity to sustain it. The activities require two distinct types of neural engagement, and these contrast one another. "Problem solving can be associated with distinct brain states ... whether the problem that follows will be solved with insight or non insight (commonly known as linear) processing" (Kounios *et al.*, 2006, p. 882). Creative output is acknowledged to be at its most effective during insight-based thinking.

Insightful approaches, or "aha" moments can be defined by considering whether or not the brain developed the solution incrementally. If the left-brain is dominant, as is usually the case, the mind will seek to incrementally piece together information and to build a very focussed picture of possible solutions in which the potential determinants are easily connectable; they derive from conscious thinking. However, sometimes a solution is not forthcoming, and the thinker's attention moves to another problem or issue that requires his or her attention. Suddenly, often when in a relaxed state such as in the shower or early in the morning, for example at times when the brain relaxes and the mind wonders or "daydreams", the idea or solution will suddenly "appear" in the mind. This is the "aha" or eureka moment that is associated with creative ideas, it is this cognitive ability that we are seeking to nurture.

The business and management educator's focus has been on the capacity to sustain a business or enterprise through a better understanding of the processes and strategies observed in such endeavours. Activities such as case study and developmental analysis dominate the pedagogical approaches. These are positivistic investigations, as any analysis will offer partially assured outcomes; the engagement is didactic and target referenced. Commonly associated with left brain activity, this is the safe domain of educational assessment; has the student responded with the correct answer, has the student referenced the acknowledged cannons of thought, can he or she describe the activities appropriately and contextualize their responses in written documentation etc./?

We also know that when we focus on something, especially under pressure, there is a tendency to block out all (apparently) irrelevant information to enable us to focus on a solution. With a few exceptions, such focussing is central to most pedagogical approaches in higher education. The visual cortex, for example, goes silent as the brain attempts to suppress possible distractions (Jung-Beeman in Lehrer, 2008). During creative analytical processes, "Almost all the possibilities your brain comes up with are going to be wrong" (Jung-Beeman, 2005; in Lehrer, 2008, p. 41), but the more extensive our thinking the wider the range of potential solutions we have to draw on. We also know that alternative strategies develop subconsciously, engaging the right cortex to deliberate on the problem (although we may be totally unaware of it).

John Kounios, a cognitive neuroscientist based in Drexel University considers that learning to develop insightful right cortex strategies will "contradict the classic model of learning in which the learning process was assumed to be gradual" (Kounios in

Lehrer, 2008, p. 42). He notes that when a solution is reached, whether it is through our traditional linear approach or as a result of "insight", the brain reacts (in the right anterior superior temporal gyrus) to the conscious knowledge of the availability of the solution, thus giving us the "aha" moment, even if we were not expecting it (Kounios *et al.*, 2006). Just as a good comedian can lead the audience to a diverse connection that they subsequently discover within a punch line, there is a feel good factor, irrespective of how much help we needed to make the connection.

So, if we experience this same emotional response irrespective of how we came to the solution, it might appear, on initial investigation, that we cannot consciously understand the difference between analytical evolution and the "aha" moment that defines the sudden illumination of a problem in a new light. However, understanding the phenomenon of "insight" (Kounios *et al.*, 2006, p. 882) is essential if we are to develop enterprising mindsets, so let us consider this in greater detail.

Archimedes is said to have shouted "Eureka" just as he stepped into his bath. Not because the water was too cold, but because he had suddenly solved a problem that had been baffling him. He had been ordered to find out if his king's crown was really pure gold. As he stepped into the bath, so the legend goes, he noticed the water rising as it was displaced by his foot. "Aha", he undoubtedly thought, water displacement could be used to calculate density. Thus in a flash he solved a problem that more methodical types might not have been able to resolve, his subconscious achieved it for him – through association of previously disparate knowledge. This is the central feature of insightful strategies that we wish to capture; mental preparation that "does not depend on information related to specific problems, but that biases a person toward processing that facilitates solution by insight" (Kounios *et al.*, 2006, p. 882).

Finally, we must consider that doctors have traditionally believed the right hemisphere to be less important than the left when analysing patients who have received brain damage through accident or injury. "It doesn't do much, and it does not do anything with language" (Jung-Beeman in Lehrer, 2008, p. 41), yet we have known for some time that aphasia sufferers, who lose the ability to use language coherently through brain injury or damage in the left cortex, can still produce a painting of some merit and communicate effectively through visual means, "Apparently, painting and linguistic capacities can exist independently of one another" (Gardner, 1982, p. 274).

To help the reader to better understand our arguments, the following text will illustrate how these understandings have been employed in the context of an established student project.

Insightfully focused pedagogical strategies – a case study

Students from Swansea's BA (Hons) Design for Advertising learn skills associated with advertising, marketing and business/enterprise promotion; their outputs are evidenced in projects and formative assessment that map their strategic development of ideas. In terms of motivation, the classes are lively and energetic and "much more fun than any of the other courses" that their friends and colleagues encounter (student group response to external examiner, July 2008). There are two underlying areas of focus. Business and creativity combine, providing an opportunity for students to learn how to innovate and offer solutions to challenging business related problems. Students become interpreters of their client's aspirations, services and products. Their primary

aims are to promote and communicate through innovative and attention seeking strategies, thus a psychological understanding evolves during their studies. Much of the curriculum is experiential, with learning through projects and engagement with external clients and businesses. There are no examinations or traditional written tests in their "practical" assessments, which are guided by the aforementioned model.

In the project that we will use as our case study, second year students were first required to note down the times and places that they experienced their "eureka" moments and most lucid insights into creative solutions while undertaking other projects. Usually, but not exclusively, these were related to their ongoing coursework. Following a formative "critique", the class was dismissed and each student was asked to consider their next journey into university and to note random things that appeared en route. As the students had no way of knowing what the information was going to be used for, they selected disparate items, such as a floating feather and a painted white line (Chacon, 2008), or a watch and a security camera (Kennedy, 2008). Over the following week, the students were asked to attempt to find or form any kind of link or connection that they could between objects that they had personally observed and recorded. In keeping with the observations that creativity is primarily making new connections and associations (Schumpeter, 1934) the project aimed to develop new and innovative solutions to, as yet, *undefined* problems. They did not know what the knowledge would be used for. Instead of forcing the mind to focus on a problem incrementally (left hemisphere), the strategy was to facilitate opportunity for the mind to wander over a period of time. Thus the neurons in the right hemisphere had ample opportunity to seek far and wide in the subconscious mind. The key is that the stimulus for solution is not focused thinking, far from it, but free time to let the ideas evolve, hence the project's title, "Free time is thinking time" (Penaluna, 2008). Subsequently, the students were required to produce an advertising campaign, with the aim of selling the idea of daydreaming as a valuable business asset. There was one proviso; the "random" observations made prior to the project had to be incorporated into the solution.

Chacon's free thinking feather eventually landed on its "landing strip" of the white line as its creative path of random discovery is concluded, and Kennedy's campaign, based on the forced inclusion of his watch and a security camera, challenged the TV viewer to come up with a great idea in ten seconds, while under the watchful eye of the security camera (see Figure 2, storyboard). Importantly, this solution does not rely on telling the viewer or simply transmitting the information, it encourages them to experience it for themselves. Thus, this student can be seen to mirror the lecturer's teaching strategy by raising curiosity. This "insightful" learning by the viewer lets them partially work out a solution in their own minds – which is inherently more motivational and considerably more memorable.

Students responses have been consistent over the five years that the project has been run, they identify the fact that ideas come to them when they first awake, are at play, in the bathroom or possibly just out walking. Results clearly indicate that the best ideas come when they were least expected, most frequently when they were relaxed or in a state of wandering mind.

Kounios *et al.* (2006) support the approaches described. Their research findings concluded (p. 889) that "a person's preparatory brain state even prior to seeing a

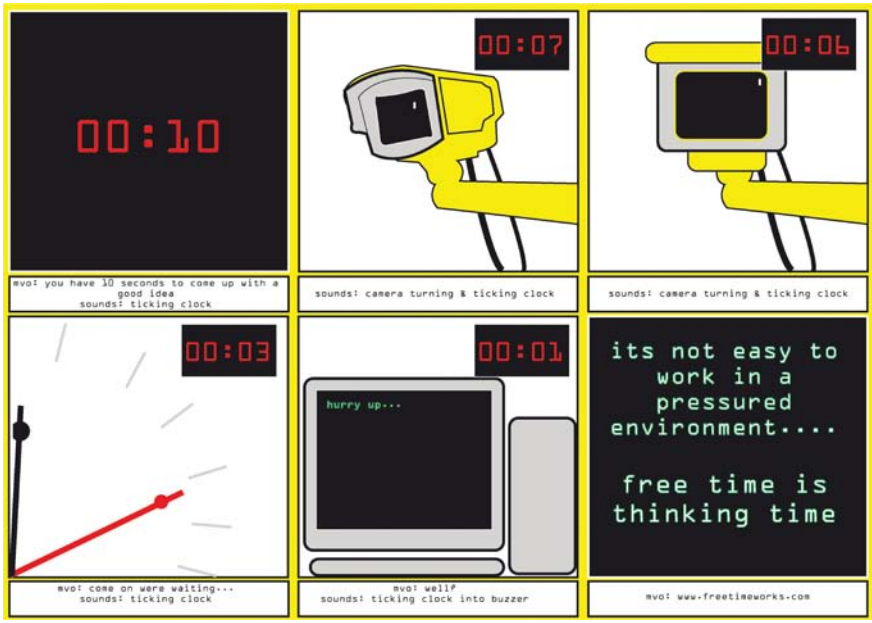


Figure 2.
Kennedy's solution to communicate the view that creative thinking is difficult under traditional pressures of time. His solution incorporates the video camera and watch – components that he had to randomly identify prior to knowing the problem that was asked to solve

problem influences whether the person will solve the problem with insight (associated with lateral) or non insight (associated with linear) processing". They observed insightful or "creative" thinking as being "Characterised by remote associations among problem elements" (Kounios *et al.*, 2006, p. 889).

In his research into Bilateral Brain Processes for Comprehending Natural Language Jung-Beeman (2005, p. 514) explains the neural activity thus: "The LH [left hand] strongly activates small and focussed semantic fields … by contrast the RH [right hand] weakly activates large diffuse semantic fields". It therefore falls that the educator is seeking to enhance the student's ability to call into action the weaker connections of the right hemisphere. Through such developmental strategies, students will acquire enhanced abilities to not only challenge assumptions, but also to recognise patterns in seemingly complex issues and to develop new perceptions of problems and issues. As metaphorically described to students in reflective sessions that follow their projects, "The wiring is there but we need a few more plugs and sockets around the place".

In order to better comprehend this metaphor, it may be useful to understand that, under micro-analysis, the right hemisphere is physically "wired" differently to the left (see Figure 3). Whereas the left hemisphere is good at developing analytical solutions through short and incremental connections, the right has (dendritic) strands that are physically longer, reaching deeper into the cortex in a more tenuous and less dense/extended manner. There is a tendency for the right brain neurons to develop more "connectable" links (synapses), which are characteristically further from the core (soma) than those in the left cortex. This structure may explain the tolerance that the right brain has for "faint, fleeting, marginal or ambiguous … details which do not 'fit'

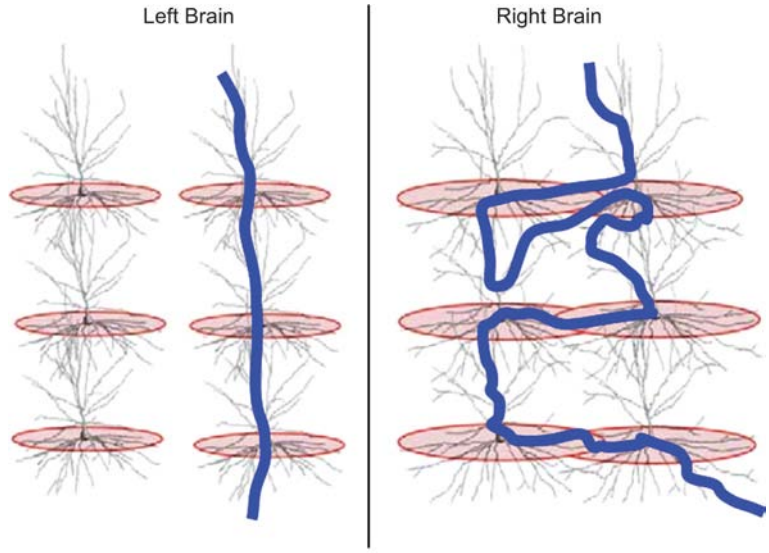


Figure 3.
Left brain and right brain microstructure

Note: The blue tracks have been added by the author for clarity
Source: Based on an illustration by Mark Jung-Beeman, Department of Psychology and Cognitive Brain Mapping Group, Northwestern University, USA

or immediately make sense" (Claxton, 1998, p. 13). The "footprint" or breadth of each semantic field is correspondingly different. Left-brain exhibits a smaller but denser footprint, enabling it to make quick and consistent connections. As explained to students of design, it has "more frequent but shorter journeys to get there" (Penaluna, 2008). Right brain fields (cortical columns), however, have a much broader area to consider on their "roadmap" toward a solution. There is also a tendency for these footprints to overlap more frequently so perhaps multiple maps might be a better metaphor. This characteristic is described to students as, "a more meandering drive that takes you a little bit further. You will get somewhere in the end, you just don't know where yet" (Penaluna, 2008).

It is essential to note here that the theoretical underpinnings are described to students *after* experiencing it for themselves. "Oh my God, that's exactly what happened, it's my floating feather" (Chacon, 2008). The left cortex now facilitates this level of comprehension; it is a logical understanding that has arrived through reflection. This approach also helps to establish stronger "synapse potential" in the brain, as the reflection enhances the development of a neurological path – a memory.

The "Key feature of insight: the feeling of certainty that accompanies the idea" (Lehrer, 2008, p. 40), often requires the enterprising individual to test the idea on others to cement their new understandings using left cortex reflection and analysis. In new and complex situations the ability to communicate can rely heavily on these two skill sets. In the case of the project under discussion, four "critique" sessions facilitated this. The ability to define the thought process verbally or visually and to rationalize

appropriately for an anticipated audience, who often prefer a left cortex activity, and the ability to develop communication channels through the use of metaphor and metonym for the more creative and innovative mindsets, becomes an imperative, as both sides of the brain need to be engaged.

It should be noted that there is a view that this is a "fragile" environment and that introducing such uncertainty increases student vulnerability (Jones, 2007). Such vulnerability is managed head on in many creative disciplines, with the unpicking of a colleague's or peer's argument, usually in front of the assembled learning group, being known as the "crit" (or critiques). Student presentations, together with the associated "crits" and peer review mechanisms, are an integral part of almost any art education. Jones (2007, p. 6) comments that the nature of student and staff vulnerability has "received little attention as a means of achieving good educational outcomes". Deeper investigation will indicate that the UK Quality Assurance Agency's Art and Design Subject Benchmark Statement support the "crits" approach, as working in "contexts of ambiguity, uncertainty and unfamiliarity" is a stated requirement (QAA, 2008, p. 8). It is the role of the educator to facilitate this development, and to constantly judge and evaluating the group's propensity for challenge. Perhaps this is the most demanding aspect of the design educators remit?

The Institute of Practitioners in Advertising's (2009) "Diagonal thinking" project recognises all the previously mentioned factors. "These top brains in commercial creativity are innovative, can explain concepts in both rational and emotional terms, have a broad range of interests and a passion for execution. They can be highly logical, but link ideas hitherto seen as remote from each other; they want to do work that is creative, but also for it to have a practical impact" (IPA, 2009). There are significant parallels with the needs of the enterprise education community.

The advertising students who are learning to learn in the case study will have to work with an incredibly diverse range of businesses and enterprises, soaking up their aspirations and desires and interpreting them in a manner appropriate to a target audience. In the view of the authors, it is this very experience that has driven the industry to come up with its own game plan when it comes to measuring the potential of creative endeavour. As described to students from an account manager with Satchi and Satchi, if one day you are selling pet food, the next a major Hollywood blockbuster and the following a recruitment campaign for the army (Guyton, 2000), you clearly have to be a nimble thinker in each business context.

Finally, Herrmann's (1996) "whole brain" (p. 245) expression of creativity comes to the fore, "Among other things, it is the ability to challenge assumptions". Csikszentmihalyi's (2001) "systems model of creativity" considers creativity to be less of an individual trait but more a systemic process that involves a range of characters in an ongoing narrative. Our paper's case study not only agrees with this perspective, it illustrates it in action.

Conclusion

We have taken the reader through a narrative. We have introduced the discipline of design and discussed some of the theoretical constructs that have led to the pedagogies that its educators employ to develop creative mindsets for business in problem-solving

contexts. Through a case study, we have illustrated how these understandings inform delivery in the classroom.

We indicate that creativity and innovation within enterprise and entrepreneurship education is not well understood and research on assessment of creativity within the discipline is at a nascent level at best – there is a dearth of research that considers any kind of evaluation of creative capacity in the context of enterprising ideas. We have therefore responded to calls for more informed responses to the development of entrepreneurial creativity by thinking outside the box of established business-related pedagogical approaches, taking a transdisciplinary perspective that embraces recent understandings in cognitive neurology and design-based disciplines.

Supported by recent neuroimaging studies (Jung-Beeman, 2005), we highlight that the UK's advertising professions have already embraced these strategies; creative ideas in a business context are everyday occurrences. The paper extends these discussions by offering an educationally derived empirical case study - based on these approaches. Specifically, this paper challenges the assumption that creativity in a business context can only be developed and assessed through algorithmic (left hemisphere) pedagogies. Developing responses that encourage, not deter, what are sometimes described as "difficult and challenging students", may be an essential step forward. Moreover, engaging expertise from the creative industries, especially that of the design disciplines – where creativity and business already intersect, could offer these and other valuable insights.

The ability to elicit multiple solutions through strategies that enhance the capacity for "aha" moments of discovery, ones that employ the subconscious capacity of the right hemisphere, should be a key pedagogical goal. It is helpful to take into account that in cognitive neurology, creative thinking and the development of right brain capacity cannot only be described; the circumstances and environments that enhance it can be predicted. It therefore follows that learning environments can be created that better enhance and develop our students' capacity to be creative.

Finally, if creativity and innovation are removed from descriptors that define entrepreneurship education, what are we left with? Is it not merely traditional business studies? Yet, in a period of financial uncertainty, when good ideas might make or break a new enterprise, these are aspects that are acknowledged to be critical understandings (CMI/NESTA, 2009). We therefore argue that in order to manage the entrepreneurial learning process effectively, these kinds of discussions are essential. To conclude, business education may well offer useful insights into entrepreneurship education, but these will be primarily associated with aspects of convergent thinking. Creativity, innovation, and opportunity recognition are reliant on divergent thinking; this develops cognitive skills that are essential in entrepreneurial contexts. As demonstrated in our text and models, these understandings form the basis of "design thinking" and therefore offer clear direction as to how entrepreneurship education can be enhanced.

References

Amabile, T. (1983), *The Social Psychology of Creativity*, Springer-Verlag, New York, NY.

Amabile, T. (1998), "How to kill creativity?", *Harvard Business Review*, Harvard Business School Press, Boston, MA.

Bhide, A. (1999), *How Entrepreneurs Craft Strategies that Work*, Harvard Business School Press, Boston, MA.

Biggs, J. (2003), *Teaching for Quality Learning at University*, Open University Press, Buckingham.

Bragg, M. (2005), "Educating for, about, and through entrepreneurship: a case study for whole-brain curriculum development", paper presented at the Internationalizing Entrepreneurship Education and Training Conference (IntEnt2005), Guildford, 10-13 July, available at: www.intent-conference.com (accessed 24 June 2010).

Brodie, J. and Laing, S. (2007), "Embracing innovative approaches to entrepreneurship teaching to support effective entrepreneurial learning", paper presented at the Internationalizing Entrepreneurship Education and Training Conference (IntEnt2007), Gdansk, 8-11 July, available at: www.intent-conference.com (accessed 24 June 2010).

Brown, G., Darling, A. and Hutton, J. (2008), *Forward to Enterprise: Unlocking the UK's Talent*, HM Treasury/BERR, London.

Carey, C. and Matlay, H. (2008), "Characteristics of creative disciplines education: a model for assessing enterprise?", paper presented at the Institute for Small Business and Entrepreneurship Conference, Belfast, 5-7 November.

Chacon, K. (2008), *Solutions to 'Free Time Is Thinking Time' – Year 2 (Level 5)*, Semester 1 Student Project for Visual Studies Module on the BA (Hons) Design for Advertising Programme, Swansea Metropolitan University, Swansea.

Chia, R. (1996), "Teaching paradigm shifting in management education; university business schools and the entrepreneurial imagination", *Journal of Management Studies*, Vol. 33 No. 4, pp. 409-28.

Claxton, G. (1998), *Hare Brain, Tortoise Mind: Why Intelligence Increases When You Think Less*, Fourth Estate, London.

Clews, D. (2007), *Creating Entrepreneurship Education for the Creative Industries – Summary Report*, Art Design Media Subject Centre, The Higher Education Academy, Brighton.

CMI/NESTA (2009), *Innovation for the Recovery: Enhancing Innovative Working Practices*, Chartered Management Institute/National Endowment for Science, Technology and the Arts, London, December.

Cox, G. (2005), *Cox Review of Creativity in Business: Building on the UK's Strengths*, HM Treasury, London.

Csikszentmihalyi, M. (2001), "A systems perspective on creativity", in Henry, J. (Ed.), *Creative Management*, 2nd ed., Sage, London, pp. 11-26.

DCMS (2008), *Creative Britain: New Talents for the New Economy*, Department for Culture Media and Sport, London.

de Bono, E. (1996), *Serious Creativity: Using the Power of Lateral Thinking to Create New Ideas*, HarperCollinsBusiness, London.

Drucker, P.F. (1999), *Innovation and Entrepreneurship*, Butterworth-Heinemann, Oxford.

Florida, R. (2002), *The Rise of the Creative Class: and How It's Transforming Work, Leisure, Community and Everyday Life*, Basic Books, New York, NY.

Florida, R. and Goodnight, J. (2005), "Managing creativity", *Harvard Business Review*, Vol. 83 Nos 7/8, pp. 124-31.

Gardner, H. (1982), *Art, Mind and Brain: A Cognitive Approach to Creativity*, Basic Books, New York, NY.

GEI (2009), "Educating the next wave of entrepreneurs: unlocking entrepreneurial capabilities to meet the global challenges of the twenty-first century", report of the Global Education Initiative, World Economic Forum, Switzerland, available at: www.Weforum/org/en/initiatives/gei/EntrepreneurshipEducation/index.htm (accessed 8 July 2009).

Gigerenzer, G. and Todd, P.M. (1999), *Simple Heuristics that Make Us Smart*, Oxford University Press, New York, NY.

Gomez, J.G. (2007), "What do we know about creativity?", *The Journal of Effective Teaching*, Vol. 7 No. 1, pp. 31-43.

Gordon, B. and Berger, L. (2003), *Intelligent Memory: Exercise Your Mind and Make Yourself Smarter*, Vermillion, London.

Guyton, C. (2000), Videotaped Presentation from an Account Manager at Saatchi and Saatchi – to Year 3 Design Students at Swansea Institute of Higher Education (now Swansea Metropolitan University), Swansea Metropolitan University, Swansea.

Handy, C. (2010), "The house of unreason", *RSA Journal*, Summer, pp. 36-7.

Herrmann, N. (1996), *The Whole Brain Business Book: Unlocking the Power of Whole Brain Thinking in Organizations and Individuals*, McGraw-Hill, New York, NY.

IPA (2009), *An Introduction to Diagonal Thinking*, Institute of Practitioners in Advertising, London, available at: www.ipa.co.uk/Content/Diagonal-Thinking-Introduction (accessed 8 March 2009).

Jackson, N., Oliver, M., Shaw, M. and Wisdom, J. (2006), *Developing Creativity in Higher Education: An Imaginative Curriculum*, Routledge, Oxford.

Jones, C. (2007), "Anticipating the spillover effects of enterprise education", paper presented at the Internationalizing Entrepreneurship Education and Training Conference (IntEnt2007), Gdansk, 8-11 July, available at: www.intent-conference.com (accessed 24 June 2010).

Jung-Beeman, M. (2005), "Bilateral brain processes for comprehending natural language", *Trends in Cognitive Sciences*, Vol. 9 No. 11, pp. 512-18.

Kellet, S. (2006), *Emergent Practices in Entrepreneurship Education for Creatives*, Higher Education Academy, University of Brighton, Brighton.

Kennedy, T. (2008), *Solutions to "Free Time Is Thinking Time" – Year 2 (level 5)*, Semester 1 Student Project for Visual Studies Module on the BA (Hons) Design for Advertising Programme, Swansea Metropolitan University, Swansea.

Kirby, D. (2003), *Entrepreneurship*, McGraw-Hill, Maidenhead.

Kirby, D. (2006), "Creating entrepreneurial universities: a consideration", National Council for Graduate Entrepreneurship, Birmingham, available at: www.ncge.com/communities/research/reference/reports/Working%20paper/7/5 (accessed 15 September 2009).

Kounios, J., Frymiare, J.L., Bowden, E.M., Fleck, I., Subramaniam, K., Parrish, T.B. and Jung-Beeman, M. (2006), "The prepared mind: neural activity prior to problem presentation predicts subsequent solution by sudden insight", *Psychological Science*, Vol. 17 No. 10, pp. 882-90.

Lau, K.W. (2009), "Creativity training in higher design education", *The Design Journal*, Vol. 12 No. 2, pp. 153-69.

Leadbeater, C. and Oakley, K. (2001), *Surfing the Long Wave: Knowledge Entrepreneurship in Britain*, Demos, London.

Lehrer, J. (2008), "The Eureka Hunt: why do good ideas come to us when they do?", *The New Yorker, Annals of Science*, July, pp. 40-5.

Löbler, H. (2005), Question to Professor Allan Gibb at the Closing Plenary of the Internationalizing Entrepreneurship Education and Training Conference (IntEnt 2005) Guildford, 10-13 July.

Loubard, T.I. and Mouchiroud, C. (2003), "Creativity: a source of difficulty in problem solving", in Davidson, J. and Sternberg, R. (Eds), *The Psychology of Problem Solving*, Cambridge University Press, Cambridge, pp. 69-92.

McWilliam, E. (2008), "Unlearning how to teach", *Innovations in Education and Teaching International*, Vol. 45 No. 3, pp. 263-9.

NESTA (2003), *Forward Thinking – New Solutions to Old Problems: Investing in the Creative Industries*, National Endowment for Science, Technology and the Arts, London.

NESTA (2009), *Creative Enterprise Toolkit*, National Endowment for Science, Technology and the Arts, London, available at: www.nesta.org.uk/assets/features/creative_enterprise_toolkit

Nieuwenhuizen, C. and Groenewald, D. (2004), "Entrepreneurship training and education needs as determined by the brain preference profiles of successful established entrepreneurs", paper presented at the Internationalizing Entrepreneurship Education and Training Conference- (IntEnt 2004), Naples, 5-7 July.

Penaluna, A. (2008), Project Briefing for "Free Time Is Thinking Time" – Year 2 (level 5), Semester 1 Student Project for Visual Studies Module on the BA (Hons) Design for Advertising Programme, Swansea Metropolitan University, Swansea.

Penaluna, A. and Penaluna, K. (2005), "Entrepreneurship for artists and designers in higher education", paper presented at the Internationalizing Entrepreneurship Education and Training Conference (IntEnt2005), Guildford, 10-13 July, available at: www.intent-conference.com (accessed 24 June 2010).

Penaluna, A. and Penaluna, K. (2006), "Stepping back to go forward: alumni in reflexive design curriculum development", paper presented at the Internationalizing Entrepreneurship Education and Training Conference (IntEnt2006), São Paulo, 9-12 July, available at: www.intent-conference.com (accessed 24 June 2010).

Penaluna, A. and Penaluna, K. (2008), "Business paradigms in Einstellung: harnessing creative mindsets for entrepreneurship education", *Journal of Small Business and Entrepreneurship*, Vol. 21 No. 2, pp. 231-50.

Penaluna, A. and Penaluna, K. (2009), "Assessing creativity: drawing from the experience of the UK's creative design educators", *Education + Training*, Vol. 51 Nos 8-9, pp. 718-32.

Pink, D. (2008), *A Whole New Mind: Why Right-Brainers Will Rule the Future*, new ed., Marshall Cavendish, London.

Pittaway, L. and Cope, J. (2006), *Entrepreneurship Education: A Systematic Review of the Evidence. National Council for Graduate Entrepreneurship*, Enterprise and Regional Development Unit, available at: www.ncge.com/communities/research/reference/reports/Working%20paper/7/20 (accessed 15 September 2009).

Pittaway, L., Hannon, P., Gibb, A.A. and Thompson, J. (2009), "Assessment practice in enterprise education", *International Journal of Entrepreneurial Behaviour & Research*, Vol. 15 No. 1, pp. 71-93.

Prisk, M. (2010), speech at the launch of the Enterprise Alliance, Houses of Parliament, London, January 27.

QAA (2008), *Subject Benchmark Statement – Art and Design*, Quality Assurance Agency for Higher Education, Gloucester.

Rae, D. (2004), "Entrepreneurial learning: a practical model from the creative industries", *Education + Training*, Vol. 46 Nos 8/9, pp. 491-500.

Raffo, C., O'Connor, J., Lovatt, A. and Banks, M. (2000), "Attitudes to formal business training and learning among entrepreneurs in the cultural industries: situated business learning through 'doing with others'", *Journal of Education and Work*, Vol. 13 No. 13, pp. 215-30.

Ramsden, P. (2008), *The Future of Higher Education – Teaching and the Student Experience*, Report Commissioned by John Denham, Secretary of State. available at: www.heacademy.ac.uk/resources/detail/ourwork/policy/paulramsden_teaching_and_student_experience (accessed 29 January 2009).

Sahlman, W.A. (1999), "How to write a great business plan", *Harvard Business Review on Entrepreneurship*, Harvard University Press, Boston, MA.

Schumpeter, J. (1934), *The Theory of Economic Development*, Harvard University Press, Cambridge, MA.

UK Competitiveness Summit (2006), UK Competitiveness Summit, London, 7 December, available at: www.berr.gov.uk/aboutus/ministerialteam/Speeches/page35900.html (accessed 3 September 2009).

Further reading

European Commission (2009), *The Impact of Culture on Creativity*, European Commission, Brussels.

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