An investigation into the effectiveness of design thinking techniques to enhance undergraduate student learning

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Dedication

To Sam for his patience throughout this research.

Abstract

Students have access to an ever-increasing quantity and diversity of information, presented to them in multiple formats. The challenge for them is to identify and use this data effectively in their projects. There is a need to support students to manage this information and knowledge. The purpose of this study was to determine whether the implementation of design thinking tools and techniques had potential to enhance undergraduate student skills in the context of knowledge management.

Design thinking is a collaborative, iterative and reflexive process and as such is closely aligned to action research and action learning. An action research methodology supported the research; an action learning approach was appropriate for the introduction of design thinking tools and techniques to students in design thinking workshops. Data was gathered from all participants, feedback and observations resulting from their reflections evaluated the tools and made recommendations for their development throughout the action cycles.

The study found that students valued the experience and perceived wide-ranging benefits in the development of their skills in the management of information, their confidence, motivation and communication skills. The iterative opportunities to develop their skills in collaboration and the articulation of concepts and ideas were perceived to be valuable to students and observers. The implementation of design thinking can be said to enhance undergraduate student learning.

List of Contents

List of Tables

List of Figures

List of Appendices

An investigation into the effectiveness of design thinking techniques to enhance undergraduate student learning.

Chapter 1 Introduction

1.1 Introduction

"Independence of mind, objectivity, capacity for abstract thought and reasoned debate grew out of the style and atmosphere of teaching as much as from absorption in the subject." Sir Ken Robinson describes the qualities associated with undergraduate learning at a time when universities were smaller, select centres of learning. He adds that these transferable skills do not come as a matter of course and that the increasing imperative to support the development of these skills is compromised by growing student numbers. (Robinson, 2001, p.53)

> The dominant ideologies of education are now defeating their most urgent purpose: to develop people who can cope with and contribute to the breathless rate of change in the 21st century – people who are flexible, creative and have found their talents (Robinson, 2001, p.57).

The skills of thinking creatively, collaboration and how to empathise are now required more than ever (Roberts, 2009), to support the development of these skills "calls for a significant re-imagining of the role of educators" in the 21st century (Bamfield, 2013, p.14).

Group tutorials as a mechanism for learning are common practice within design education. These provide the opportunity for students to think creatively in a collective situation, addressing in part, the requirements described above. The researcher's experience of leading group tutorials for textile design students, over a period of ten years, encountered the considerable potential of tutorials for the constructive and creative development of individual student projects. Providing an opportunity for collective discussion of common issues and the sharing of ideas tutorials offer a constructive and supportive environment for student learning

The subsequent development of the BA (Hons) Fashion and Textile Buying / Management / Retailing programme aimed to provide a learning environment to support and engage fashion business students with an appropriate balance of creativity and business acumen. The teaching and learning strategies previously developed for design students offered the researcher a platform from which to build a learning environment to engage students in a creative approach to problem solving. Although not practice-based

these students are highly creative in their approach. As such the assessment strategy for this course is weighted heavily towards project work. To support this project work, in particular the final year Major Project, group tutorial-based learning was adopted and has been practised for a number of years.

Sometimes the Major Project group tutorials worked extremely well and at other times less so. Where it worked well students were generous and supportive, the group discussion providing insightful and constructive suggestions. It was considerably less effective where students perceived an obligation to bring tangible evidence of successful development of their project to the tutorials. This is notably more difficult for students who are not engaged in the development and creation of artefacts and more likely to bring examples and accounts of information gathered.

The ever-increasing wealth of resources available to these students provides both opportunity and challenges. Managing data, which is varied in quality and authenticity, is becoming increasingly challenging for students, particularly within a context of problem solving, creativity and innovation. The conventional tutor-led group tutorial provides an environment for constructive discussion to support the management of information, however the tutorials lacked consistency in their effectiveness and appropriateness for some fashion management students. This has prompted the search for a more effective learning strategy to support project work for these students.

> Knowledge management for researchers consists of making connections among ideas, integrating new information into what we already know, developing new ideas, and bringing knowledge from the depths towards the surface, where it's ready to be transformed into information. (Orna & Stevens, 2009, p.14).

The development of these skills can be directly linked to graduate employability. According to the Department for Business Innovation & Skills (BIS) (2013, p. 49), important benefit is gained from increased employability and skills development. Employers value graduates because they:

- Challenge how things are done and come at things from a different perspective
- Use their initiative and act without waiting for instruction
- Problem solving and flexibility
- Assimilate knowledge quickly and bring new ideas and energy

These skills are embodied in the concept of design thinking. There is no concurrence on a single definition of design thinking, it is more usefully described as an approach or methodology. Brown (2009, p.3) describes this approach as one that is "powerful, effective, and broadly accessible, that can be integrated into all aspects of business and society, and that individuals and teams can use to generate breakthrough ideas that are implemented and therefore have an impact." As a process there is broad agreement that

it can be described as collaborative, iterative and reflexive. Noting that many people outside professional design have a natural aptitude for design thinking, Brown (2008) describes the characteristics identified in design thinkers as: Empathic, Integrative Thinking, Optimism, Experimentalism and Collaboration. Developing this further, Drews (2009, p.39) research found that there was agreement that:

> A design thinking mindset includes the urge to create something new; to challenge the given problem; to be comfortable with ambiguity; to connect with people; to create multiple solutions using various methods; and to visualize intangible concepts, models or ideas.

As these attributes are not the sole preserve of designers, design thinking has extended in application to managers. Rylander (2009) contextualises design thinking within a business context:

> However, within the increasingly important discourse on the innovation economy, creativity is the more desirable attribute, and too heavy an emphasis on rationality may be seen to stultify organizations. It is in this context that design thinking is lauded as an approach to problem solving. While an approach based on rationality may be more efficient in on-going operations, implying less risk when a problem is well defined, it also less likely to come up with a new solution (the essence of innovation) than an approach celebrating (artistic) creativity.

This research will investigate whether in utilising appropriate techniques and processes of design thinkers students could further develop and enhance their skills; their metacognition, their skills in knowledge management, collaboration and communication. Design thinking is essentially a collaborative process; this emphasis on social interaction is such that the philosophy underpinning this research is developed within a framework of social constructionism. Kember (2000) makes a compelling case for participation in educational action research projects as a means of educational development. Action research by definition deals with social practice this in turn supports the application to education. Additionally there is evident commonality between the approaches of design thinking and action research in that both are participatory, iterative and reflexive. An action research methodology therefore provides an appropriate framework for this research.

1.2 Background

The setting for this research is within the School of Art, Design & Architecture at the University of Huddersfield. The participants in this action research project are undergraduate students in their final year of the BA (Hons.) Fashion & Textile Buying Management programme. Within the final year of the programme students undertake projects sequentially, each requiring skills of idea generation, research, analysis,

problem solving and communication. This research will investigate the effectiveness of design thinking tools and techniques to support students in developing these skills and to enhance their learning.

Within the context of design, architecture and engineering, the concept of design as a way of thinking has been well documented in the varied discourses on both theory and practice. With origins in the work of Bruce Archer, who described it as a 'goal-directed problem-solving activity' and John Chris Jones (1992), design thinking was further developed by Lawson (1980), Cross (1982) and Rowe (1987), informed by Schön (1983) and subsequently linked to the work of Buchanan (1992) on wicked problems. Herbert Simon (1969) widened the perspective in his proposition that design is the science of decision-making and as such is situated in the domain of a broad range of professions including management. In a contemporary context the work of IDEO developed and applied these concepts as described by Kelley (2001, 2006) and Brown (2008, 2009). David Kelley concurrently developed this human-centred, multi-disciplinary and collaborative process (see Figure 1.1) within IDEO and within an educational context in the post-graduate d.School at Stanford University Institute for Design.

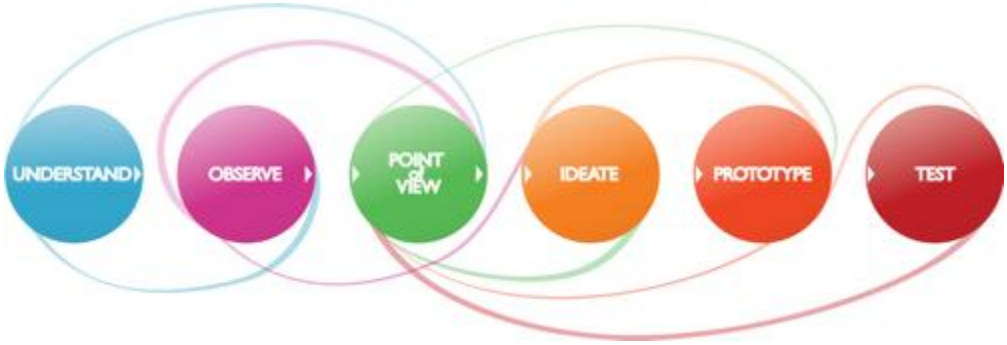


Figure 1.1 Design Thinking Process d.school Stanford University Institute for Design (d.school, 2013)

Working in a context of management theory, Boland and Collopy (2004) set 'design attitude' as central to their argument. Martin, similarly working within the management context, expands upon the work of Brown and Kelley, integrating it within the MBA programme at the Rotman School of Management, Toronto (Dunne & Martin, 2006). The case for design thinking in a management context is made stronger by the contributions of protagonists of differing backgrounds, practice, academia, design, management and information systems.

In education there has been considerable development of the explicit use of design thinking within teaching and learning, primarily within the design subject area at undergraduate level, becoming broader in scope at post-graduate level. The opportunity to explore design thinking techniques within undergraduate management programmes seems evident, in particular situating this within a context of educational theory. Specifically within design thinking education Carroll et al. (2010) and Rauth et al. (2010) suggest further opportunities for research. However, there is considerably less published documenting the teaching of design thinking (Lugmayr, Stockleben, Zou, Anzenhofer & Jalonen, 2013). Acknowledging more recent developments in education (Melles, Howard & Thompson-Whiteside, 2011) note that there are currently four broad approaches – 'design thinking as course logic, e.g. Masters in design thinking; within a course as a discrete program unit; as individual seminars or lectures; or a combination of any of the above as a general philosophy for schools'. These developments primarily concentrate on post-graduate programmes and programmes for designers, there is a clear opportunity for research into the effectiveness of design thinking for undergraduate students who are not specifically studying design.

1.3 Aim and objectives

The principal aim of this research study is to evaluate selected techniques of design thinking in the context of their potential to enhance undergraduate student skills in knowledge management.

The objectives are:

1. To investigate and evaluate techniques and processes of design thinking
2. To analyse and evaluate current student practice of knowledge management within the School of Art, Design & Architecture for a selected student group.
3. To devise model task based scenarios utilising design thinking techniques for undergraduate students.
4. To analyse and evaluate the model task based scenarios through action research cycles.

1.4 Outline of the structure

A review of the literature forms chapter three. The methodology is established within the following chapter, the data is presented and analysed in chapter four. Reflection on the cycles of action research is documented in chapter five. The following chapter discusses and synthesises the data prior to the concluding chapter.

Chapter 2 – Literature Review

2.1 Introduction

Much has been published on the practice of designers, the processes and methods that they use (Jones 1992, Lawson 2006) providing considerable insight for the benefit of academics, professionals and students of design alike. These range from a theoretical perspective on design research theory to the more recently published 'how to' guides on Design Thinking (Ambrose & Harris, 2010, Curedale, 2013). Although, in a few cases there is an acknowledgement of a broader audience such as Liedtka and Ogilvie's book *Designing for Growth, a design thinking tool kit for managers* (2011) these publications are primarily aimed at those engaged with research or practice in the broader context of design. There is considerably less published that documents the practice and benefits of design thinking (Lugmayr et al, 2013) within an educational context.

The literature review consists of four areas. Section 2.2 reviews the literature in relation to design thinking, discussing the origins and development of design thinking within the realms of design. Within design research the practice and methods of designers' work has been discussed for over forty years (Johansson-Sköldberg, Woodilla, and Çetinkaya, 2013). However the discourse on design thinking within the context of management has emerged more recently. Section 2.3 explores the development of design thinking within this context. The application of design thinking approaches and techniques within education, in particular Higher Education, will be examined in section 2.4. The context of design thinking within education will be further developed through an evaluation of student learning and cognition. The literature reviewed on this subject is presented in 2.5.

2.2 Design thinking

In their preface to *Managing as Designing* Boland and Collopy (2004) state their belief that "more widespread design thinking among organizational leaders is desirable for the creation of a humanly satisfying and sustainable future." So what is design thinking that it can promote this admirable ambition?

2.2.1 Design Methods

Within the context of design, architecture and engineering, the concept of design as a way of thinking has well-established origins documented in the varied discourses on both theory and practice. Literature on design methods began to appear in most industrialised countries in the 1950s and 1960s (Jones, 1992). The Conference on Design Methods,

held in London in 1962 "enabled a core of people to be identified who shared interests in new approaches to the process of designing" (Design Research Society, 2013). John Chris Jones (1991), a co-founder of this conference, recalls "we sought to be open minded, to make design processes that would be more sensitive to life than were professional practices of the time." Jones (1992) writes of that time that the methods proposed and the descriptions of the design process are equally diverse. In an early recognition of a user-centred approach Jones himself examined the design process in order to ensure that the process was inclusive of ergonomics, so that the human requirements would come first and the machine requirements would come second. His work also placed emphasis on how a problem was considered and framed in order to develop a solution (Kimbell, 2011).

A key proponent, Bruce Archer, Professor of Design Research at the Royal College of Art (in the 1980s) stated in his 1965 publication *Systematic Methods for Designers,* cited by Cross (2007), that "The most fundamental challenge to conventional ideas on design has been the growing advocacy of systematic methods of problem solving, borrowed from computer techniques and management theory, for the assessment of design problems and the development of design solutions." Essentially a "goal-directed problem-solving activity" (Archer, 1965) cited by Jones (1992).

However, C. Thomas Mitchell (1992), describes the development of an unintended emphasis on rigidity of methods and methodology contrary to the intentions of Jones and his fellow design methods pioneer Christopher Alexander who rejected this over-rationalization, favouring a more explicitly intuitive approach. From this movement we see the emergence of streams of thought concerning a user-centred approach, the nature of problems and the development of process to be systematic and to be intuitive. Kimbell (2011). Illustrating the fragmented development of this research are the contrasting viewpoints of Christopher Alexander, (1971, p.15) for whom "the ultimate object of design is form" and that of Herbert Simon who adopted a more expansive view that design is the science of decision making. (Kimbell, 2011).

2.2.2 Herbert Simon and the science of decision making

It can be argued that the concept of design as being primarily concerned with form and making remains to the fore. However, in his seminal work *The Sciences of the Artificial*, Herbert Simon makes the following proposition.

> Everyone designs who devises courses of action aimed at changing existing situations into preferred ones. The intellectual activity that produces material artefacts is no different fundamentally from the one that prescribes remedies for a sick patient or the one that devises a new sales plan for a company or a social welfare policy for a state. (Simon, 1996, p.111).

This situates design as knowledge in the domain of the professions such as engineering, management or medicine (Kimbell, 2011). There is no evidence to suggest that Herbert Simon used the term 'design thinking' (Johansson-Sköldberg et al., 2013). However, with his cognitive approach to decision making and his frequently quoted definition of design as "the transformation of existing conditions into preferred ones" (Simon, 1996, p.111) is a principal point of reference for academic researchers on the subject of design and design thinking.

Simon (1996) saw design as a set of rational procedures in response to well-defined problems, arguing that these procedures were also suited to ill-defined problems. Simon makes the case that design constitutes a different mode of thinking to that of science and the humanities (Cross, 1982, Melles, 2010). Citing Simon's description of 'satisficing' as opposed to optimising, the importance of generating a satisfactory solution quickly rather than on prolonging analysis of the problem is argued by Cross (1982). Producing one of a number of satisfactory solutions rather than seeking the optimum solution (Cross, 1982). Buchanan (2004) concisely describes Simon's position that "design is the science of decision making, and it matters little whether the product of decision making is an organization or a consumer product", adding emphasis to the view that better understanding of cognitive processes will improve decision making in all areas of professional work.

2.2.3 A user-centred, iterative and reflective process

Peter Rowe's work *Design Thinking* published in 1987 is arguably the first widely recognised use of the term, two principal ideas are evident in this work. Firstly, that "design professionals have an episodic way of working; they rely on hunches and presuppositions, not just facts" and secondly, the argument that "the problem-solving process itself shapes the solution." (Kimbell, 2011, p.291). Although not as frequently cited as others in the subject area, these broad concepts of iteration and abductive thinking have considerable resonance within the later literature on design thinking.

In examining design and designerly thinking as "a way of reasoning, making sense of things", a discourse of design thinking specifically identified by Johansson-Sköldberg et al. (2013), the works of Bryan Lawson and Nigel Cross are seen as foundational. Lawson's work connects psychology to the creative processes of design (Johansson-Sköldberg et al. 2013). Examining the nature of design and the characteristics of design problems, he addresses the thought processes that are required to understand such problems and propose solutions to them, placing new emphasis on design cognition (Cross, 2007). Cross has published extensively on 'designerly ways of knowing' basing much of his work on ethnographic research and case studies of practical experience (Johansson-Sköldberg et al. 2013). Cross (1982, 2001, 2006) views the designers'

method of problem solving as being solution focussed. Romme (2003, p.564) describes Cross's view that,

> When faced with ill-defined situations and challenges, designers employ a solution-focused approach. They begin with generating solution concepts very early in the design process, because an ill-defined problem is never going to be completely understood without relating it to an ideal target solution that brings novel values and purposes into the design process.

Concurring with Simon, Cross situates this "within a larger argument about design as a coherent discipline of study distinct from the sciences and humanities" (Kimbell, 2011). This prompts the debate about acknowledgement, firstly that design is distinct from science and the humanities, but secondly whether it is the sole preserve of designers.

Schön (1983) "challenged both researchers and practitioners to reconsider the role of technical knowledge versus 'artistry' in developing professional excellence" (Johansson-Sköldberg et al. 2013). Schön presents an approach to design, developed from a practice-based focus, that moves between creation and reflection upon the creation (Schön, 1983) that fosters improvement and re-creation (Johansson-Sköldberg et al. 2013). Schön's work is widely recognised as a foundation of design practice. Johansson-Sköldberg et al. (2013) identify his work as the core of the sub discourse they describe as 'Design and Designerly Thinking as a Reflexive Practice.'

What can be drawn from these works is a sense of an iterative process, human centred in its approach, cycling between the development of an idea or concept and reflection upon that idea with the aim to achieve better solutions.

2.2.4 Wicked problems

Wicked problems, are described variously however at the core of Rittel and Webber's 1973) work are problems which are ill-defined, where the information is confusing, involving many decision makers with differing perspectives and values.
A coherent argument for integrating the disciplines of understanding, communication and action is made by Buchanan (1992), becoming a foundational reference not only for design thinking but also for the subject of design as a whole (Johansson-Sköldberg et al. 2013). This work provides a clear foundation for the concept of integrative thinking.

Buchanan (1992) observes that the subject matter of design is 'potentially universal in scope, because design thinking may be applied to any area of human experience' thus the problems are 'indeterminate' or 'wicked'. This paper moved the focus of design theory from its origins in craft and industry 'towards a more generalised 'design thinking'' concept (Kimbell, 2011).

Rather than a linear model of an analytical step of problem definition followed by a synthetic sequence of problem solution, Buchanan (1992) uses the concept of placements to contextualise and orientate thinking (Johansson-Sköldberg et al. 2013). Within Buchanan's (1992) 'doctrine of placements' he identifies four areas of design thinking that offer opportunity for reconsideration of problems and solutions, the design of:

1. Symbolic and visual communication,
2. Material objects,
3. Activities and organized services,
4. Complex systems or environments for living, working, playing, and learning.

Charles Owen (1998) proposes that "creativity, whether discovery or invention, is inspired by good questions". Making reference to Rittel and Webber, Rylander (2009) provides a clear overview of the nature of wicked problems.

> Such problems are open-ended in the sense that they are ill defined and characterized by incomplete, contradictory, and changing requirements and complex interdependencies – that the information needed to understand the problem depends upon one's idea for solving it. Thus there are no right or wrong solutions, only better or worse solutions. (Rylander, 2009, p.10)

The discourse of design and designerly thinking identified by Johansson-Sköldberg et al. (2013) as creation of meaning is based primarily on the work of Krippendorff (2006). The premise is that the importance is placed on meaning, in the accounts of practices, methods and their articulation rather than on artefacts or systematic recording of process. Krippendorf places this in conjunction with the importance of interaction and the necessarily human aspect of a network of stakeholders with different interests.

> Most outsiders see design as an applied art, as having to do with aesthetics, unlike a solid profession unto itself, with technical knowledge, skills, and responsibilities to rely on. Insiders to design, by contrast, talk of innovative ideas, coordinating the concerns of many disciplines, being advocated for users, and trying to balance social, political, cultural and ecological considerations (Krippendorf, 2006, p47).

The view of Johansson-Sköldberg et al. (2013) is that the discourses of designerly ways of thinking could be viewed more concisely as three streams, that of the practice-based approaches of Schön, Buchanan, Lawson and Cross which differ from the meaning creation approach of Krippendorf and contrast to the rationalized, systematic study of

design, by Herbert Simon. Broadly, it can be drawn from these works the sense of an approach that is human centred, iterative, reflective and concerned with understanding the nature of problems and envisaging possible solutions.

2.3 Design thinking within the context of management

Lucy Kimbell (2011) notes that the publications that have done most to popularise the concept of design thinking have made little reference to the literature published by academics conducting research in the design disciplines. Johansson-Sköldberg et al. (2013) concur with this viewpoint noting that there is little evidence to suggest that reference has been made to this important body of literature, despite there being elements of commonality between both discourses. Currently, the term design thinking is most evident in publications that discuss the challenges and opportunities facing organisations. However, it can be argued that Simon (1996) had set the foundations for a broader perspective and one that specifically made reference to management –"Design thinking is a rigorous body of knowledge about the design process as a means of approaching managerial problems". Cooper et al. (2009) set design thinking contemporaneously "what is different today is that it [design thinking] has been discovered by more people as a valuable tool with which to address problems and issues that do not necessarily involve a product to manufacture for sale."

Johansson-Sköldberg et al. (2013) make the distinction between the "design-based, scholarly literature" which they describe as the 'Designerly Thinking' discourse and that which is documented in the more widely accessible business media, describing this as the 'Design Thinking' discourse. The two main proponents who have "reconfigured design thinking" (Kimbell, 2011) in this context are Tim Brown of the design consultancy IDEO, and Roger Martin who until recently was Dean of the Rotman School of Management in Toronto. Kimbell (2011) observes that, although both explore design thinking within organisations, each describes design thinking differently. Concurring with this, Johansson-Sköldberg et al. (2013) identify these discourses as being separate streams based on different origins, adding a third stream based on the work of two professors of management information systems, Richard Boland and Frank Collopy (2004). This classification provides an appropriate framework for further consideration of the literature related to 'Design Thinking' in the context beyond design and particularly situated within the field of management.

2.3.1 Design thinking and innovation

The first of the streams identified by Johansson-Sköldberg et al. (2013) is categorised as "Design Thinking as Design Company IDEO's Way of Working with Design and Innovation". Accounts of the successful working practices of IDEO are well documented by Tom Kelley, who offers insight into the working practices of IDEO including the methodology adopted, the work culture and infrastructure (Johansson-Sköldberg et al. 2013). Kelley (2001) observes the unique position of IDEO in that they are both practitioners and advisers, describing the approach taken by IDEO as empathic, one that emphasizes both user understanding and teamwork. Setting his work in the context of increased recognition of the importance of innovation not only to organisations but also to the economies of nations, in *The Ten Faces of Innovation* Kelley (2006) presents a spectrum of the 'personas' required for effective design thinking teams, being careful to differentiate the personas from personality traits.

Similarly, as might be expected, in *Change by Design* Tim Brown (2009) also perceives considerable benefits to design thinking "an approach to innovation that is powerful, effective and broadly accessible that can be integrated into all aspects of business and society, and that individuals and teams can use to generate breakthrough ideas that are implemented and that therefore have impact."

In his article for the Harvard Business Review in 2008, Brown describes design thinking as "a methodology that imbues the full spectrum of innovation activities with a human-centered design ethos". Brown (2008) reinforces the view that innovation is now "a principal source of differentiation and competitive advantage" which has expanded from a basis in product to include services, processes, experience and entertainment. He situates design thinking within this holistic view advocating its application from concept, through design and production to communication and finally to support for the product or service. Roger Martin (2009) frequently refers to Tim Brown's definition of design thinking (2008) "a discipline that uses the designer's sensibility and methods to match people's needs with what is technologically feasible and what a viable business strategy can convert into customer value and market opportunity" suggesting that this offers a broad underpinning of the 'Design Thinking' discourse. The observations Brown (2008) makes on the evolving role of the designer, from one who traditionally made an 'idea' more attractive to consumers, to a role of idea creation which responds to consumers' needs and which anticipates their wants, is critical to the understanding of broader engagement with design thinking in the management context. The creation of ideas and concepts, which Brown describes as more strategic and leading to "dramatic new forms of value" is more closely aligned to management objectives and thus more accessible to non-designers.

2.3.2 The IDEO design thinking process

Through case studies Brown describes varied applications of design thinking. At the core of all the examples is a 'human-centered' methodology. Brown (2008, 2010) describes the process as "a system of spaces rather than orderly steps – 3 spaces, inspiration, ideation and implementation". In Brown & Wyatt (2010) it is noted that these are not always sequential processes and are "best thought of as a system of overlapping spaces rather than a sequence of orderly steps." Visually represented in the Harvard Business Review, Brown (2008) describes in both text and graphics the stages of "Inspiration for the circumstances, be they a problem, opportunity or both, that motivate the search for solutions; Ideation for the process of generating, developing and testing ideas that may lead to solutions; Implementation for the charting of a path to market" see Figure 2.1.

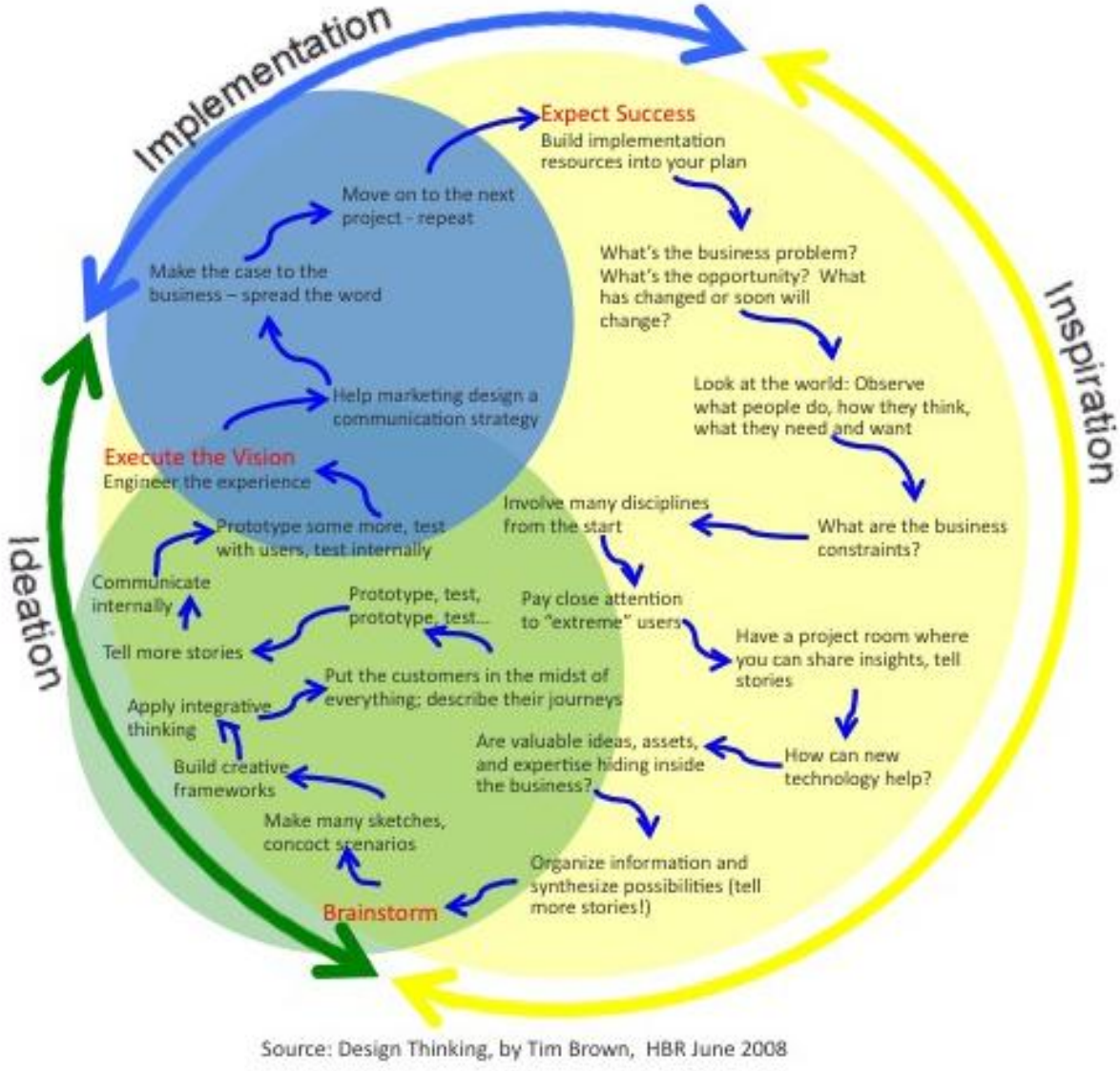


Figure 2.1 Design Thinking Process Model (Brown, 2008)

Brown and Wyatt J (2010) describe the process as being 'deeply human' stressing that it "relies on our ability to be intuitive, to recognize patterns, to construct ideas and have emotional meaning as well as being functional, and to express ourselves in media other than words or symbols."

Brown (2008, 2009) portrays the process as a journey, 'iterative, non-linear' in nature, cycling through stages of brainstorming, prototyping, testing and refinement. Prototypes are described as often being rudimentary the immediacy of the process being critical to the communication of concepts and the opportunity to build on ideas, to develop and to refine. Brown (2008) is careful not to reject the importance of aesthetics citing Pink's (2008) "abundance has satisfied, and even over-satisfied, the material needs of millions – boosting the significance of beauty and emotion and accelerating individuals' search for meaning" as indicative of an increasing expectation of ever more sophisticated experiences.

As noted by Kimbell (2011) design thinking is not the sole preserve of developing a product or service but also addresses the needs of societies confronting complex public issues. In *Design Thinking for Social Innovation* Brown and Wyatt (2010) explore this context further, in this paper they describe design thinking as "inherently optimistic, constructive, and experiential – addresses the needs of the people who will consume a product or service and the infrastructure that enables it." This supports Buchanan's view that design thinking may be applied to any aspect of human experience postulated in his defining publication *Wicked problems in Design Thinking* (1992 p16). It is perhaps because of this wider application of design thinking to different contexts that makes a consensus regarding a definition of design thinking problematic. Brown and Wyatt (2010) continue the development of this theme to say that '[a]s an approach, design thinking taps into capacities we all have but that are overlooked by more conventional problem-solving practices.' This suggests that design thinking is not the sole preserve of designers but of a much wider community echoing the view of Simon (1996).

2.3.3 Design thinking as problem solving for business

The second of the sub-discourses identified by Johansson-Sköldberg et al. (2013), 'Design Thinking as a Way to Approach Indeterminate Organizational Problems, and a Necessary Skill for Practising Managers' has as its focus, the work of Roger Martin. Although, from differing perspectives, Brown as a designer and Martin as an academic and consultant in strategic management, there are evidently connections between the work of Brown and Martin (Johansson-Sköldberg et al., 2013). Both explore design thinking in the context of organisations and both identify their approaches in relation to innovation, Martin (2009) making the case that sole reliance on analytical thinking and a fear of intuitive thinking compromises innovation.

In *The Opposable Mind* (2007), Martin explores the concept of integrative thinking, which resonates with the work of Buchanan. Martin defines this as the metaskill of being able to face two (or more) opposing ideas or models and instead of choosing one versus the other, to generate a creative resolution of the tension in the form of a better model, which contains elements of each model but is superior to each (or all). Martin (2009) makes comparison between integrative thinking, and design thinking describing them as having much in common.

> I consider design thinking to be the productive mix of analytical thinking and intuitive thinking. I call it a *productive* mix because you need both kinds of thinking if you're going to analyse the past, project what you can from it, and create futures that go beyond an extrapolation of the past (Martin & Euchner 2012).

Central to Martin's (2009) publication is his model of value creation that balances analytical thinking and intuitive thinking. Here he argues that neither mode of thinking is sufficient in its own right and that rather than making a choice, reconciliation between the two modes of thinking offers greater opportunity, and this in his view can be described as design thinking. Further developing his discussion on thinking, Martin (2009) places considerable importance on abductive reasoning, "logical leaps of the mind", as being an essential component of design thinking, situating abductive logic alongside deductive and inductive logic and stressing the importance of achieving balance. See Fig.2.2 below, the cycle of design thinking.

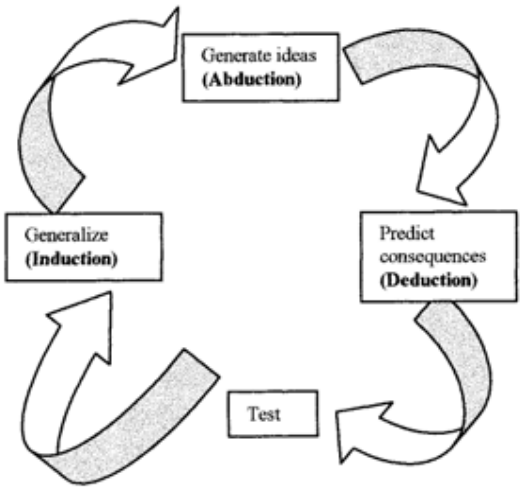


Figure 2.2 The Cycle of Design Thinking (Dunne & Martin, 2006)

Martin (2009) alongside March (1976), cited by Cross (1982) and Burdick & Willis (2011), credits Charles Sanders Peirce, one of a group which included John Dewey,

known as the American pragmatist philosophers, with the development of abductive logic, "it is modal reasoning: its goal is to posit what could possibly be true".
The relationship of design thinking to design practice is described by Dunne & Martin (2006) as "a project based work flow around wicked problems". 'The Knowledge Funnel', (see Fig. 2.3), illustrates this in a staged, although not necessarily linear, process, moving from mystery to heuristic to algorithm, providing a model for Martin's (2009) view of the understanding of problems and the development of potential solutions.

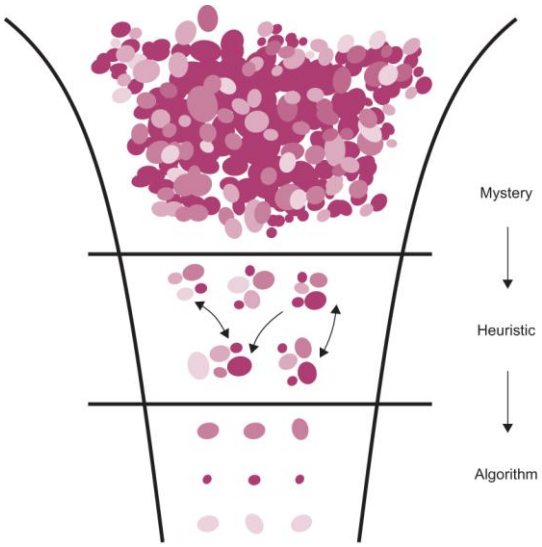


Figure 2.3 The Knowledge Funnel (Martin, 2009)

Referencing the work of management theorist James March, Martin additionally proposes that the application of integrative thinking offers resolution to the conflicting tensions arising between exploitation and exploration (Kimbell, 2011). Exploring further organisational tensions, in particular, reliability versus validity, Martin (2009) recognises the strong commercial argument for producing reliable, consistent and predictable outcomes, but makes the case for validity that meets a desired objective, proposing that achieving a balance is critical for the success of organisations.
Characterising the nature of the design thinker, Martin (2009) proposes that to become a design thinker, "you must develop the *stance, tools,* and *experiences* that facilitate design thinking. Stance is your view of the world and your role in it. Tools are the models that you use to understand your world and organize your thinking. Experiences are what build and develop your skills and sensitivities over time", see Fig. 2.4 below.

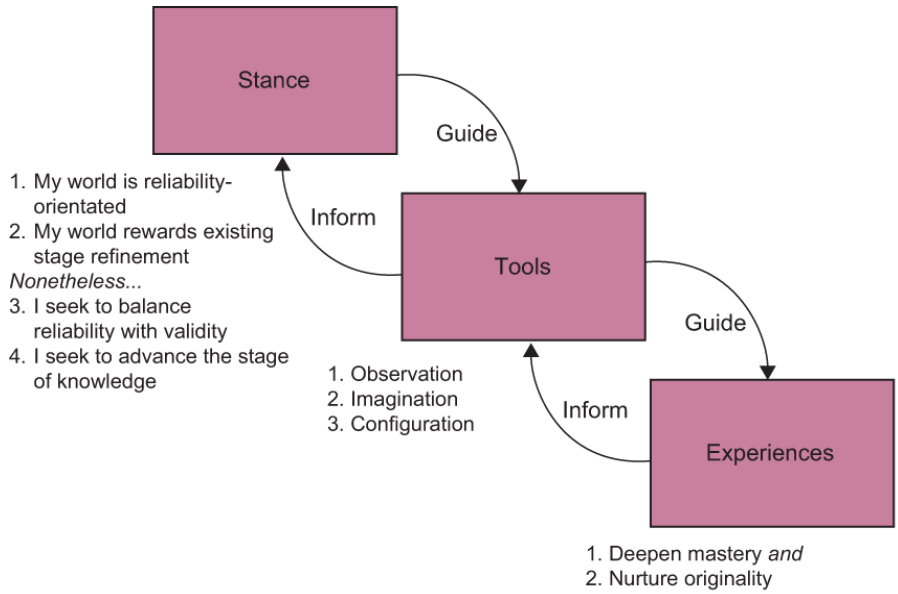


Figure 2.4 Stance, Tools and Experiences (Martin, 2009)

Building on this work with Roger Martin at the Rotman School of Management, Heather Fraser has developed an enterprise model 'Business Design'.

> Business design is about creating a model for symbiotically delivering market value and enterprise value. It embraces important design factors such as fostering multi-disciplinary collaboration, considering altogether new possibilities rather than aiming for incremental improvements, sourcing creativity from constraints, prototyping early (both in the lab and in the market), and creating new and better models through systems thinking (Fraser, 2009)

Figure 2.5 The Three Gears of Business Design (Rotman, 2014)

The 'Three Gears of Business Design' see Fig. 2.5, as described by Fraser (2010) is an iterative framework that incorporates "empathy and deep user understanding, concept visualization and prototyping, and strategic business design". The benefits, Fraser (2010) would suggest are "bigger breakthroughs faster – using insights and unmet needs to inspire high-value conceptual solutions and extract strategic intent".

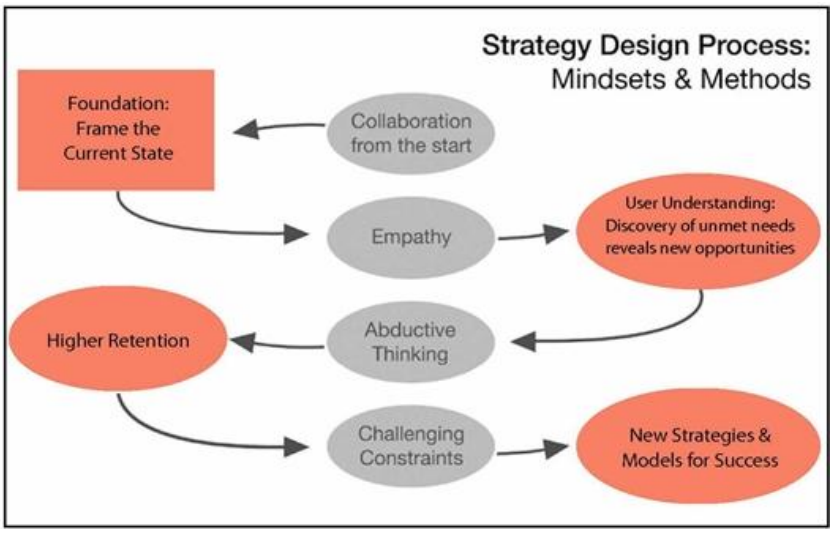


Figure 2.6 Strategy Design Process: Mindsets & Methods (Fraser, 2010)

The practice of business design, according to Fraser (2010), is a mindset, utilizing team intelligence, creativity and ambition. The method to achieve effective, holistic solutions is illustrated as a model (see Fig. 2.6) which embraces the elements of collaboration, empathy, abductive thinking and challenging constraints identified by Martin.

2.3.4 Design thinking as part of management theory

The work of Boland and Collopy is identified by Johansson-Sköldberg et al. (2013) as a sub discourse that they describe as 'Design Thinking as Part of Management Theory'. Inspired by their observation of the process of the architect Frank Gehry, Richard Boland, a Professor of Management and Fred Collopy, a Professor of Information Systems convened a workshop in 2002, which explored the potential for the development of management roles and responsibilities using a design approach.

Managing as Designing (Boland & Collopy, 2004) is a collection of work that comments on the parallels between the domains of management and design exploring the intellectual basis for approaching managing as designing (Dunne & Martin, 2006). In the opening chapter Boland and Collopy (2004) make a clear statement of intent, "we believe that if managers adopted a design attitude, the world of business would be different and better". Indeed the case is made that at the root of some of the current

crises in the business world is a paucity of good ideas that could be constructively addressed, "a potent antidote for the lack of attention to true functionality in corporate America" (Boland et al., 2008), through the adoption of a design attitude.

Boland & Collopy (2004) propose that the prevalent scenario in management education portrays "a manager that is faced with a set of alternative courses of action from which a choice must be made", placing the emphasis on the complex and difficult decision making process rather than in the possibility of developing alternatives from which to make a choice. Describing this as the 'decision attitude', they contrast this with the 'design attitude' that is central to their argument. They describe the design attitude as one that "assumes that it is difficult to design a good alternative, but once you have developed a truly great one, the decision about which alternative to take becomes trivial" (Boland & Collopy, 2004; Dunne & Martin, 2006). Drawing from the work of Simon (1996) and Schön (1983), Boland & Collopy emphasise the importance of the way the problem is represented, arguing that a decision attitude with a default representation of the problem comes with an implicit solution", whereas a design attitude begins by "questioning the problem".

They still contend that a decision attitude is relevant, but in particular to more clearly defined and stable situations. In a context of a more complex world, their contention is not that it is a choice of either the adoption of a decision attitude or a design attitude, but a balance of both. They observe that both carry some risk. That of susceptibility to concluding the space given to problem solving too soon in the decision attitude, and susceptibility to over-extending the search for alternatives beyond what is helpful in the design approach.

Boland and Collopy (2004) expand their definition to include a sense of both expectation and legacy; "a design attitude views each project as an opportunity for invention that includes a questioning of basic assumptions and a resolve to leave the world a better place than we found it". This definition is also indicative of process, which they develop through reflection on their observations of the process of Frank Gehry. They note the importance of starting with people; inviting comment, asking questions and instigating discussions before moving on to an iterative process of model-making together with collaborative discussion, "the more ways of thinking we have available to us, the better our problem-solving outcomes can be" (Boland & Collopy, 2004). Noting Frank Gehry's description and use of a 'vocabulary' as central to the design process, and acknowledging Simon's (1996) reference to a vocabulary, Boland and Collopy (2004)

further develop this concept, taking vocabulary as a broadly embracing term inclusive not only of words but also visual imagery, strategies and inspirations.
Although they make reference to process, their proposition places more emphasis on what could be termed cognitive characteristics (Johansson-Sköldberg et al. 2013), describing a design attitude as a "neglected but centrally important cognitive mode that should be nurtured in management practice and education" (Boland et al. 2008). As such, there are similarities to the work of Roger Martin (Dunne & Martin, 2006) Johansson-Sköldberg et al. (2013) who comment on the difficulty of assessing the impact of this work. However, they suggest that it may have provided impetus for discussion within special journal issues and conferences.

2.4 Design thinking within education

There is a long established argument for design as a "third area of education", situated alongside the sciences and the humanities (Cross, 1982), which serves to set a context for the development of design thinking within education. Cross (1982) notes that a number of observational studies of how designers work, in particular the work on design cognition of Lawson (1979), support the view that there is a "distinct 'designerly' form of activity that separates it from typical scientific and scholarly activities". It can be said that "design develops students' abilities in tackling a particular kind of problem... characterised as ill-defined, or ill-structured" (Cross, 1982), essentially wicked problems, and as such there is a strong educational justification that design develops cognitive skills in real-world problem solving (Cross, 1982). A second area of justification is found in the development of constructive thinking, which Cross (1982) aligns with Charles Sanders Pierce 'abductive' reasoning (March, 1976).
Cross (1982) identifies three main areas of justification for the integration of design within education:

- Design develops innate abilities in solving real-world, ill-defined problems.
- Design sustains cognitive development in the concrete / iconic modes of cognition
- Design offers opportunities for development of a wide range of abilities in nonverbal thought and communication.

2.4.1 The development of design education and its application to a broader audience

Charles Owen (2006) contends, "design thinking is usually taught tacitly" in current design education programmes. However, he argues that "for some of the characteristics, though, particularly those that have developed more recently, tacit assimilation is not enough", suggesting a need for a more explicit approach within design education.

Dunne & Martin (2006) extend this to management education, asserting that as design thinking has identified opportunities for managers this will have impact on business schools, stressing the evolving expectation of competency in design methods. Cooper et al. emphasise the need for developments in higher education.

> The imperative now is for business schools and design schools alike to open new paths for students to acquire skills that allow them to think through design. This involves the ability to visualize quickly problems and concepts, the development of people-based scenarios, and the design of business strategies based on design research methods. In this new way, managers are able to see how design methods and principles can help them navigate the uncertainties and complexities they now face (Cooper et al., 2009)

2.4.2 Current approaches to design thinking within education

Acknowledging more recent developments in the subject Melles, Howard & Thompson-Whiteside (2011) note that in the main there are currently four broad approaches – "design thinking as course logic, e.g. Masters in design thinking; within a course as a discrete program unit; as individual seminars or lectures; or a combination of any of the above as a general philosophy for schools." The teaching of design thinking can be broadly divided into two types (Melles et al., 2011):

- Those within design / engineering schools with specific focus on the nature of design practice;
- Those broadly within business / management schools introducing non-designers to design methods.

There is also evidence of both research and practice in respect of design thinking at school level, both primary and secondary, providing holistic insight into broader application of design thinking both as strategy and device. A number of these initiatives have been instigated by organisations such as IDEO, and educational institutions such as Stanford University REDlab – Research in Education & Design and the Hasso-Plattner Institute – Potsdam. To support the integration of design thinking within schools, IDEO has facilitated workshops and teaching materials 'Design Thinking for Educators' to develop both learning strategies and curricula. In the case study of Ormondale Elementary School (IDEO, 2013) IDEO provided workshops for primary school teachers to support the development of curricula, establishing "models and tools for use in engaging new learning experiences" described as "Investigative Learning" with the purpose of "inspiring students to be seekers of knowledge, rather than passive receivers of information".

In their relatively recent paper Scheer A., Noweski C., Meinel C. (2012) conclude from their case study research that design thinking offers teachers support to improve learning. The context for their research is schools. The case focuses on students in their

last year of school before college. Their argument is that design thinking empowers teachers "to facilitate constructivist learning in order to foster 21st century skills." Collectively this demonstrates the integration of design thinking both within the student learning experience and application to the development of teaching strategies and curricula.

Describing the benefits, David Kelley (von Zastrow, 2010) notes the current debate on the teaching of 21st century skills within schools and argues that design thinking equates to the development of these skills and that they can be regarded interchangeably.

Design thinking in Higher Education

Early evidence of taught elements of design thinking within Higher Education can be found in the development of modules at Stanford University. In 1958 within the successful design programme Professor John Arnold instigated a 'human centered' approach to the Design Engineering programme. Bob McKim built on this work, developing module ME101 Visual Thinking supported by his publication *Experiences in Visual Thinking* (1972), a module that still runs today. A team including Rolf Faste and David Kelley continued to develop the multi-disciplinary programme, later adding a business emphasis (Design Programme Stanford University, 2013). This work, set within the design school, proved foundational for the subsequent development of the d.school programme.

Within the management context, the Rotman School of Management developed a model for business education based on Martin's "integrative thinking for solving wicked problems" (Curedale, 2013). The team of Roger Martin, David Kelley, Patrick Whitney and Heather Fraser established a goal "to fuse together the complementary pieces of the puzzle provided by design education and business education in order to create the discipline of Business Design." (Fraser, 2012). Martin and Fraser further developed their 'Business Design' initiative, founding Rotman DesignWorks in 2005.

> We teach students how to tackle complex business challenges using Business Design, a human-centred, creative problem solving methodology. We draw on the designer's way of working and apply it to the way we build businesses – from innovative user experiences to creative business strategies and models. (Rotman School of Management, 2013).

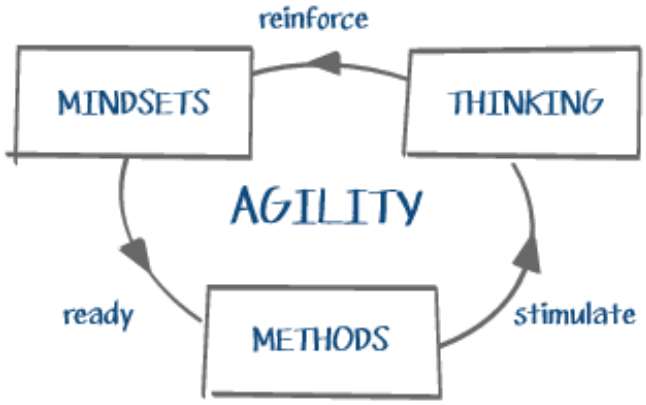


Figure 2.7 Mindsets and Methods (Fraser, 2014)

Fraser (2013) describes this as a methods-based approach to innovation, stressing the importance of a combination of "the right mindset (*being)* and a rigorous methodology *(doing)* that unlocks a person's thinking*",* illustrating this as a cyclical process see Fig. 2.7 above.

The rationale for this educational initiative that Martin considers to be the imperative for the development of design thinking in education is addressed by Dunne & Martin (2006) within their much cited article *Design Thinking and How It will Change Management Education: An Interview with Discussion*. The focus of the article is a discussion of the potential for design thinking to address criticisms being levelled at MBA programmes such as: insufficiency in the development of innovative approach, lack of attention to social responsibility and prioritising the shareholder over the consumer. They observe that students would benefit from the development of skills of observation and inquiry to gain insight and understanding both to users' needs and an innovative mindset.

Importance is attached by Martin (Dunne & Martin, 2006) to setting work within the context of a finite project (Wang & Wang, 2008), suggesting that this classic design way of working prompts collaboration with the potential to reach more holistic solutions that better address wicked problems. Central to this discussion are the three elements of design thinking: cognitive, affective and interpersonal. Within the cognitive context, Martin's view is that MBA programmes provide students with inductive and deductive reasoning but under-emphasize abductive reasoning (Dunne & Martin, 2006).

Referencing Boland & Collopy (2004), importance is made of a design attitude as distinct from a decision attitude. However a point of difference arises in Martin's view from both Simon (1996) and Boland and Collopy (2004) concerning constraints, Martin proposing that constraints are a means of generating ideas as opposed to limitations. In respect of

the interpersonal, Martin's perspective on an empathic, user-centred approach combined with collaboration reflects the practices of IDEO (Kelley, 2001, Brown, 2009). In Dunne's critique of Martin's views he observes a number of challenges to the integration of design thinking within MBA programmes, noting that these students are not recruited for their creativity and may not see themselves as innovators, although Martin argues that these qualities alongside the traditional skills are needed in contemporary business (Dunne & Martin, 2006). Dunne additionally notes the risk of design thinking being an 'add-on' to the programme, not as Martin would envisage "design thinking needs to pervade everything business students do".

The coincidence of ethos between the d.school and Rotman is unsurprising in that David Kelley has a central role in the development of both educational programmes. Kelley led the initiative that resulted in the establishment in 2005 of the Hasso Plattner Institute of Design, otherwise known as the d.school at Stanford University. In its 'manifesto' (2013) the d.school at Stanford states four intentions:

- to 'prepare future innovators to be breakthrough thinkers and doers',
- to 'use design thinking to inspire multi-disciplinary teams',
- to 'foster radical collaboration between students, faculty and industry',
- to 'tackle big projects and use prototyping to discover new solutions'.

The d.school describes its environment as a hub for innovators and draws students from engineering, medicine, business, law the humanities, sciences, and education (d.school Stanford, 2013). Emphasising the importance of a multi-disciplinary approach, the students participating in the d.school are primarily, but not exclusively, at a post-graduate level of study. The current version of their process and their most used tools are made publicly available via the d.school website (2013). 'The d.school Bootcamp Bootleg' is described as a "loose collection of methods", first disseminated to a wider audience on-line in 2009. It is based on the practice and methods used by past and current students. These methods (Lugmayr et al., 2013) seek to develop user-centred innovative solutions in a variety of contexts by means of cross-disciplinary teams. A European base for the d.school was created with the development of The School of Design Thinking at the Hasso-Plattner Institute in Potsdam in 2007 (Hasso Plattner Institute, 2013). Their similar philosophy places emphasis on collaboration, a multi-disciplinary approach to challenges and an environment that is inclusive of external organisational partners. Both d.schools participate in a common research programme into design thinking.

Design thinking in undergraduate education

In contrast with post-graduate education there is less evidence of the integration of design thinking within undergraduate education. The majority of evidence within the realm of undergraduate education is most frequently associated with students undertaking programmes within the disciplines of design, architecture and engineering. Melles (2010, 2011) reviews a number of examples of courses teaching design thinking, the Open University course being a typical example in that it is situated within a School of Design. However in this case it is open, not only to undergraduates of design, but also to those from other disciplines and for those students too, it will count towards their degree. In describing the aim of the development of their undergraduate program to expand the "design basis" of students, Melles and Misic (2011) situate their work specifically within the most prevalent context, that of developing design education for designers. Melles (2010) noting that, although in some cases enrolment by non-designers is permitted within design thinking activities, it is primarily design students who participate in design thinking. This is in contrast to post-graduate level where the position moves to one of positive encouragement of participation from varied disciplines, notably in a number of Masters of Business Administration (MBA) programmes, and is very clearly illustrated by the d.school, Stanford (see Fig. 2.8 Multi-disciplinary collaboration).

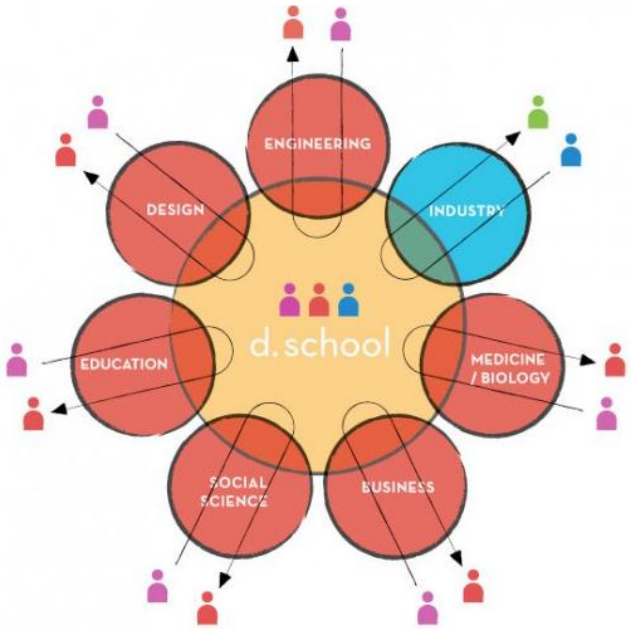


Figure 2.8 Multi-disciplinary collaboration (d.school, 2013)

Integrating undergraduate and post-graduate students and researchers Lugmayr et al. (2013) developed their programme of design thinking within the context of a broad approach to media management education. In this case the student group was of varied

backgrounds (business, psychology, media-management, human-computer interaction and IT) as well as of varying levels.

2.4.3 Design Thinking education – process and methods

As described by Rauth, Köppen, Jobst & Meinel (2010) "Design thinking is a holistic concept to design cognition and design learning that enables students to work successfully in multi-disciplinary teams and enact positive, design-led change". The core elements for supporting these learning experiences are clearly illustrated by the d.school, University of Potsdam (see Fig. 2.9 below)

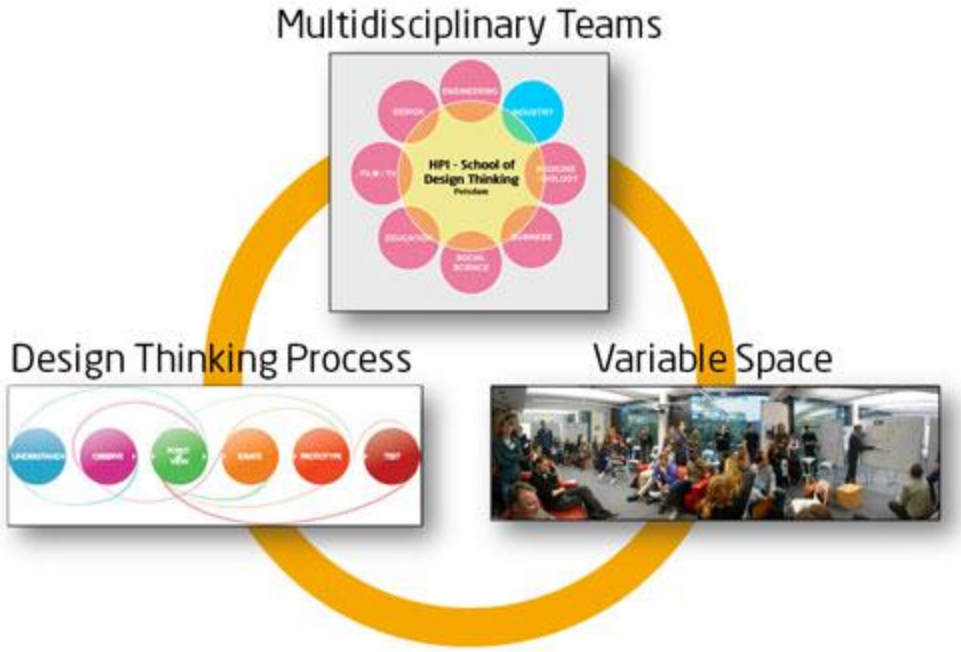


Figure 2.9 Design Thinking - Core elements (d.school, HPI University of Potsdam, 2013)

There are varied methods of approach to design thinking education practice. However in the main, these comprise of introduction to the concept of design thinking through literature review prior to the practical application of methods in group project work. (Melles and Misic, 2011; Lugmayr et al., 2013). Methods, and process to an extent, are identified typically through use of resources developed by IDEO and the d.School at Stanford. These include the d.School Bootcamp bootleg manual, the IPod app for IDEO method cards (Melles and Misic, 2011) and the IDEO Human Centered Design Toolkit (Lugmayr et al., 2013). Providing further support for teachers, IDEO has developed "The Design Thinking Toolkit for Educators" (IDEO, 2013) specifically adapted for the context of K-12 education. There is a considerable number and variety of tools described in this literature. Knowledge of them and how they might be used is dependent on teachers' experience and student's backgrounds (Rauth et al., 2010).

Some programmes have developed their own 'toolbox' of design thinking methods to support workshops (Withell & Reay, 2011). The case described by Melles and Misic (2011) additionally utilises blogs, along with Pecha Kucha as a mechanisms of project development and presentation.

A development of the iterative design thinking concept originated in the work of Brown, Kelly and Moggridge at IDEO. The d.school model provides a foundation for several educational design thinking programmes.

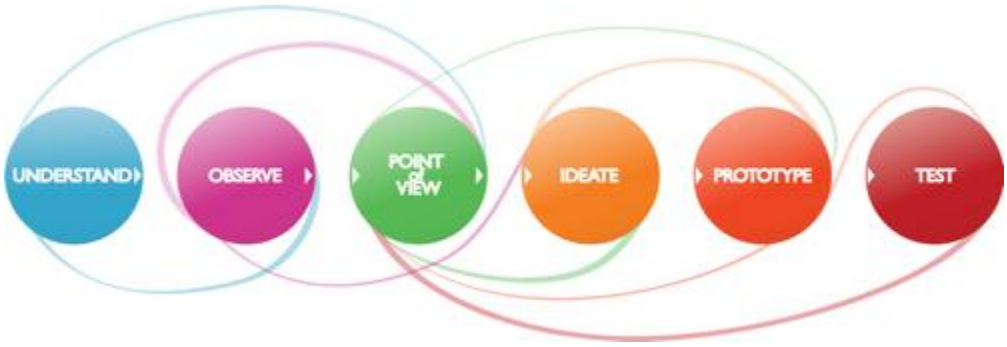


Figure 2.10 Steps in Design Thinking Process – (d.school, Stanford University, 2013)

A typical adaptation of this model is demonstrated (see Fig. 2.11 Adapted model of design thinking phases) in the context of media management education (Lugmayr et al., 2013).

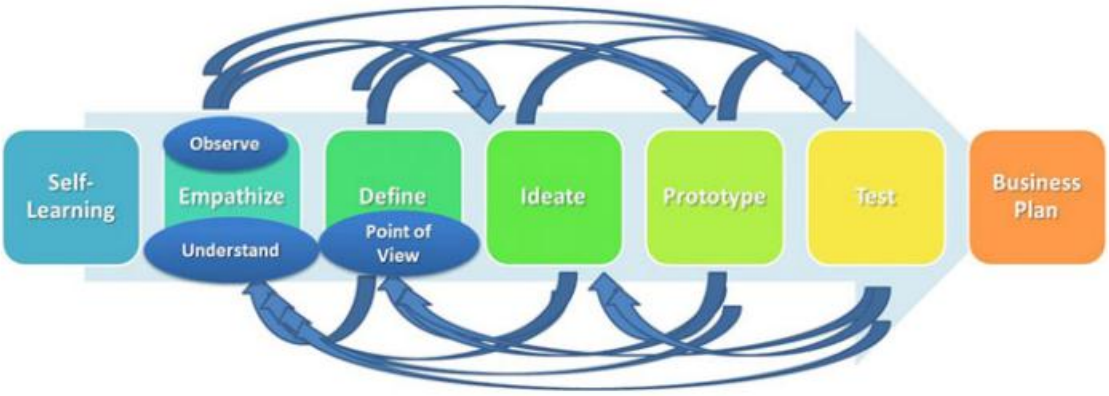


Figure 2.11 Adapted model of Design Thinking phases (Lugmayr et al., 2013)

The process is described by Rauth et al. (2010) as modes represented by steps. In each mode, students learn appropriate tools in order to engage effectively. First experiences of the process are likely to be more linear in order to enable an understanding of the framework, subsequently developing into an iterative and reflective cycle with experience (Rauth et al., 2010). To provide focus and ensure effectiveness, the process is centred on project work. Rauth et al. (2010) describe the initial use of pre-defined challenges progressing to situations where the challenge is not only to

develop a solution but also to find the right question, essentially defining 'wicked problems'. As identified by the REDlab (2014), the definition of problems is a key component of the process, suggesting that this emphasis promotes empathic action and innovation.
As a learning model, design thinking supports the development of creative confidence through a collaborative, iterative, reflective and ultimately a creative process (Rauth et al., 2010).

2.5 Student learning and cognition

2.5.1 The educational context of the 21st century

"In an ever changing society of the 21st century, there is a demand to equip students with meta-competences going beyond cognitive knowledge (Scheer, Noweski & Meinel, 2012). Tony Wagner (2012), Innovation Education Fellow at the Technology & Entrepreneurship Center at Harvard University states that "what matters today, however, is not how much our students know, but what they can do with what they know." He argues that in order for students to achieve and retain good jobs and to "contribute solutions to the world's most pressing problems", the most essential educational challenge is "to graduate all students innovation-ready". Wagner goes on to state that to "succeed in the new global knowledge economy, all young people must learn to be innovators." This statement concurs with Brown's view of a need for an approach to innovation that is accessible and can be "integrated into all aspects of business and society" (Brown, 2009).

The nature of employment has evolved (Pink, 2006) and therefore needs have changed in the educational landscape. Suto (2013) proposes that "the understanding and skills needed to compete in today's global economy are arguably quite different to those upon which 19th and 20th Century education systems have traditionally focussed". Suto (2013) sets the context of an "international, multicultural and inter-connected" society fuelled by advances in Information and Communication Technologies (ICT). It is therefore unsurprising that debates should have arisen regarding the so-called 21st Century skills needed to support this evolution.

2.5.2 21st Century skills

The international research group *Assessment and Teaching of 21st Century Skills (ATC21S)* has compiled an extensive review of key literature regarding 21st Century skills see Fig. 2.12 below.

ATC21S		21st Century skills projects reviewed by ATC21S				
Categories of 21st Century skills	**21st Century skills**	**Partnership for 21st Century Skills (2013)**	**Lisbon Council (2007)**	**International Society for Technology in Education (ISTE) NETS (2013)**	**ETS iSkills (2013)**	**Confederation of British Industry (CBI) (2007)**
Ways of thinking	1. Creativity and innovation	Creativity and innovation		Creativity and innovation	Creativity and innovation	
	2. Critical thinking, problem solving, decision-making	Critical thinking, problem solving, decision-making	Problem-solving	Critical thinking, problem solving, decision-making	Critical thinking, problem-solving	Problem-solving
	3. Learning to learn, metacognition					
Ways of working	4. Communication	Communication		Communication	Communication	Communication
	5. Collaboration (teamwork)	Collaboration	Collaboration	Collaboration		Collaboration
Tools for working	6. Information literacy (includes research on sources, evidence, biases, etc.)	Information literacy, media literacy,	Information literacy	Information literacy	Information literacy	Application of numeracy
21st Century skills	**21st Century skills**	**21st Century Skills (2013)**	**Lisbon Council (2007)**	**Technology in Education (ISTE) NETS (2013)**	**ETS iSkills (2013)**	**(CBI) (2007)**
	7. ICT literacy	ICT operations and concepts	ICT operations and concepts	Research and inquiry, Digital citizenship, ICT operations and concepts	ICT operations and concepts	ICT operations and concepts
Living in the world	8. Citizenship – local and global					
	9. Life and career	Initiative and self-direction, Flexibility and adaptability, productivity, leadership and responsibility	Flexibility and adaptability			Initiative and self-direction
	10. Personal and social responsibility – including cultural awareness and competence					Business awareness Customer care

Figure 2.12 ATC21S Definitions of 21st Century skills adapted from Suto (2013)

Problem solving is listed by all organisations. Communication and collaboration are also listed frequently (Suto, 2013). In broad concurrence, Professor Tony Wagner (2011) describes the following list of skills as survival skills for careers, college and citizenship:

- critical thinking and problem solving;
- collaboration across networks and leading by influence;
- agility and adaptability;

- initiative and entrepreneurialism;
- effective oral and written communication;
- accessing and analysing information;
- curiosity and imagination.

Associating these skills closely with need for meta-competences Scheer et al. (2012) propose that "education, therefore, needs a transition from transferring knowledge to developing individuals potentials with the help of constructivist learning". This implies that there should be development of communicative, social and creative meta-competences in addition to cognitive skills (Carroll et al., 2010).

2.5.3 A constructive approach – constructive, self-regulated, situated and collaborative (CSSC) learning

The concept of learning has evolved during the 20th century from the work of Piaget which has led to a focus on the active role of the learner as a sense-maker, this constructivist view has been further developed to highlight the role of the context in which cognition and learning take place (de Corte, 2010, p.41). Driscoll (1994, cited in Downing, Kwong, Chan, Lam, & Downing, 2009) identifies three basic principles on which cognitive theorists generally agree:

1. The learning environment should support the activity of the learner (i.e. an active, discovery-orientated environment);
2. The learner's interactions with peers are an important source of cognitive development (i.e. peer learning and social negotiation);
3. Instructional strategies that make learners aware of conflicts and inconsistencies in their thinking promote cognitive development (i.e. problem-solving and Socratic dialogue).

"Active engagement reflects the learning preferences of the current student" (McWilliam, 2009). It can therefore be proposed that a learner-centred approach that is active, inclusive of social interaction and focused on problem solving, offers a valuable learning model. This is discussed by de Corte (2010) in his concept for the development of new classroom practices and culture, in order to create a significant shift from guided learning towards action and experiential learning to achieve progressively what is described as 'adaptive competence' or 'adaptive expertise'.

De Corte (2010) proposes a concept for effective learning, constructive, self-regulated, situated and collaborative (CSSC learning).

> *Learning is constructive:*
> What is essential in the constructivist perspective is the mindful and effortful involvement of students in the processes of knowledge and skills acquisition in interaction with the environment.
>
> *Learning is self-regulated:*
> Constructive learning, being about process rather than product, is also 'self-regulated', individuals are "meta-cognitively, motivationally and behaviourally active participants in their own learning process". (Zimmerman, 1994, p3 cited in de Corte, 2010)
>
> *Learning is situated:*
> The situated view rightly stresses that learning is enacted essentially in interaction with, and especially through participation in, the social and cultural context.
>
> *Learning is collaborative:*
> According to de Corte (2010) there is substantial evidence to supporting the positive effects of collaborative learning on academic achievement.

In addition to the four main characteristics, de Corte (2010) notes two other aspects: that learning is cumulative and individually different. That it is cumulative is implicit in its constructive nature, "students develop and build new knowledge and skills on the basis of what they already know and can do" de Corte (2010). This can be developed to include insight gained through individual experiences (Scheer et al. 2012), thus emphasising the learner's prior knowledge.

> Learning is also individually different, which means that its processes and outcomes vary among students on a variety of pertinent variables. Prior knowledge is one of these variables, but so are ability, students' conceptions of learning, learning styles and strategies, their interest, motivation, self-efficacy beliefs and emotions. (De Corte, 2010)

This learner-centred and constructivist concept of CSSC learning fits well with the andragogical model developed by Knowles:

1. The need to know
2. The learners' self-concept
3. The role of the learners' experiences
4. Readiness to learn
5. Orientation to learning
6. Motivation

(Knowles, Holton & Swanson, 2011)

Students' conceptions of their learning, identified within CSSC learning, are an essential element of effective learning. "In our rapidly changing world, the challenge for teachers

is to help undergraduate students develop skills that will not become obsolete. As such, metacognitive strategies are essential for the twenty first century because they will enable students to successfully cope with new situations, and the challenges of lifelong learning." (Downing, 2007, p11)

2.5.4 Action learning

Based on foundational work of Revans (1998), action learning according to Zuber-Skerritt (2002) is "learning from concrete experience and critical reflection on that experience – through group discussion, trial and error, discovery, and learning from and with each other". In action learning it is the learners themselves who take responsibility to become experts on the problem, and to devise the means to solve it. A continuous process of learning and reflection, action learning takes place in a group, usually referred to as an action set, the set is tasked to work collaboratively typically to solve a problem or to develop an issue (Yeadon-Lee, 2013). Eight principal features of action learning have been identified by Pedler, Burgoyne and Brook (2005).

through research in Higher Education:

1. Sets of about six people
2. Action on real tasks or problems at work
3. Learning is from reflection on actions taken
4. Tasks / problems are individual rather than collective
5. Tasks / problems are chosen independently by individuals
6. Questioning as the main way to help participants proceed with their tasks / problems
7. Part of an existing programme
8. Facilitators are used

Essentially action learning is about helping people 'learn how to solve problems' (Revans, 1980) cited by (Pedler & Burgoyne, 2008).

2.5.5 The importance of experience and a reflective learning cycle

Direct experience according to Senge (1998) provides the most powerful learning platform. This active engagement with the environment of which the student is a part (Boud et al., 1997 in Jordan, Carlile & Stack, 2008) provides an important opportunity for reflection to improve subsequent performance. The perspective of experience can be

widened to include, not only personal experience, but also the experience of others (Jordan et al., 2008). Schön (1987) divides this reflection into two types:

- *Reflection-in-action* – occurs at the same time as the action, making tacit assumptions explicit so that they are demystified;
- *Reflection-on action* – involves a retrospective examination of events.

Kolb's (1984) learning cycle provides a method for reflecting on experience, an iterative process of observation, reflection and action that can begin at any point in the cycle.

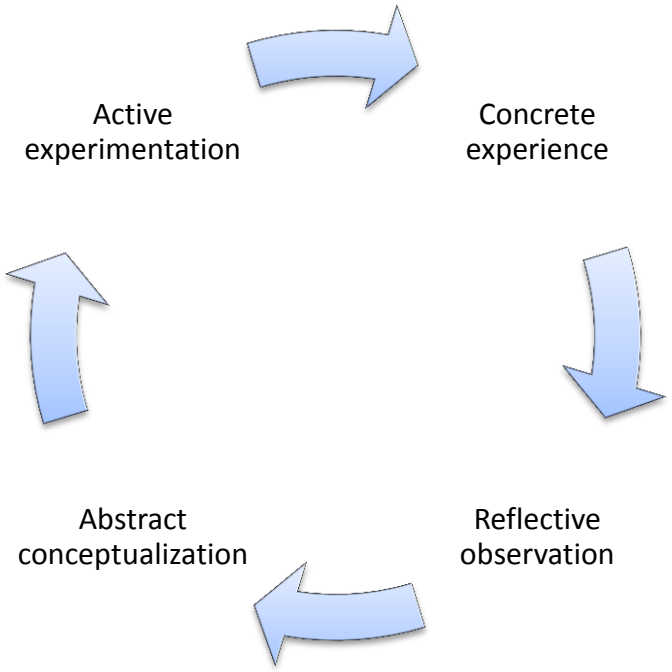


Figure 2.13 Kolb's learning cycle, adapted from (Kolb,1984)

As illustrated in Fig. 2.13 above, Schön and Kolb present reflection as an important means for improving future practice (Jordan et al., 2008) and, as such, a process whereby knowledge is created through transformation of experience. (Kolb, 1984, cited in Jordan et al., 2008)

2.5.6 How design thinking education delivers constructive learning of 21st century skills and develops creative confidence

The implementation of design thinking within teaching and learning strategies can help students to develop a skill set beyond those in traditional settings, contributing to higher levels of creative knowledge, creative skills and creative mindsets (Kwek, 2011). Design thinking is a problem-solving approach that can be described as an empathic, collaborative, iterative and reflective process. In education this is most frequently observed as a progressive, stepped process with opportunity to cycle backwards as well as forwards through the steps. Different competencies are developed throughout the

steps "such as prototyping skills, emotional skills, capability of adopting perspectives, empathy and a certain mindset" (Rauth et al., 2010).
An essential characteristic of design thinking is social interaction, not only of the user but between all stakeholders (Krippendorf, 2006). This social interaction facilitates cognitive development and is supported by Rogoff (1990, p.141) describing Vygotsky's model. The collaborative nature of design thinking, which embraces both experts and novice stakeholders is further supported by Rogoff (1990, p. 141) as developing cognition by building on "the internalization by the novice of the shared cognitive processes, appropriating what was carried out in collaboration to extend existing knowledge and skills." Dewey advocates activity-guided problem solving to facilitate education, the context of real world problem solving in a project based approach. Design thinking not only addresses these needs but also enriches the experience through social interaction. (Kwek, 2011). The iterative and reflective nature of this interaction offers opportunities for more experimental 'ideation' and more error-tolerant modes of engagement.

Considering the opportunities for enhancing education through design thinking, Scheer et al. (2012) propose Design Thinking as a meta-disciplinary methodology which offers teachers support to deliver key competence learning. Indeed, they claim that Design Thinking as a "team-based learning process offers teachers support towards practice-orientated and holistic modes of constructivist learning in projects" and supports the development of 21st century skills.

It has become evident that Design thinking within the educational context can be identified as a learning model. As a result of their research, Rauth et al (2010) define design thinking as a model "which supports design creativity, utilizing a project and process based learning process by emphasizing creative confidence and competence". The visualisation of their model, (see Fig. 2.14) is a representation of how creative confidence and competence can be developed and reinforced in design thinking education (Rauth et al. 2010).

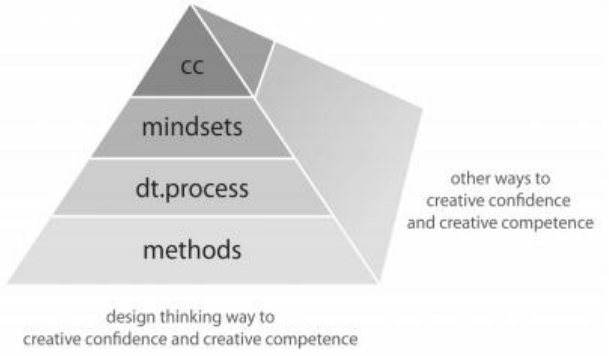


Figure 2.14 Development of Creative Confidence (Rauth et al.,2010)

However, as noted by Carroll et al. (2010) and supported by Rauth et al. (2010) "As design thinking comes to play a more important part of educational communities, further research is needed on its role in learning."

2.6 Summary

This chapter reviewed the literature relating to the four identified areas that form the basis of this study: design thinking, design thinking in the context of management, design thinking within education and the context of student learning in relation to design thinking education.

The research into design methods has evolved since the 1960s to establish the nature of design thinking as a human-centred approach with particular concern for the nature of the problem. The literature documents the development of a concern for the nature of problems, particularly those that are complex and ill-defined, termed 'wicked problems', how these problems should be framed, or defined, and how this influences the problem solving activity. The design thinking process is described as an iterative process informed by reflection and one that relies on hunches, which resonates with the later work of Roger Martin. The identification of a reflexive process be it during action or retrospectively, establishes a foundational element that underpins design thinking. Much of this research is situated within the fields of architecture, product design and engineering. However, the broader approach of Herbert Simon is both insightful and inclusive in his view of design as an activity of changing existing situations into preferred ones. His view is critical to the further development of a wider application of design thinking to decision making, beyond what might be termed as the creative industries, as evidenced by the fact that his work is extensively cited from publication to present across the widely differing disciplines engaged with design thinking. Together these elements provide an essential foundation for design thinking.

Within the broader and more recent management context, design thinking has further evolved. Although the literature indicates that previous design thinking research within the fields of architecture, product design and engineering has been under-utilised in the development of design thinking within the management context, essential themes are common to both. The elements of a human-centred, iterative, reflective process remain essential elements; however the aspect of collaboration assumes more emphasis within the management context. This problem-solving process as identified by Brown becomes visualised in three modes: inspiration, ideation and implementation. These modes are not regarded as a linear process, but offer the opportunity to cycle through them to

improve problem definition and to achieve more sophisticated solutions. If the work of Brown and his colleagues within IDEO is associated more closely with the development of innovative products and services, then the work of Roger Martin and Heather Fraser extends this to strategy within organisations. Exploring the mindsets within business, Martin identifies a model that that balances analytical and intuitive thinking, described as integrative thinking, to achieve a progression through 'the knowledge funnel' from mystery through heuristic to algorithm. Emphasising the importance of building on experience to support abductive reasoning in addition to inductive and deductive reasoning.
The importance of mindset is explored by Boland & Collopy who propose that the prevalent 'decision attitudes' carries with it an implicit solution and that the adoption of a 'design attitude' which questions the problem more rigorously offers the potential for better solutions. This extension to ways of thinking is identified by Boland and Collopy as an important cognitive mode.

In its origins, design thinking within education was tacitly situated in programmes specifically for architects, designers and engineers. There is now recognition that even within design programmes elements need to be addressed and delivered more explicitly. There is now recognition that design thinking techniques and process have broader application to a wider subject base, specifically to include management and that design thinking has application to all levels of education as is evidenced from post-graduate through to primary education.
There are close associations between design practice and educational institutions at all levels as is evidenced by the provision of resources, 'toolkits' of methods being the most prevalent, from established practitioners to those embarking on the integration of design thinking within educational programmes. The 'toolkits' are frequently used within a context of the broader, empathic, collaborative, problem-solving process originally identified by David Kelley and Tim Brown in their work at IDEO. David Kelley has done much to inform the practice of design thinking education in his work principally with the d.school at Stanford, but also at the Rotman School of Management.
From this it can be seen that there is increasing evidence of the recognition and realisation of opportunities for design thinking within education as a whole. However it is notable that the evidence indicates that within Higher Education, design thinking can be found within varied disciplines at post-graduate level but apparently almost exclusively within architecture, design and engineering disciplines at undergraduate level.

The changing nature of employment brings with it a new imperative to equip students with the understanding and skills needed to be successful in the global economy.

Research has developed in identifying what are termed the '21st Century skills' required by both graduates and employers. These skills place emphasis on problem solving, communication and collaboration. A constructivist learning approach supports the development of these skills, specifically CSSC learning provides a framework, where the learning is constructive, self-regulated, situated and collaborative. Active engagement is identified as a learning suited to the preferences of the current student. Therefore the 'real-life' problem-solving context of design thinking education offers an appropriate process for students to engage with a CSSC learning framework. Action learning effectively links this active engagement with problem solving. The design thinking process additionally facilitates the opportunity for utilising and building on experience, learning through social interaction and reflection within an iterative, and consequently less risk averse process. Ultimately the aim is to build creative confidence; the educational model devised by Rauth et al. serves to support this, although they note the opportunity for further research and development.

Chapter 3 Methodology

3.1 Introduction

This research seeks to evaluate selected techniques of design thinking in the context of their potential to enhance undergraduate student skills in knowledge management. In the collaborative context of design thinking the emphasis on social interaction is such that the philosophy underpinning the research is developed within a framework of social constructionism. An action research methodology provides an appropriate framework for this research, the "boundary-crossing nature of action research... makes it a particularly well-suited methodology for educational transformation in the twenty-first century" (Somekh & Zeichner, 2009, p.6). Within the context of action research, the approach taken will be one of action learning. The action learning process is "essentially developmental in that it encourages creative, innovative thinking by asking open-ended questions about how to improve or recreate what matters to us..." (Zuber-Skerritt, 2002, p.118). Furthermore there are clear parallels between the processes of action research, action learning and design thinking in that they are participatory, iterative and reflexive as shown in Figure 3.1. Swan (2002) proposes that the theoretical frameworks of action research would require little adjustment to be applicable to a description of the action of designing. Action research adds "the promotion of change to the traditional research purposes of description, understanding and explanation" (Robson, 2011, p.188).

Action Research	***Action Learning***	***Design Thinking***
Integrates research and action with the aim of improvement of practice	*Action on real tasks* *Helping people learn how to solve problems*	*Problem solving*
Participation in a democratic, collaborative process, determined by the practitioners	*Action 'set' of peers providing support* *Accords primacy to the people who actually face the problems*	*Collaborative* *Empathic*
A cyclical, living, emergent process	*The action process is essentially developmental.*	*Iterative*
Engagement with a wide range of knowledge, theoretical and experiential		*Integrative thinking*
Involves a high level of reflexivity	*Reflexive nature*	*Reflexive*

Figure 3.1 Mapping of parallels between Action Research, Action Learning and Design Thinking

(Based upon Brown, 2008; Coghlan & Brannick, 2010; Greenwood & Levin, 2007; Kember, 2000; McNiff & Whitehead, 2011; Pedler & Burgoyne, 2005; Reason & Bradbury, 2008; Saunders et al., 2012; Somekh, 2006; Zuber-Skerritt, 2002)

Action research is portrayed as a process that is cyclical or spiral rather than linear, involving a series of steps that include planning, acting, observing and reflecting. A defining element of action research is that it is carried out with the intention of improving practice (Kember, 2000).

Because it is anticipated that students and tutors will have unique responses to the experience of working with design thinking techniques, as previously discussed, the research is situated within a constructivist / constructionist philosophy, the data gathered will therefore be qualitative (Quinlan, 2011). Qualitative data is associated with representing, feelings, thoughts, ideas and understandings and is typically non-numeric (Quinlan, 2011). The study is longitudinal in that it will take place during two academic years in order to facilitate 'cycles' of action. Longitudinal research is identified with a capacity to study change and development and is therefore apt for this study (Saunders, Lewis & Thornhill, 2012). The action research cycles will be conducted during the academic years 2012-13 and 2013-14.

3.2 Action Research Theory

The origins of action research lie in the work of John Collier in the 1930s and Kurt Lewin in the 1940s, being associated with social change to facilitate social justice (McNiff & Whitehead, 2011). Lewin is credited as being the first to use the term action research (Somekh & Zeichner, 2009; Robson, 2011); his concept of a cycle of steps, involving action and reflection are foundational to the work of many researchers (McNiff & Whitehead, 2011). Lewin (1946) is explicit in describing a circle of planning, executing and reconnaissance for the purpose of evaluating results in a rational preparation for the next step within an overall plan. This cyclical process is shown below in Figure 3.2.

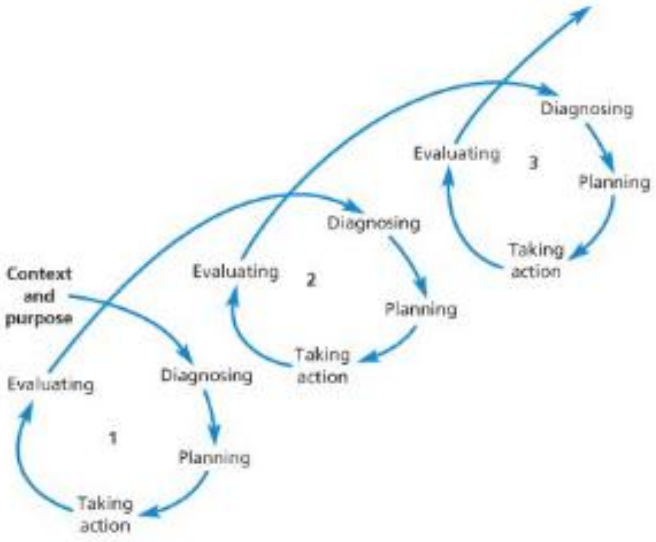


Figure 3.2 The action research spiral (Saunders et al., 2012)

The cyclical process of observe – reflect – act – evaluate – modify can be applied in multiple iterations (McNiff & Whitehead, 2011). Swann (2002, pp.55-56) states that this cyclical approach is familiar to designers, closely associating the design process with the action research process "problem/research – analysis – synthesis – evaluation (plan-act-observe-reflect)."

3.2.1 Characteristics of action research

Although interpreted in a number of different ways, within the literature there are common themes in the descriptions of action research, which can be identified as shown in Figure 3.3.

Somekh (2006)	Greenwood & Levin (2007)	Reason & Bradbury (2008)	Coghlan & Brannick (2010)	McNiff & Whitehead (2011)	Saunders, Lewis & Thornhill (2012)
• Integrates research & action • Conducted by a collaborative partnership of participants and researchers • Development of knowledge and understanding • Vision of social transformation and greater social justice for all • Involves a high level of reflexivity • Involves exploratory engagement with a wide range of existing knowledge • Engenders powerful learning for participants • Locates the inquiry in understanding of broader historical, political and ideological contexts	• Research • Action • Participation	• A set of practices that responds to people's desire to act creatively • Calls for engagement *with* people in collaborative relationships • Draws on many ways of knowing, • Is values oriented, seeking to address issues of significance concerning people & environment • Is a living, emergent process that cannot be pre-determined and develops as those engaged deepen their understanding	• Research in action, rather than research about action -resolution of important social or organizational issues -cyclical steps • A collaborative, democratic partnership • Research concurrent with action, improving action while building a body of knowledge • A sequence of events and an approach to problem solving – iterative cycles	General agreement about – • Action – taking action to improve practice • Research – finding things out and coming to new understandings – creating new knowledge Disagreement about – The balance between action and research Who does the action and who does the research	• Purpose – addressing practical purposes, resolving issues • Process – emergent and iterative + evaluation • Participation – social process • Knowledge – theoretical knowledge + experiential knowledge + knowing in action • Implications – beyond the research project to inform other contexts

Figure 3.3 Review of characteristics within the literature on action research

Themes that can be identified from this review include the relationship between research and action, the context of collaboration, the subsequent development of knowledge as a result of an emergent and iterative process.

The linking of the terms action and research is critical to the approach, described in an educational context by Kemmis and McTaggart (1988, p.6) as "trying out ideas in practice as a means of increasing knowledge about the curriculum, teaching, and learning" with an aim to improve education through change and learning from the consequences. The context of collaboration is considered essential to action research and notably it is equally fundamental to design thinking. The theme of an iterative and

emergent process can usefully be described as a self-reflective spiral, integrating the elements of reflection, action and progression (Kemmis & McTaggart, 1988). Within this research study these themes can therefore be closely aligned to those identified with design thinking.

3.2.2 Differing approaches to action research

There are differing approaches to action research, McNiff and Whitehead (2011, p.10) identify two elements where there is concurrence:

> ***Action***: taking action to improve practice, and...
> ***Research***: finding things out and coming to new understandings, that is, creating new knowledge. In action research the knowledge is about how and why improvement has happened.

They contrast this with disagreement about two aspects; the balance between taking action and doing research, and who does the action and who does the research and subsequently creates knowledge (McNiff & Whitehead, 2011).

Two groups are described with differing emphases on the elements of action research, those who support interpretive action research and those who believe that "a practitioner is able to offer their own explanations for what they are doing", referring to this as: "Self-study action research, first-person, living theory or just plain action research" (McNiff and Whitehead, 2011, p.11)

Further to this, Elliot (1991) as a protagonist of the former group, describes the principal aim of action research as being to improve practice rather than to produce knowledge thereby illustrating the second point of difference between the two schools of thought, the balance between taking action and doing research (McNiff & Whitehead (2011).

The current research seeks to bridge this gap; the balance between taking action and doing research within this study will be equally balanced. The study will seek, through action cycles, to identify and to develop selected design thinking techniques with the intention of improving students' learning, through their ability to manage information and to identify problems more effectively. As such, the participants in this action learning will be a collaboration between the following; the researcher as tutor, a fellow tutor and final year students from two cohorts. The research and subsequent creation of knowledge will be the responsibility of the researcher.

3.2.3 Action research in education

In the 1950s, action research was taken up in education, Stephen Corey was a key proponent in the USA, his publication *Action Research to Improve School Practices*

(1953) was influential at that time (McNiff & Whitehead, 2011). Through the influence of Stenhouse, working in teacher education, action research developed within the UK.

In the last twenty years here has been a proliferation and diversity of publications of texts related to action research in education (Noffke & Somekh, 2009; Stringer, 2008). The diversity reflects the differing purposes and theoretical positions of the authors, their differing methodologies leading to differing sets of practices. Figure 3.4 identifies leading figures and their positions in the development of action research within the field of education together with their key texts

Stephen Corey	*Action Research to Improve School Practices* (1953)	Working extensively with schools Corey developed his method, which he described and discussed as 'cooperative action research' (Somekh & Zeichner, 2009).
Lawrence Stenhouse	*An introduction to curriculum research and development* (1975)	Working in the context of teacher education Stenhouse's view of 'curriculum' was holistic in that it incorporated both what the students learned and the classroom practices of teachers and students. The emphasis of his work lies in the exploration of teacher-student interaction (Somekh & Zeichner, 2009), in particular that teachers should study their own practice. "The commitment to systematic questioning one's own teaching as a basis for development; The commitment and the skills to study one's own teaching; The concern to question and to test theory in practice by the use of those skills" (Stenhouse 1975: 144, cited in McNiff & Whitehead, 2011)
Wilf Carr & Stephen Kemmis	*Becoming critical: Education, knowledge and action research* (1986)	Stephen Kemmis has achieved worldwide recognition by developing ideas with a critical and participatory focus (McNiff & Whitehead, 2011). His work with Carr can be described as visionary setting an ideal of collaboration that is 'free and open, unconstrained by considerations of power and status' (Somekh & Zeichner, 2009).
John Elliott	*Action Research for Educational Change* (1991)	Elliott's work is concerned with improving education through action research, developing the situational understanding and responsibility of teachers. Essentially teachers being in charge of their own practice, Elliot's approach is described as multi-level and interpretive (McNiff & Whitehead, 2011; Somekh & Zeichner, 2009).

Figure 3.4 Leading figures in the development of action research within the field of education.

Challenging the prevailing theoretical positions, Stenhouse advocated a critical and reflective study of one's own teaching, developing the concept of teacher as researcher; however, believing that this research required to be reported by full-time researchers. Elliot and Whitehead further developed the approach of teacher as researcher however with differing perspectives, Elliot adopting an interpretive approach, Whitehead a self-study perspective (McNiff & Whitehead, 2011). This research is aligned with the view that the study of one's own teaching practice is an imperative and offers an opportunity to learn and potentially create knowledge. Further to this a focus of this research is that the iterative process of reflection and subsequent reporting is central to learning.

3.2.4 Meta-learning

Within any action research project there are two action cycles, the first is concerned with the aims of the project (the core action research), the second is a reflection cycle, an action research cycle about the action research (Coghlan & Brannick, 2014; Zuber-Skerritt & Fletcher, 2007). Argryis (2003) as cited by Coghlan & Brannick (2014) argues that this reflection on the core cycles is central to the development of actionable knowledge. As such this process can be described as meta-learning. Reflection on and throughout the cycles of this action research project will be carried out by the researcher and documented in chapter 5.

3.2.5 Action learning

Within the context of action research the approach taken by this research is action learning. According to Zuber-Skerritt (2002, p.114) action learning is "learning from concrete experience and critical reflection on that experience – through group discussion, trial and error, discovery, and learning from and with each other".
Action learning is a continuous process of learning and reflection conducted within a "set", normally of six to eight participants who are concerned with taking action to resolve problems or issues (Yeadon-Lee, 2013).

Within a context of Higher Education Pedler, Burgoyne & Brook (2005, p.321) found general agreement on the following key features of action learning:

9. Sets of about six people
10. Action on real tasks or problems at work
11. Learning is from reflection on actions taken
12. Tasks / problems are individual rather than collective
13. Tasks / problems are chosen independently by individuals
14. Questioning as the main way to help participants proceed with their tasks / problems
15. Part of an existing programme

16. Facilitators are used

The success of action learning according to Zuber-Skerritt (2002, p.119) relies on the adherence of the participants to the values of:

- Collaboration, trust and openness;
- Team spirit and mutual respect for individual differences, talents and needs; and
- Tolerance of mistakes, from which we learn.

3.2.6 Summary of methodological position

Gergen and Gergen (2013) identify four significant convergences between social constructionist theory and practices of action research. These convergences can also be aligned with the approach of action learning and the principles of design thinking.

- The active engagement in value relevant research
- Collaborative practice
- The presumption of social change
- Starts with the problems or challenges encountered in everyday life

(Gergen and Gergen, 2013)

The position of this research is to investigate design thinking techniques using an action research methodology, situated within an approach of action learning.

3.3 Research design

3.3.1 Population

The population of a study, according to Quinlan (2011) is all of the individuals relevant to the study; within an action research methodology the individuals involved are participants, critical friends and validators, and interested observers, all of whom have the same status as the researcher (McNiff & Whitehead, 2011). Action research requires the conscious selection of people on the basis of attributes, or criteria, described as purposive sampling (Stringer, 2013)

Purposive sampling is a form of non-probability sampling, involving the researcher using judgement to achieve a particular purpose (Robson, 2011). The researcher must ensure that the diverse perspectives of all stakeholders likely to be affected by the issue

participate within the study (Stringer, 2013). Therefore the criterion for inclusion within the study is the capacity to inform the research (Quinlan, 2011).

The importance of trust is described by Stringer (2013), the credibility of a study is developed by the use of multiples sources of information. The varied perspectives of student, tutor and researcher as participants will support the triangulation of data.

Participants

The participants in this study are undergraduate students, in the final year of the BA (Hons) Fashion & Textile Buying / Management / Retailing programme who are undertaking projects requiring them to develop individual responses to self set briefs. The two tutors who support and facilitate the students during these projects are equal participants, the first assuming the role of researcher, the second the dual roles of peer observer and critical friend. Critical friends provide a "sympathetic but critical hearing" (McNiff & Whitehead, 2011, pp. 94 – 95).

The criteria for inclusion are: that the students are in the final year of the BA (Hons) Fashion & Textile Buying / Management / Retailing programme, and willing to participate in the research. This includes those students who are in year 3, having progressed directly from year 2 of the programme, and those students who are in year 4 having undertaken a placement year.

The setting for this research is within Higher Education, specifically the University of Huddersfield. The participants are undergraduate students within the School of Art, Design & Architecture, those undertaking the BA (Hons) Fashion & Textile Buying / Management / Retailing programme. Specifically they are final year students, some have undertaken placement others have progressed directly from second year to the final year of the course. The BA (Hons) Fashion & Textile Buying / Management / Retailing programme is designed for those for undergraduate students who have the intention to become fashion business professionals in roles such as Buying, Merchandising and Fashion Management. Students enter their final year of the BA (Hons) Fashion & Textile Buying / Management / Retailing programme from two different routes; having previously undertaken a placement year or having progressed directly from the second year of the programme.

The attributes of the participants are that, although they have gained insight into the role and practice of design, they essentially have a perspective of awareness of the

importance of design rather than that of a practitioner and as such can be described as creative business students.

The structure of the final year of the programme comprises of three honours level modules:

- THD1501 International Business with Finance
- THD1502 Contemporary Issues in Fashion & Textiles
- THT1696 Fashion & Textile Buying / Management / Retailing Major Project

These modules are equally weighted, each attracting 40 credits; the delivery of the modules is sequentially in a 'block teaching' strategy as shown in figure 3.5 below. This strategy has been designed to offer students the opportunity to build on skills and knowledge within modules and sequentially between modules.

Teaching week	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*		*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*Revision*
THD1051 International Business with Finance																										
THD1502 Contemporary Issues in Fashion & Textiles																										
THT1696 Major Project																										

Figure 3.5 Block delivery of final year modules

The actions associated with this research are situated within two final year modules, firstly the THD1502 Contemporary Issues in Fashion & Textiles module, and subsequently THT1696 Fashion & Textiles Buying / Management / Retailing Major Project. Contemporary Issues in Fashion & Textiles has two points of assessment, firstly the Case Study and secondly the Dissertation. The Fashion & Textiles Buying / Management / Retailing Major Project also has two points of assessment, the self-

determined brief and feasibility study followed by the written report and verbal presentation. For each of these assignments students determine the subject of their study, however tutor approval is required to ensure that the requirements of the module will be met.

In order to facilitate a series of cycles, the participants for this research included students from two cohorts: those in the final year of their programme during 2012-2013 and those in the final year of their programme during 2013-2014, thus providing two action sets. Those students undertaking their final year in the academic year 2012-13 are described as the first action set, those undertaking their final year in the academic year 2013-14 are described as the second action set. The first action set included 18 students, 15 of whom had undertaken a placement year. The second action set included 24 students, 15 of whom had undertaken a placement.

The role of the researcher

Stringer (2013) describes the importance, within action research, of establishing the role and function of the researcher, developing a position that is 'legitimate and nonthreatening'. Facilitating the research requires informing participants of the purpose of the research with clarity but not definitively.

Critical friends

The importance of public testing within educational action research is noted by McNiff and Whitehead (2011); they suggest that feedback on data and ideas from 'critical friends' is one such mechanism. Critical friends as described by Kember (2000) can perform a variety of roles; the role most clearly aligned with the current research is that of 'critical friend as mirror', encouraging reflection on the meaning and implication of data. This research identified the support of a critical friend in relation to two aspects; the implementation of design thinking tools and techniques, and the educational context of the students.

The criteria for purposive sampling of the critical friend in relation to design thinking were; experience of implementation of design thinking, experience of introducing design thinking within an educational context. Steve Heron, an experienced professional within the fields of innovation and qualitative research, was identified as meeting the criteria for this role.

The criteria for purposive sampling of the critical friend in relation to the educational context were; an academic role within the University of Huddersfield, familiarity with the course and the modules being undertaken by the students. Jo Conlon as final year tutor for the course and responsible for co-delivery of the modules was identified as meeting the criteria for this role

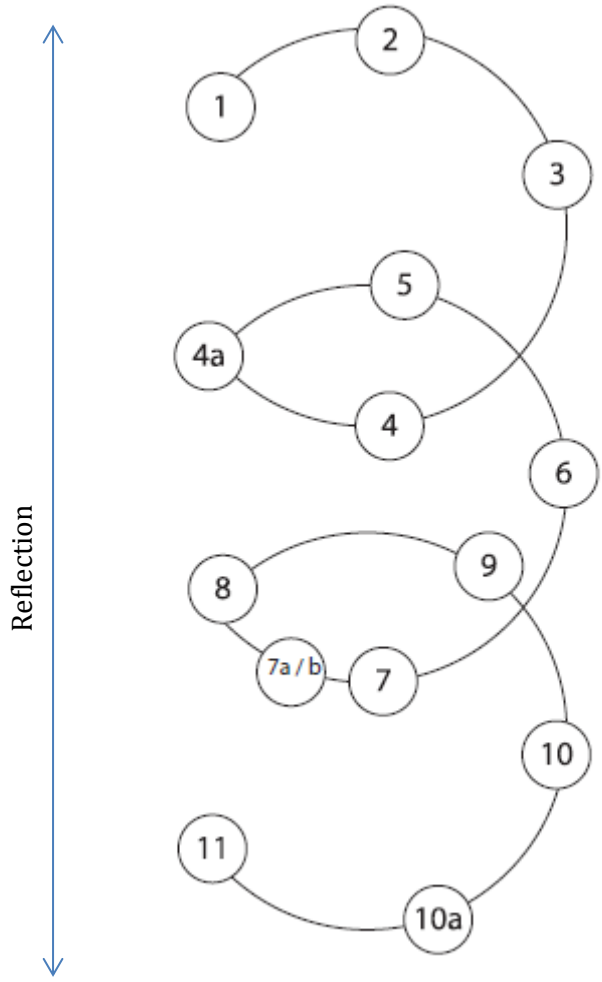
Peer observer

To support the research, observation of the design thinking workshops, in addition to that of the researcher, was undertaken by the fellow tutor. The value and credibility of observation when it is carried out over a period of time is identified by Stringer (2013); Jo Conlon observed the design thinking workshops over the three cycles of action. In doing so she was able to observe both action sets of students.

3.3.2 Method of inquiry

Adapted Action Research Model

Elliot (1991) proposes that Lewin's 'spiral of cycles' model can be further developed to facilitate greater flexibility and analysis. The researcher adapted and modified the model in consideration of this and in the context of the current study. The adapted action research model shown in Figure 3.6 contains three action cycles, which were implemented over a period of two academic years. Each cycle includes a sequence of planning, action, evaluation and amendment.



1. Identify idea
2. Reconnaissance
3. Planning
4. First action – Design thinking workshop

4a. Reprise of first action – second design thinking workshop

5. Evaluation of first action
6. Amend plan
7. Second action step - design thinking workshop

7a /b Second action step extension

8. Evaluate second action step
9. Amend plan
10. Third action step – design thinking workshop

10a. Reprise of third action – design thinking workshop

11. Evaluate third action

Figure 3.6 Adapted Action Research Model

The steps identified in the adapted action research model correspond to those identified in the table of actions shown in Figure 3.7.

Figure 3.7 Table of actions

Step	*(see Figure 3.6 Adapted Action research model)*	1st Action set	2nd Action set	**Date**	**Action**	**Participants**	**Participant feedback**
Step 1	Identify idea				*Identify concerns and opportunities*	Researcher Tutor observer / critical friend	Researcher data Tutor observer / critical friend (JC) feedback.
Step 2	Reconnaissance			15 Nov. 2012	Devise questionnaire **Questionnaire**	Critical friend Potential student sample –18 final year students: 15 returners from placement 3 progressed directly from second year Industry practitioner critical friend	Feedback – draft questionnaire Student responses to questionnaire Industry practitioner critical friend interview
Step 3	Planning				Research into design thinking resources Development of workshops using design thinking techniques	Researcher Tutor - Critical friend	Researcher data Tutor -Critical friend feedback.
Step 4	First action			28 Nov. 2012 29 Nov. 2012	Introduction to design thinking Workshop - Divided into two groups **Workshop 1A – 2 hours** 'Story tell' 'Brainstorm' 'Voting' **Workshop 1B – 2 hours** 'Feedback Capture'	Researcher Students Fellow tutor observer	Researcher data End of workshop 1A & 1B student feedback: individual comments gathered on post-it notes. Fellow tutor observer feedback

				Date	Action	Participants	Participant feedback
Step 4a	Reprise of first action			15 Jan. 2013	**Workshop– 4 hours** 'Story tell' 'Brainstorm' 'Voting' 'Feedback Capture'	Researcher Students	Researcher data End of workshop student feedback: individual comments via e-mail
Step 5	Evaluation of first action				Analysis of student and peer observer feedback	Researcher	Recording of data
Step 6	Amend plan				Amend activities for second action step workshop	Researcher	
Step 7	Second action step			13 Feb. 2013	**Workshop– 4 hours** 'Story tell' 'Brainstorm' 'Voting' 'Feedback Capture'	Researcher Students Fellow tutor observer	Researcher data End of workshop student feedback: individual comments gathered on post-it notes. Tutor peer observer / critical friend feedback.
Step 7a	Second step extension – *to 'Feedback Capture'*			14 Feb. 2013	**Workshop –** 'The story so far...'	Researcher Students	Researcher data End of workshop student feedback: individual comments
Step 7b	Second step extension – *to integrate with existing activities*			19 & 21 Feb. 2013	**'Pecha Kucha'** 'Poster'	Researcher (as observer) Fellow tutor Students	Feedback situated within final student questionnaire
Step 8	Evaluate second action step			May 2013	Devise questionnaire **Questionnaire**	Tutor critical friend (JC) Students	Feedback – draft questionnaire Student feedback on experience holistically, post submission of case study, dissertation and major project.

				Date	Action	Participants	Participant feedback
Step 9	Amend plan				Develop workshop in light of feedback	Researcher	
	Reconnaissance for second action set			27 Nov. 2013	**Questionnaire**	Students	Student completion of questionnaire to give perspective of new action set.
Step 10	Third action step			27 Nov. 2013	**Workshop– 4 hours** 'Story tell' 'Brainstorm' 'Voting' 'Feedback & Capture'	Researcher Students Fellow tutor observer	Researcher data End of workshop student feedback Tutor observer feedback.
Step 10a	Reprise of third action step			10 Dec. 2014	**Workshop– 4 hours** 'Story tell' 'Brainstorm' 'Voting' 'Feedback & Capture'	Researcher Students	Researcher data End of workshop student feedback
*Step 10b**	*Repeat of third action step (at student request)*			*19 Feb. 2014*	*Workshop– 4 hours* *'Story tell'* *'Brainstorm'* *'Voting'* *'Feedback & Capture'*	*Researcher* *Students*	
Step 11	Evaluate third action				**Questionnaire** Evaluation of feedback from students Reflection	Students Researcher / tutor critical friend	Student feedback on experience holistically, post submission of case study and dissertation. Interview

* Step 10b was outwith the planned data collection, it was provided in response to student request

Description of steps and data generation

This section describes the purpose of each step in the first cycle and identifies the points and mechanisms of data generation. Action research data arises from interaction with participants, Coghlan and Brannick (2014) note that the acts of collecting data are themselves interventions, generating learning data both for the researcher and the participant.

Step 1 - **Identify initial idea**

Confidence in knowledge management and effective problem solving can be demonstrated to enhance employability (Department for Business, Innovation & Skills, 2013). The idea for the research developed from the search for a more effective learning strategy to support students in the development of these skills. The concept of developing students' skills and learning through design thinking techniques was expanded through the literature review. The action is therefore, within a context of action learning, to investigate the potential of these techniques to enhance students' skills, learning and metacognition.

Researcher's Reflective Journal

McNiff and Whitehead (2011) identify personal logs and diaries as an appropriate record of personal action, reflection on the action and the learning arising from it. Reflection is an integral element of both action research and action learning processes, reflective writing within a journal is a commonly used mechanism (Kember, 2000). Zuber-Skerritt and Fletcher discuss the value of a reflective diary citing Kolb (1984) that students "learn from experience" and become more effective and "reflective practitioners" (Schön, 1983). The researcher started recording entries in a journal from the outset of the research, in concurrence with Kember (2000), the material recorded varied to include; reflections on the topic, plans, a record of actions taken, observations and results obtained.

Interview

Interviewing in action research tends to be unstructured and open ended (Coghlan & Brannick, 2014) and should be characterised as informal conversations (Stringer, 2013). An informal interview was conducted with Jo Conlon as fellow tutor and critical friend to gain feedback on the initial idea.

Step 2 – **Reconnaissance**

Elliot (1991) describes reconnaissance as clarifying the nature of the problem. Coghlan and Brannick (2014) use the term 'constructing' and note the importance of collaboration to establish a practical and theoretical foundation for the research.

Questionnaire

Questionnaires have the capacity to acquire information from a larger group within a limited time frame (Stringer, 2008). The purpose of this survey was to establish an understanding of how the students currently managed information from multiple sources. The questionnaire contained a series of open and closed questions. The responses to the closed questions employed a five point Likert scale. The questionnaire was organised in three sections; firstly about the sources and nature of information, secondly about their use and organisation of information, and finally about their management of information. The last open question offered an opportunity to add further thoughts on the collection and management of data. A pilot questionnaire was administered to other teaching staff for comment. The comments were minor and related to presentation, the questionnaire amended in line with their comments.

Interview with industry practitioner – critical friend

The purpose and focus of an interview with an industry practitioner was to gain insight into the contemporary application of design thinking techniques within a context of creative organisations. Steve Heron was identified as a practitioner with experience of working for IDEO and also with experience of implementation of design thinking techniques within an educational context. He was therefore selected through purposive sampling. This interview was informal, unstructured with open-ended questions.

Step 3 - Planning

Planning action follows on from the reconnaissance step that explored the context and purpose of the research and as such is consistent with this (Coghlan & Brannick, 2014). The purpose of this step was to situate appropriate design thinking tools and techniques within appropriate student learning contexts, and to devise an appropriate plan for delivery of the design thinking workshop.

Design thinking resources

The literature review identified principal sources of 'tools' or 'techniques' established within the practice of design thinking.

- d.school bootcamp bootleg document and process model (d.school, 2012)
- IDEO design thinking for educators (IDEO, 2012)
- Design thinking process model - Tim Brown, Harvard Business Review (2008)
- Designing for Growth: A Design Thinking Toolkit for Managers - Liedtka and Ogilvie (2011).

An analysis was undertaken to identify themes between these sources. A review of the purpose and function of the techniques was undertaken. Four themes emerged; generating ideas, synthesis, enhancing research, and reflection.

Framework

The selection of modules in which to situate the design thinking activities was based on those in which the assessment required students to self-select their own subject matter and to plan, execute and to report their research findings on an individual basis.

Design of workshop activity

From the four themes a selection was made of appropriate tools and techniques, the following criteria were identified in order to make the selection.

- That the techniques be appropriate to the stage the students were at in the development of their research projects.

- That the techniques provided an opportunity for students to 'build' ideas and subsequently develop their individual subject.

The techniques that resulted from this process were:

- 'Storytell'
- 'Brainstorm'
- 'Voting'
- 'Feedback & Capture'

Plan of workshop activities 1A and 1B

Introduction to the workshop by the researcher / facilitator, including an introduction to design thinking, the purpose of the workshop, the activities and what is expected of participants. An information sheet for participants (see figure 3.9) to be provided to

guide the participants through the process. In the first workshop 1 the process follows three sequential steps; story tell, brainstorm, and voting.

'Story tell' – students asked to individually describe the key focus of their research (5 minutes) on large post-it notes. Participants will then be divided into two groups, a tutor facilitating each group. Each student to fix their 'story tell' post-it note to the centre of a large sheet of paper and to then describe verbally the focus of their research.

'Brainstorm' – this element requires the student participants of the group to be invited to contribute thoughts and ideas on the subject. The ideas contributed to be recorded informally on post-it notes positioned on the large A1 size sheets of paper.

'Voting' – the large sheets with post-it notes to be laid out across the tables, each participant to be offered the opportunity to 'vote' for three post-it ideas, per sheet, that they feel contribute most to the topic. Participants to undertake this activity simultaneously.

The second workshop was delivered on day two, facilitating an opportunity for student reflection between workshops. Following a brief introduction which outlined the purpose and agenda for the workshop, students were introduced to 'Feedback & Capture' as a technique designed to reflect on feedback contributed by peers in the previous workshop.

'Feedback & Capture' – A systematic tool for reflection on feedback and what has been learned from the collaborative discussion. Students were asked to construct their own grids on large sheets of paper provided.

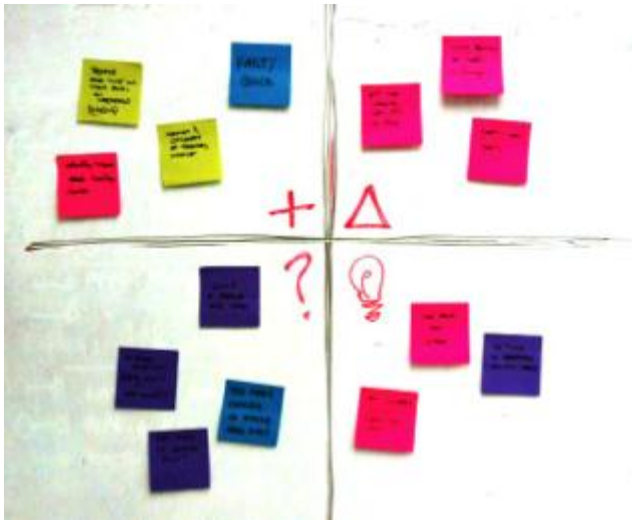


Figure 3.8 Feedback & Capture grid
(d.school, 2012)

Resources

Planning of appropriate staff and physical resources was required to facilitate the activity. The resources required for the design thinking workshop were:

- Staff, researcher and fellow tutor as facilitators
- Room (flat, mobile tables and seating to create appropriate group work setting)
- Equipment: large A1 sheets of paper, large post-it notes, small post-it notes, marker pens

Feedback

An informal interview with Jo Conlon as critical friend was carried out to test the validity of the proposed selection of techniques and plan of workshop activity.

Step 4 - **First Action**

The implementation of the planned activity adhered closely to the plan for the session. The information sheet provided to support participants is shown below in figure 3.9.

First action / workshop data generation

Observation notes were made by the researcher and the fellow tutor / facilitator. Further entries were made in the researcher's reflective journal.

Student participant feedback

Immediately on the conclusion of the workshops students were invited to give feedback on the design thinking workshop. Large 'Post-it' notes were supplied to the students for them to record individual commentary on the practice and experience of participating in the workshop. The 'post-it' notes were used to reflect the open-ended, un-restricted approach of the workshop, and therefore to encourage and capture a broad spectrum of responses. There was no limit to the number of post-it notes that a student could contribute. Responses were anonymous and individual although collective discussion whilst compiling the responses was not prevented. The 'post-it' notes were compiled on large sheets, visible to all, within the classroom.

THD1502 Contemporary Issues – **Ideas & information workshop**

We are going to employ some adapted techniques from the school of Design Thinking, in particular from some of the techniques used by post-graduate students in the
D-school, Stanford University in the US.

Workshop 1

	What to do	*Why do it*	*What you take away*
'Storytelling'	Write on the large post-it note what the key question / focus of your case is. You can write in sentences or in bullet points as you prefer. Put your post-it at the centre of the large A1 sheet. Describe your case to the group – you will have 2 minutes to do this.	*Encapsulating your concept in a few words develops your focus* *Saying out loud clarifies your thoughts and ultimately your aim.*	*Reflection on your idea / concept /aim for your case study* *Reflecting on what you write and say helps to confirm your priorities* *Thoughts on how to write your aim for the case study.*
'Brainstorming'	Your group is asked to contribute ideas, observations, comments and questions to your study, and those of the other group members They will do this by verbally expressing their thoughts, writing it on a post-it note and adding it to your A1 sheet. The group will be encouraged to think about what is positive about your idea, what aspects they think are most important, any perspectives they feel should be considered and any opportunities for further research. This is an evolving process so people can add to the ideas of others. You can also participate in the brainstorm. Brainstorming rules: Defer judgment, encourage wild ideas, build on the ideas of others, stay focused on your topic, one conversation at a time, you can be visual, go for quantity.	*It's an opportunity to benefit from a broader perspective on your idea – a 360° viewpoint* *It may help to ensure you don't 'miss anything'* *It can add depth and / or breadth to your idea*	*At the end of both workshops you will be able to take away your sheet and all the suggestions / comments made.* *You can capture photos of any or all of the information at the end of the activity*

'Voting'	You and your group will have the opportunity to 'vote' for any of the notes / observations / comments that have been made that they feel have value to your research and your case. You do this by adding stickers to post-it notes that you feel have most to offer. Each person's A1 sheet will be laid on the desks for you to look at, **add your stickers to three ideas on each sheet that you feel have most to offer.** There will be 10 minutes for this task; the voting on all the group members' sheets will take place at the same time.	*It starts the process of reflecting on and evaluating the contributions of the brainstorm.* *It will help you to reflect on opportunities to add breadth and/or depth to your case.*	*It will help you reflect on your priorities for your case.* *A starting point for critical reflection of your case study so far.*

Workshop 1B

	What to do	*Why do it*	*What you take away*
'Feedback & capture'	Using the group brainstorm sheet on your subject and taking note of the voting develop an analysis of the information gathered. Section off the new blank A2 page you have given into quadrants Draw a **+** in the upper left quadrant, a **Δ** in the upper right quadrant, A**?** in the lower left quadrant and a  in the lower right quadrant. Then put: • Things you like, find notable / **positive** put in the upper left (+) • **Constructive criticism** in the upper right (**Δ)** • **Questions** that have been raised go in the lower left (?) • **Ideas** that have emerged go into the lower right ()	*It 'unpacks' the ideas, contributions and voting from the previous activity, it helps you to think about what you have learned, what is valuable and what you might use it for.*	*The basis for actions to focus and develop your case study and / or dissertation and / or major project.* *A new reflective technique.*

	Try to give input into each quadrant		
'What have I learnt and how will I use it'	Two questions to answer: What points will I follow up for case study and / or dissertation and / or major project, how and in what order? What aspects of the activities have been of most constructive help, would you use them again?	*To decide upon actionable points to follow up and how to prioritise them.* *To reflect on what works for you*	*A plan of action including priorities* *A reflection on your learning and tools that can aid the process*
Action Research: Feedback on the workshop	On a large post-it note please give any feedback *(comments, observations, ideas & suggestions)* on the activities you have undertaken yesterday and today.	*By the end of the workshops you will have participated in an action research project therefore your view and feedback is essential to evaluate and develop the activities further.* *More workshops are planned for you to take part in and these will incorporate your feedback.*	

Figure 3.9 Ideas & Information Workshop – information sheet for participants

Step 4a - Reprise of First Action – 15 Jan. 2013

An intermediate analysis of feedback was undertaken and discussed with the observer / critical friend. Amendments were made to the design of workshop, in particular responding to student feedback suggesting the workshops should be in one four hour session rather than split across two sessions of two hours over two days. In response to researcher observation the groups were self-run, facilitator input was for guidance on timing only. The researcher was sole facilitator due to staff availability, observations and notes were recorded in the researcher's reflective journal.

Student participant feedback

Immediately on the conclusion of the workshop students were again invited to contribute reflective comments on the practice and experience of participating in the workshop. The format was replicated from the previous workshop.

Second cycle

A further cycle within the action research spiral was conducted during the study, denoted by steps 6 and 7. This second cycle was also conducted with the first action set of participants. The second cycle included the same design thinking tools and techniques with the addition of an extension to the 'feedback capture' tool, which is described as 'The Story So Far…". Student feedback and researcher observations were gathered for this activity.

The design thinking activities were planned to be implemented prior to the delivery of the established sessions of 'Pecha Kucha' and 'Poster', these are therefore recorded on the table of actions. Student feedback on these activities in order to evaluate the integration of the design thinking tools was gathered in the final student questionnaire.

Evaluation of the first and second actions

According to Coghlan and Brannick (2014) evaluating action is concerned with examining the outcomes of the action with a view to seeing:

- If the original constructing fitted;
- If the actions taken matched the constructing;
- If the action was taken in an appropriate manner; and
- What feeds into the next cycle of constructing, planning and action.

Data generated to support the evaluation included further entries in the researcher's reflective journal, interview with fellow tutor / observer, additionally a questionnaire was distributed to students at the conclusion of their final submission of work.

Questionnaire

The purpose of this survey was to establish an understanding of how the participants perceived the impact of the design thinking workshops on their management of information and their learning. The questionnaire contained a series of open and closed questions. The responses to the closed questions employed a five point Likert scale.

The first question aimed to find out the students' perception of which piece of work, if any, they considered was most 'helped' by using design thinking techniques. The second question aimed to find out the students' perception of which, if any, technique they found most helpful. The third question aimed to find out the students' perception of the way in which design thinking techniques may have benefitted their work and the way that they work. The fourth question aimed to find out the students' perception of what they will 'take away' from the experience that they perceive may be beneficial to them. The final question offered the opportunity to add any further thoughts and observations.

A pilot questionnaire was administered to other teaching staff for comment; minor amendments were proposed to elicit fuller responses. Amendments were made to the questionnaire in line with the suggestions.

Third cycle

A further third cycle within the action research spiral was conducted during the study, the design thinking workshops situated within the third cycle were provided to support the second action set of students. Two workshops were planned within the timeframe of this research project, however a third workshop was provided in response to student recommendation. This third workshop was included in student feedback within the final questionnaire.

3.4 Data analysis

Qualitative data analysis is appropriate for the nature of this research and the type of data collected. Further to this the cyclical process of action research means that there is a requirement to analyse data that emerges from the on going research, (Stringer, 2013). Reflection on the analysis informed successive steps of the action research cycles.

A process of categorising and coding identifies units of meaning within the data and supports the organisation of the units to summarize the experience and perspective of the participants (Stringer, 2013). Having conducted the initial coding by hand, and in consideration of the quantity of data the researcher considered it appropriate to continue in this manner.

The immediacy of participant feedback from at the end of the activities facilitated data to support, what Stringer (2013) describes as initial interpretive work, which in turn provided a basis for immediate action. Thematic coding as an approach to the analysis of qualitative data (Robson, 2011) was used to identify themes. The emergence of the themes informed the planning of the subsequent actions.

A framework will be used to structure the discussion of the analysis of the data. A four point framework devised by Levin (2003) to explore quality in action research, uses four criteria for evaluation: participation, real-life problems, joint-meaning construction and workable outcomes (in Coghlan & Brannick, 2014).

3.5 Ethical issues

Involving people in research requires awareness of ethics, involving three aspects; "negotiating and securing access, protecting your participants and assuring good faith" (McNiff & Whitehead, 2011, p.95). There were no major ethical issues identified within the study, however consent was required from the students prior to the completion of questionnaires and participation in workshops. An introductory paragraph included at the beginning of the questionnaires to inform participants of the purpose and nature of the research. The questionnaires were anonymous. A verbal introduction prior to the start of each workshop informed participants of the purpose and mode of operation of each session. For those participating in interview a consent form was presented which the interviewee signed to document their acceptance. The interviews were not anonymous.

3.6 Summary

This chapter has established that an action research methodology is an appropriate framework to evaluate selected tools and techniques of design thinking in the context of their potential to enhance undergraduate student skills. Action research is a reflective process involving a series of steps that include planning, acting, observing and reflecting carried out with the intention of improving practice. Action research is an established qualitative research methodology within education.

Within the framework of action research, an action learning approach will be taken. There are clear parallels between the processes of action research, action learning and design thinking in that they are participatory, iterative and reflexive. The collaborative context of action research is equally fundamental to design thinking. The emphasis on social interaction within this collaborative practice is such that the philosophy underpinning the research is social constructionism.

Purposive sampling identified the population for the study. The participants are the researcher as tutor, a fellow tutor and final year students from cohorts in two successive academic years. Selected design thinking tools are implemented through workshops situated within the action steps. The process involves three cycles of action, participant feedback informs each action. The data is gathered through interview, questionnaire and through student comment gathered at the end of each design thinking workshop. Categorising and thematic coding is an appropriate method of data analysis.

The following chapters documents the data gathered during the action research cycles and the reflection on the process.

Chapter 4 Analysis and Discussion of Data

4.1 Introduction

This chapter presents the data that was collected and analysed during the cycles of action research. The previous chapter discussed the action research model and documented the methods used to gather and analyse primary data. Data was collected and analysed, areas for improvement identified and recommendations proposed. The presentation of this data is closely aligned to the cycles of action research described in the previous chapter. The first section, 4.2, describes the development, from the resources identified in section 2.4.3 of the literature review, of the design thinking tools and techniques to be tested by the two action sets of participants.

Sections 4.3, 4.4, 4.5 and 4.6 document the findings in respect of the first action set of participants. Section 4.3 establishes an understanding of their current student practice in the management of information together with a perspective of current industry practice in the application of design thinking. The planning and implementation of design thinking workshops is described in the following section. This action set participated in the first and section action steps; evaluation of the feedback of these steps is located in sections 4.5 and 4.6 respectively.

Similarly the current practice of the second action set of students is recorded in section 4.7. This action set participated in the third action step; evaluation of participant feedback is located in section 4.8.

In respect of written student feedback, in open questions within the questionnaire and in the end of workshop student participant feedback, for clarity the author has added text, which are indicated by the use of square brackets, misspellings of words have been corrected and acronyms expanded.

4.2 –Identify initial idea

4.2.1 Researcher data

The context of this work is the enhancement of student learning and skills. This research was initiated with a perspective that potentially, we can learn from those who 'think ahead', in particular the consumer trend forecasters and design thinkers. The work of these practitioners who successfully use specific tools and techniques to manage information can be drawn from to enhance student skills and learning.

Preliminary research considered the wider field of consumer trend forecasting in addition to design thinking. The participatory nature of design thinking and its suitability for application at the earliest stages of project development indicated greater potential for application to the development of student learning. It was established through the literature review, Chapter 2, that design thinking techniques are used effectively within post-graduate education and design education.

4.2.2 Interview with fellow tutor

An interview with Jo Conlon, fellow tutor on two established final year modules, reflected on teaching and student learning specifically in relation to the development of student ideas for dissertations and major projects. Jo noted the very varied levels of student ability to generate concepts and ideas for their work, noting the subsequent difficulties encountered by delay in establishing an idea or concept. Reflection on the trial of Pecha Kucha style presentations and subsequent poster presentations, for a previous project, suggested that this technique had value but that further support was required earlier in the process of project development. The work of IDEO in respect of idea generation was discussed, Jo recommended further consideration and for integration within delivery.

4.2.3 Summary

It was determined that there is a need to support final year students at the very earliest stages of project development, in the development of their abilities to identify problems and opportunities to centre their work on. From the literature review it was established that design thinking techniques have previously been used in educational contexts to support student learning, although for students at post-graduate level and in design practice.

The introduction of design thinking tools & techniques at early stages of final year undergraduate student projects was identified as an opportunity to develop student learning and management of knowledge. These activities should be integrated within existing modules and be situated prior to the existing Pecha Kucha activity.

4.3 – Reconnaissance

4.3.1 First action set student questionnaire

Student data was gathered prior to the implementation of the first action. The aim of the questionnaire was to gain an understanding of student management of information and their perceptions of the impact this has on their project work. (See appendix 2 for the questionnaire, and appendix 3 for full results).

The survey was organised in three sections; firstly concerning the sources and nature of information, secondly about the use and organisation of information, and lastly about their management of information. An opportunity to add further thoughts on the collection and management of data was offered in the final question.

Fourteen students, out of a possible eighteen students in their final year of the BA (Hons) Fashion and Textile Buying Management course completed the survey, of these; eleven students had completed a placement year prior to entering the final year, three students had progressed directly from the second to the final year of the course.

The first section of the survey was designed to identify the breadth and diversity of sources of information that students have accessed and / or used.

Table 4.1 Sources of information accessed / used

Books	14	100%
Websites	14	100%
Newspapers / magazines	13	92.86%
Lecture notes	13	92.86%
Journals / journal articles	12	85.71%
Observation (e.g. store / consumer) results	6	42.86%
Questionnaire /survey results	4	28.57%
Interviews	3	21.43%

n=14

Other - Within this section: 1 student used /accessed television programmes, 1 student accessed YouTube channels, I student accessed UniTube, 1 student accessed DVD.

Table 4.2 Number of sources of information accessed / used

Number of sources accessed / used	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Number of students	2	4	4	3	0	0	1
	14.29%	28.57%	28.57%	21.43%	0%	0%	7.14%

n=14

Tables 4.1 and 4.2 indicate that students accessed varied sources of information, weighted more towards secondary sources, the majority worked with six sources or more. Data was then sought on the different formats that students may have accessed or used for project work.

Table 4.3 Formats of information accessed / used for project work

Copies of journal articles	14	100%
Your own notes	13	92.8%
Copies of articles from Newspapers / magazines	13	92.8%
Printouts from websites	13	92.8%
Copies of illustrations / images	9	64.29%
Observation results - text	5	35.71%
Interview transcripts	4	28.57%
Observation results – visuals e.g. photographs	4	28.57%
Questionnaire /survey results	3	21.43%

Other - Within this section: One student stated that they had used /accessed video.

Table 4.4 Number of formats of information accessed / used for project work

Number of formats accessed / used	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Number of students	1	1	4	5	3	0	0
	7.14%	7.14%	28.57%	35.72%	21.43%	0%	0%

n=14

Tables 4.3 and 4.4 indicate that the students work with information presented in varied styles and formats, principally text based but also including visual elements. The majority, over 50% of students work with at least six different formats of information.

The second section of the survey sought to identify whether the students had previously used brainstorming / mind mapping within project work, additionally to establish if this was a technique that they would choose to repeat. The first question sought to identify whether students have previously used a mind map/ brainstorm exercise at the start of a project.

Table 4.5 Previous use of mind map / brainstorm exercise at the start of projects

Always = 4	Usually = 4	Sometimes = 3	Seldom = 1	Never = 2
28.5%	28.57%	21.43%	7.14%	14.29%

n=14

The majority of students had used these techniques previously, twelve students would use this method again. The respondents noted that the content of these exercises was in the main, text based, only two out of twelve students who used these techniques, stated that they included diagrams. Additional comments from two respondents linked the activities to the development of a 'to do' list. A further question asked students to comment on whether they had used the techniques of brainstorming / mind mapping at intervals during a project.

Table 4.6 Previous use of mind map / brainstorm exercise during projects

Always = 1	Usually = 3	Sometimes = 4	Seldom = 2	Never = 4
7.14%	21.43%	28.57%	14.29%	28.57%

n=14

Fewer students used brainstorming / mind maps during a project, of those who did, all said that they would use this technique again. It is notable that the content of these documents expands, beyond the responses to brainstorming at the start of a project, to include illustrations and slightly more emphasis on visual elements. Although students are introduced to mind mapping techniques during the first year of the course a number of student make infrequent or no use of these tools during project work.

The survey asked students to consider how they organised the information they gathered, whether by nature of the source or by the subject / objectives of their project.

Table 4.7 Organisation of information by source

Always = 2	Usually = 3	Sometimes = 3	Seldom = 4	Never = 2
14.29%	21.43%	21.43%	28.56%	14.29%

n=14

Most students have previously organised work according to the source, for example by book or by journal article, although to varying degrees. Of these varied responses eleven students said that they would repeat this method.

Table 4.8 Organisation of information by subject / objectives of the project

Always = 2	Usually = 7	Sometimes = 3	Seldom = 0	Never = 2
14.29%	50%	21.42%	0%	14.29%

n=14

It was more common for respondents to state that they organise information according to the objectives / sub topics of their research subject. Ten students indicated that they would repeat this approach to managing information. The varied responses and their intention to repeat previous methods of organisation suggest that students select methods they are comfortable with and 'stick with them'.

Respondents were then asked to indicate whether they developed and used research proposals in order to manage their projects.

Table 4.9 Use of research proposals to manage projects

Frequently = 1	Usually = 5	Sometimes = 2	Occasionally = 4	Never = 2
7.14%	35.71%	14.29%	28.57%	14.29%

n=14

The majority of students had made use of proposals although varied in the frequency of their usage; of the respondents, twelve indicated that they were likely to use this approach again. The majority of proposals were text based with four respondents including visual elements of diagrams or illustrations. In order to establish if proposals were useful during projects, respondents were asked if they had previously made a proposal whether they referred to this during their project.

Table 4.10 Reference to research proposals during projects

Frequently = 3	Often = 1	Sometimes = 1	Occasionally = 6	Never = 1
21.43%	7.14%	7.14%	42.86%	7.14%
2 respondents omitted this question				

n=12

The majority of students rarely referred to their proposal during their project suggesting that these may be regarded as a framework rather than a management tool.

Action plans are recommended to students in the first year of the course as a mechanism to manage projects; in response to the question 'have you ever made a plan of action to manage your research for a project?' all the respondents indicated that they had used action plans.

Table 4.11 Use of action plans to manage research for a project

Always = 6	Usually = 4	Sometimes = 4	Seldom = 0	Never = 0
42.86%	28.57%	28.57%	0%	0%

n=14

All the students used action plans, although this varied in frequency of use all the respondents indicated that they would use this approach again. The format of the action plans was predominantly text based with four responses indicating the use of diagrams; one additional response indicated that lists were an element of their action plan. The subsequent question sought to establish whether action plans were referred to during projects.

Table 4.12 Use of action plans to manage research during a project

Frequently = 7	Often = 3	Sometimes = 2	Occasionally = 0	Never = 2
50%	21.42%	14.29%	0%	14.29%

n=14

It is interesting to note that, although it is encouraging that all respondents used action plans, two of these respondents never referred to the action plan during their project.

The next section of the survey required respondents to give information on the networks of people that they sought help from in order to manage information, develop projects and to support their work. Thirteen out of fourteen respondents talked to people in order to gain help in this respect. It is of some concern that one respondent made no record of working with others in this respect; it could be that this was an error of survey completion.

Table 4.13 People students sought help from in order to manage information

Subject / course tutors	13	92.86%
Fellow students on the course	13	92.86%
Friends (not students) / family	11	78.57%
Placement workplace colleagues	6	42.86%
Fellow students out with the course	6	42.86%
Graduated students from the course	4	28.57%
Tutors / university staff outside the course	3	21.43%
Acknowledged experts in your subject	3	21.43%
Academic skills tutors	2	14.29%

n=14

Principally students sought support from those involved with the course, tutors and peers, although their immediate family and friends are of considerable importance. The subsequent questions asked respondents to indicate the type of support they gained from individuals in different roles.

Table 4.14 People students sought guidance from on the subject of their research

Subject / course tutors	11	78.57%
Fellow students on the course	8	57.14%
Placement workplace colleagues	3	21.43%
Friends (not students) / family	3	21.43%
Acknowledged experts in your subject	2	14.29%
Tutors / university staff outside the course	2	14.29%
Fellow students outside the course	1	7.14%

n=14

For support and guidance related to the subject of their research students predominantly sought help from those most closely connected with the course, tutors and fellow students on the course.

For practical guidance on research methods, students indicated the following were sources of support.

Table 4.15 People students sought guidance from on research methods

Subject / course tutors	9	64.29%
Fellow students on the course	8	57.14%
Tutors / university staff outside the course	3	21.43%
Academic skills tutors	2	14.29%
Acknowledged experts in your subject	2	14.29%
Placement workplace colleagues	1	7.14%
Graduated students from the course	1	7.14%
Fellow students outside the course	1	7.14%

n=14

As for subject research students sought help from those closely connected to the course, and increasing in importance are members of staff within the university able to offer support specifically on academic skills. Students were then asked who they sought advice from when they wanted to test out concepts or ideas for projects.

Table 4.16 People students sought guidance from on 'sounding out ideas'

Fellow students on the course	9	64.29%
Subject / course tutors	7	50%
Fellow students outside the course	5	35.71%
Friends (not students) / family	5	35.71%
Placement workplace colleagues	3	21.43%
Graduated students from the course	2	14.29%
Tutors / university staff outside the course	1	7.14%
Acknowledged experts in your subject	1	7.14%

n=14

There is evidence of an increasing breadth of networks used by students to gain feedback on their ideas, that include; friends and family and those with some connection to the course and industry in that they work within placement providing organisations or have graduated from the course. In terms of broader support the students identified the following as providing help.

Table 4.17 People students sought 'moral support' from

Friends (not students) / family	10	71.43%
Subject / course tutors	7	50%
Fellow students on the course	7	50%
Fellow students outside the course	7	50%
Graduated students from the course	2	14.29%
Tutors / university staff outside the course	1	7.14%
Placement workplace colleagues	1	7.14%
Acknowledged experts in your subject	1	7.14%

n=14

The results are as might be expected, that students turn to those they are closest to for help and encouragement of a more personal nature.

The last question in this section sought to identify whether students made use of study skills books and websites or research methods books and websites to support their project work.

Table 4.18 Use of study skills books and websites

Study skills book	6	42.86%
Study skills website	2	14.29%
Research methods book	2	14.29%
Research methods website	0	0%

n=14

Less than half of the students make use of these resources, books were more frequently accessed than websites. Publications that were identified by students were those

recommended in course literature. The majority of students identifying that they accessed this form of support indicated that they would use this again.

In the final section students were asked to think about their experience of managing information; a Likert scale was used to categorize responses. All students completed responses for this set of questions. In the first two questions the respondents were asked to consider their perceptions of the implications of working with a large amount of research information.

Table 4.19 Working with a large amount of research information improves my chances of a good outcome

Strongly agree	*Agree*	*Neutral*	*Disagree*	*Strongly disagree*
2	7	4	1	0
14.29%	50%	28.57%	7.14%	0%

n=14

The majority of students perceived it to be the case that a greater quantity of information improved their chances of a good outcome. The second question was designed to identify whether a greater quantity of information might also be perceived as challenging.

Table 4.20 Working with a large amount of research information is overwhelming

Strongly agree	*Agree*	*Neutral*	*Disagree*	*Strongly disagree*
8	4	1	1	0
57.14%	28.57%	7.14%	7.14%	0%

n=14

A considerable majority of students agreed or strongly agreed that they found that working with a large amount of research information was overwhelming, confirming the perception of the researcher that the benefits of increasing access to information provides both benefits and challenges to students. This was echoed by an additional respondent who stated at the end of the questionnaire, "…all the information you collect at beginning is overwhelming and sometimes [an] overload."

Table 4.21 Working with a small amount of focused information improves my chances of a good grade

Strongly agree	*Agree*	*Neutral*	*Disagree*	*Strongly disagree*
4	4	5	1	0
28.57%	28.57%	35.72%	7.14%	0%

n=14

The majority of students indicated that working with less, but focused information would improve their chances of achieving a good grade. An additional response was offered elaborating on this point, "…depends on quality / authority of information / sources; I would rather have one really relevant piece of information than several pieces that are of no use to me."

Table 4.22 Working with a small amount of focused information limits my opportunities for a good outcome

Strongly agree	*Agree*	*Neutral*	*Disagree*	*Strongly disagree*
1	4	3	5	1
7.14%	28.57%	21.43%	35.72%	7.14%

n=14

The majority of responses indicated students perceived that working with a small amount of information would not limit their opportunities for a good outcome.

The next two questions were concerned with the perceptions of managing information from diverse sources.

Table 4.23 Working with diverse sources of information improves my opportunities for a good outcome

Strongly agree	*Agree*	*Neutral*	*Disagree*	*Strongly disagree*
9	5	0	0	0
64.28%	35.72%	0%	0%	0%

n=14

The responses indicated that students strongly valued diversity in the sources that they accessed information from.

The subsequent question sought to establish whether they perceived that this might be challenging.

Table 4.24 Working with diverse sources of information is challenging

Strongly agree	*Agree*	*Neutral*	*Disagree*	*Strongly disagree*
4	3	1	6	0
28.57%	21.43%	7.14%	42.86%	0%

n=14

There is no consensus in response to this question, the students are varied in their perceptions regarding the challenges of working with diverse sources.

Summary of First action set student questionnaire

In line with an ever-increasing number of sources available to access, both within universities and externally, the sources and formats of information accessed and used by this set of students is diverse both in source and format. The growing importance of newer sources is exemplified by a student comment at the end of the survey;

> "The importance of networking (social, webinars, events) is so high on my list of research methodology as you never know who you might meet and might have expertise in your field!"

In respect of the use and organisation of information, although introduced to a number of strategies and techniques in the first year of the course the student responses indicate variable engagement with and use of these to develop and manage project work. The responses indicate varied perceptions of the opportunities and challenges in respect of the management of information. The majority perceive that greater quantities and diversity of information sources are to be valued; however fewer, although still a significant number perceive there are challenges associated with these benefits.

4.3.2 Interview with Steve Heron, industry practitioner

This was an opportunity to test the concept of design thinking to enhance student learning with an expert in the implementation of design thinking techniques, to present the idea and gain feedback. The interview was informal, unstructured and conducted using open-ended questions.

In response to presentation of an overview of the nature and purpose of the research Steve Heron was supportive of the concept. He concurred that the issue of increasing access to a greater quantity and diversity of information in varied formats was a challenge generally but particularly for students with less experience of managing information.

Steve reflected on his experience of working with staff and students at a university within the United Kingdom (UK) on a project for a major UK retailer of childrenswear: in the case cited, the project evolved to spend more time developing an understanding of the problem, essentially 'establishing the right question'. The student teams presentation to the retailer was their 'definition of the problem' rather than a solution, which was well received. Through this example, considerable emphasis was placed on the importance of establishing the right question, and that in itself requires research and analysis. Managing information to ensure that there is sufficient data to establish sufficient understanding of the problem or opportunity is identified as key. Collaboration was noted as central to this approach, ensuring a holistic view of the problem.

Steve was cautionary on the issue of student engagement with 'obvious' solutions and ideas, he re-iterated the importance of 'asking the right question' stressing the importance of ensuring that students see this as a critical focus of the application of design thinking techniques. Iteration is important, 'keep going back' to ensure that the right question is being asked.

In consideration of the practical tools of design thinking, Steve discussed the intrinsic value of mind-maps / brainstorming, the importance of sharing and visualising information to promote contribution. He recommended that sufficient space and post-it notes are made available as they are an effective mechanism to support the recording of ideas.

Summary of industry interview

There were three critical points drawn from the interview with Steve Heron, central to these was the critical focus on identifying the problem, 'asking the right question'. In conjunction with this the importance of collaboration to explore the problem or opportunity holistically was identified together with emphasis on avoiding 'obvious' solutions. It was recommended to iterate in order to reflect, develop and refine.

4.4 – Planning

The planning section includes the analysis of design thinking tools and techniques, and the actions associated with devising and preparing the workshop activities delivered.

4.4.1 Design thinking resources

The literature review, Chapter 2, identified principal sources of 'tools' or 'techniques' established within the practice of design thinking:

- Design thinking process model - Tim Brown, Harvard Business Review (2008)
- d.school bootcamp bootleg document and process model – d.school (n.d.)
- IDEO design thinking for educators – IDEO (2012)
- Designing for Growth: A Design Thinking Toolkit for Managers - Liedtka and Ogilvie (2011).

Each of the four models has been designed for different audiences and for differing purposes. Tim Brown's design thinking model was published for an academic and professional audience. The d.school model arises out of their work with multi-disciplinary post-graduate students. Developed from their work with schools in the United States of America (USA), IDEO have made the design thinking toolkit for educators widely available via the internet. The publication by Liedtka and Ogilvie is aimed specifically at managers, as an introduction and guide to the implementation of design thinking techniques. All the models offer frameworks for the implementation of design thinking, and three offer specific tools and techniques. The presentation of the tools and techniques varies from the prescriptive (Liedtka & Ogilvie) to an open and flexible approach (d.school). All are designed to support collaborative endeavour to achieve collective goals.

a) Design thinking process model – Tim Brown (2008)

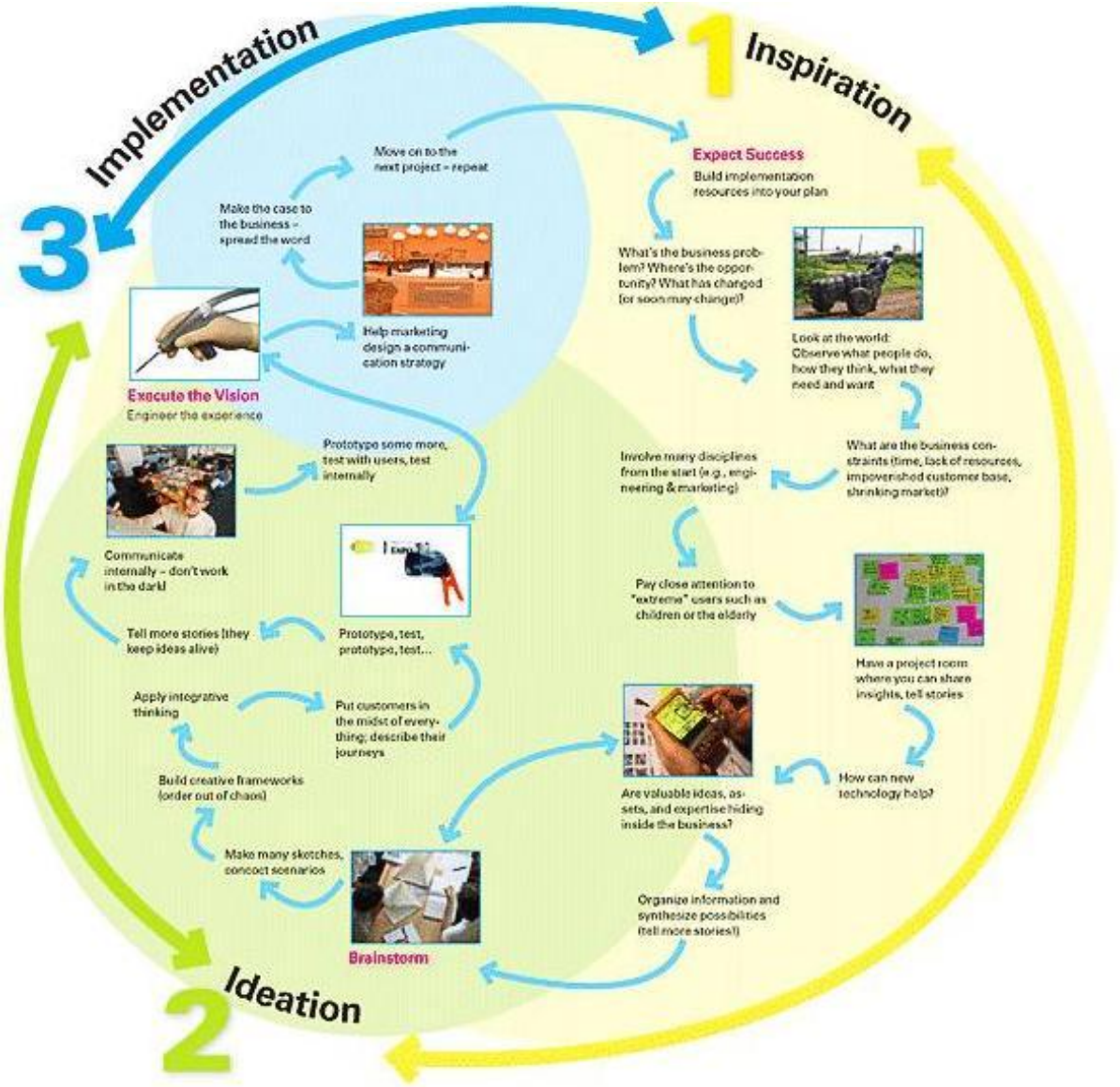


Figure 4.1 Design thinking process model – (Brown, 2008)

The model devised by Tim Brown from his work with IDEO provides a valuable framework to consider the context and purpose of the student workshops and to evaluate tools and techniques to assess their appropriateness. As such there are no specific descriptions of tools and techniques associated with this model, although IDEO method cards, initially developed as an in-house resource were published in 2003. The method cards provide fifty-one techniques, based on human and social research methods, intended to inspire designers. The cards are designed to inspire and prompt development of an identified problem or opportunity.

As the students are still in the early stages of generating concepts and identifying opportunities, Brown's (2009) foundational concept of competing constraints provides

the most open and adaptable approach. The criteria of "feasibility (what is functionally possible within the foreseeable future); viability (what is likely to become part of a sustainable business model); and desirability (what makes sense to people and for people)."

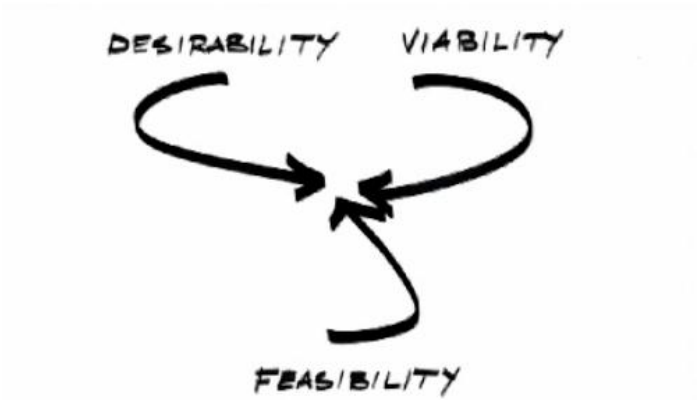


Figure 4.2 Competing constraints model – (Brown, 2009)

b) d.school bootcamp bootleg document and process model

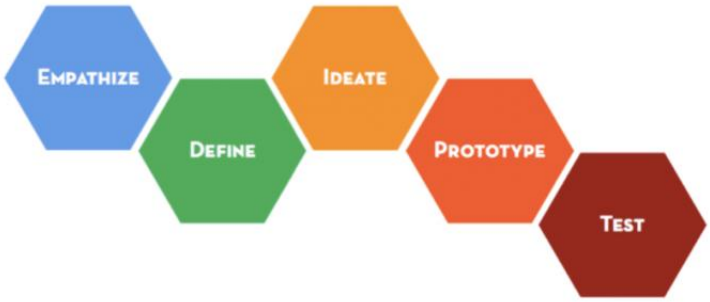


Figure 4.3 d.school – The Design Thinking Process (d.school, n.d.)

The five-step process of design thinking within the d.school at Stanford University starts with identification of the problem and concludes with implementation of the solution, the needs of the user are placed at the centre of this process. The visualisation of 'd.mindsets' is central to the bootcamp bootleg toolkit, establishing what might be termed a 'culture' in which to situate and practice the methods described.

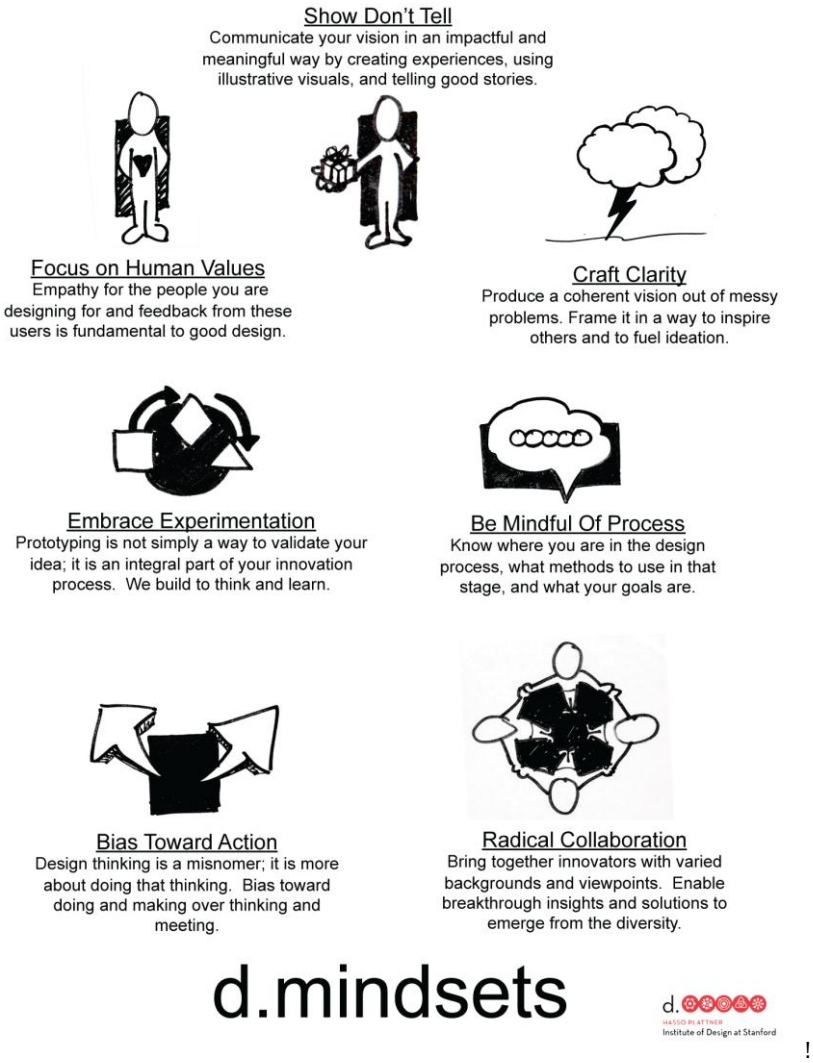


Figure 4.4 d.school – d.mindsets (d.school, n.d.)

The bootcamp bootleg toolkit expands on the five modes or steps, shown in figure 4.3, but makes no attribution of particular methods to specific modes. Thirty-eight methods are provided within the toolkit, each with a brief rationale to identify the potential benefits and instructions for use.

c) IDEO design thinking for educators

Arising from the work of IDEO with school teachers in the USA, this toolkit is designed to support the design of solutions, responses to problems and opportunities specifically within the environments of schools and communities.

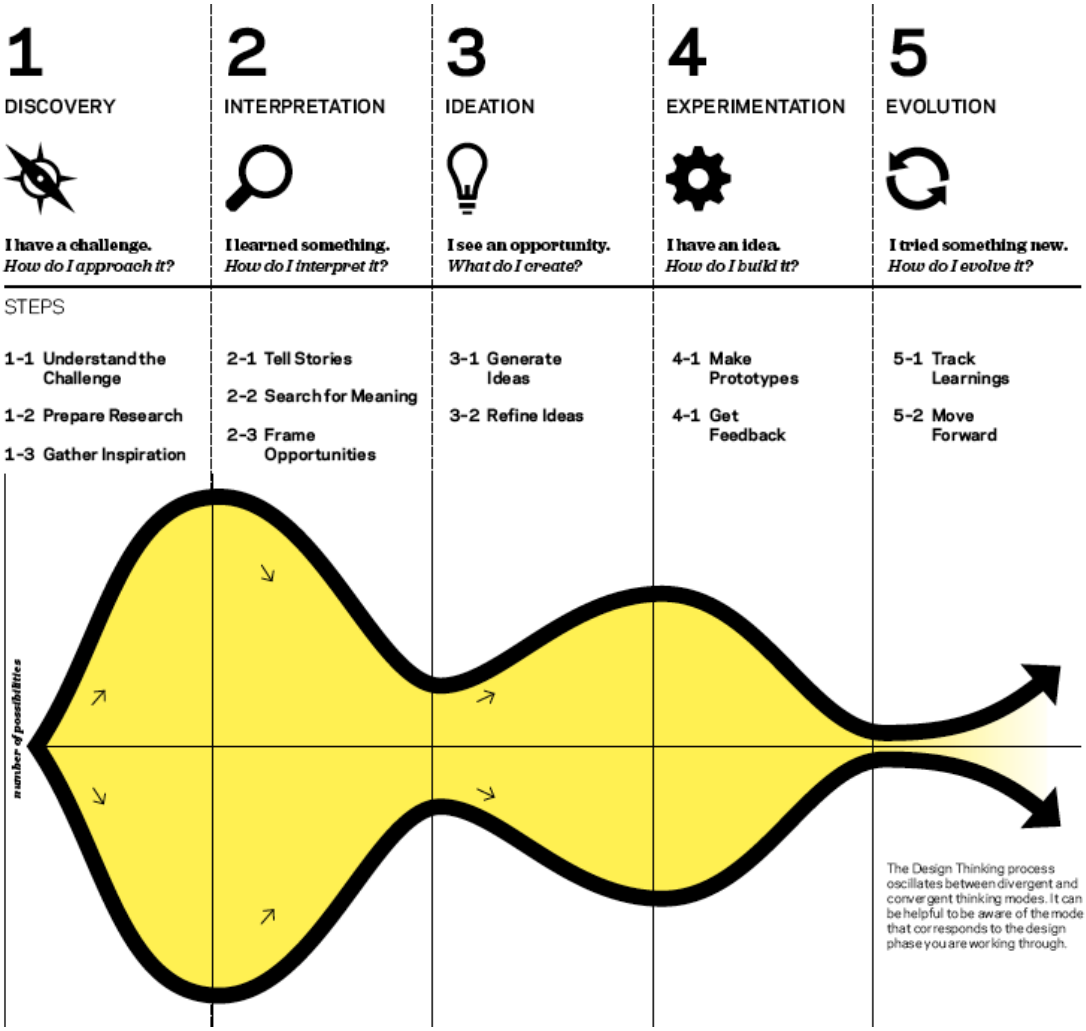


Figure 4.5 The Design Thinking Process – Design Thinking for Educators toolkit (IDEO, 2012)

A more extensive and comprehensive document than the d.school publication, information is provided to introduce the concept and benefits of using design thinking in addition to providing guidance for implementation. An extensive range of tools and methods is provided, each with a rationale to support clear and specific instructions on their use. The tools are clearly aligned to specific stages within the process.

d) Designing for Growth: A Design Thinking Toolkit for Managers - Liedtka and Ogilvie (2011)

In this much more extensive publication the argument is made for the importance of design thinking specifically to managers. The aim is to "demystify 'design' from an abstract idea into a practical everyday tool any manager can profit from" The process they define is characterised by four stages; what is? (explores current reality), what if? (envisions a new future), what wows? (makes some choices), What works? (takes us into the marketplace) (Liedtka & Ogilvie, 2011).

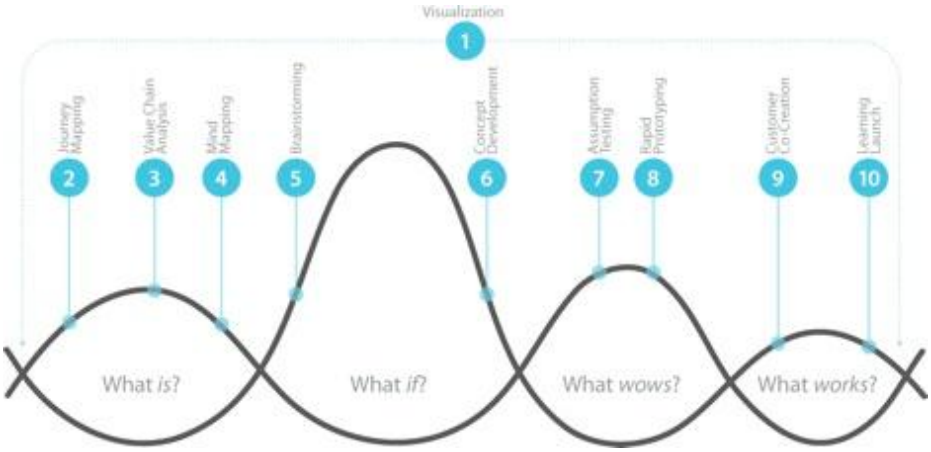


Figure 4.6 The Design Thinking Process – Designing for Growth: A Design Thinking Toolkit for Managers – (Liedtka and Ogilvie, 2011)

Ten tools are provided and linked to specific stages, or questions, of the process. Each tool is contextualised with a clear rationale, the following instructions are detailed and supported by exemplars. Emphasis is placed on the value of visualisation as a 'meta' tool in collaborative work. Acknowledged as "imposing artificial linearity on a very fluid process" Liedtka and Ogilvie (2011) present a prescriptive process for the use of the methods they describe.

Analysis of models of the design thinking process

Four models of the design thinking process were identified in the Chapter 3, an analysis adapted from Curedale (2013), to identify themes is illustrated below in table 4.25.

Table 4.25 Analysis of design thinking process models

	Identifying the problem	Interpret the results	Idea generation	Prototype experiment	Test implement improve
Design thinking process model - Tim Brown, Harvard Business Review (2008)	Inspiration		Ideation	Implementation	
d.school bootcamp bootleg document and process model	Empathize	Define	Ideate	Prototype	Test
IDEO design thinking for educators	Discovery	Interpretation	Ideation	Experimentation	Evolution
Designing for Growth: A Design Thinking Toolkit for Managers - Liedtka and Ogilvie (2011)	What is? (explores current reality)	What if? (envisions a new future)		What wows? (makes some choices)	What works? (takes us into the marketplace)

Analysis of tools and techniques

The four models of design thinking process were then reviewed to identify and evaluate any potential design thinking tools and techniques that were appropriate for use in design thinking student workshops.

There are a variable number of methods and tools associated with different models. Although invaluable as a framework, the lack of described methods associated with Brown's (2008) model prevented further consideration in this respect.

A preliminary selection process was applied taking into account three criteria; firstly that the students were within the very earliest stages of development within their projects, secondly the recommendation by the fellow tutor that early stage support was required

and finally the advice of the industry practitioner that exploring the nature of the problem, 'asking the right question' is an imperative.

A review of the purpose and function of the selected techniques, with particular focus on the early stages of project development, was undertaken. Four themes emerged; generating ideas, synthesis, enhancing research, and reflection.

Table 4.26 Analysis of design thinking tools and techniques

	Generating ideas	Synthesis	Enhancing research	Reflection
d.school bootcamp bootleg document and process model	Brainstorming Facilitate a Brainstorm Why-How Laddering Storytelling Selection (incorporating Voting) Feedback Capture Grid	Saturate and Group Journey Map Powers of Ten 2 x 2 Matrix	Interview Preparation Interview for Empathy	Critical Reading Checklist
IDEO design thinking for educators	Prepare for Brainstorming Facilitate Brainstorming Share What You Know Identify Sources of Inspiration Build a Question Guide Select Promising Ideas	Create a Visual Reminder Find Themes Make Sense of Findings Define Insights	n/a*	n/a*
Designing for Growth: A Design Thinking Toolkit for Managers - Liedtka and Ogilvie (2011)	Visualization: using imagery to envision possibilities and bring them to life Journey mapping: assessing the existing experience through the customer's eyes Value chain analysis: assessing the current value chain that supports the customer's journey Mind Mapping: generating insights from exploration activities and using those to create design criteria Brainstorming: generating new possibilities and new alternative business models	Concept Development: assembling innovative elements into a coherent alternative solution that can be explored and evaluated.	n/a*	n/a*

* None of the techniques in the preliminary selection were in these categories

Selection of design thinking tools

The presentation of the tools and techniques in the context of each process model varied, from the open and flexible approach of the d.school to the prescriptive and linear process of Liedtka and Ogilvie. There are similarities between the design thinking processes developed for educators and for managers in that they designed for professionals, whereas the d.school methods are primarily for the use of post-graduate students. The emphasis on mindset within the d.school toolkit offers potential for development in relation to student learning.

There is notable concurrence in the essential characteristics of some of the tools and techniques offered, 'Brainstorming' in particular is an inclusion in all cases. Elements of selection, sharing or telling 'stories' of individual or the customer 'journey' were also common.

With focus on the early development stage of student projects, the theme of generating ideas offered most potential. Within that the approach and presentation of the d.school offered the most flexibility and alignment to a student learning experience. Mindful of the industry practitioner's recommendation of the value of brainstorming, together with its inclusion in all cases, the 'Brainstorming' tools became a clear focus. In consideration of the sequence of student activities, 'Story telling' offered a mechanism for the instigation of discussion by students within the workshops. The inclusion of a tool to gather feedback from a wider group on the results of the brainstorming exercise prompted the integration of the 'Selection' (or 'Voting') method. To facilitate student reflection on the combined results the 'Feedback Capture' grid provided an appropriate tool.

Summary of design thinking resources

Four models of design thinking process were considered and, although designed for varied users and professional contexts common themes emerged; identification of the problem, interpretation of results, idea generation, prototype experiment and test, implement, improve. The over-arching framework of Brown (2009) is valuable; however it is the 'toolkits' of methods disseminated by the d.school and published in the 'Design Thinking for Educators' document that provide a rich resource of design thinking tools and techniques.

Consideration of the location and participants together with information from an industry practitioner and a fellow tutor lead to the selection of methods suited to early stage project development. The coincidence of tools (story sharing, brainstorming, selection and organisation of ideas) between processes supported their inclusion.

How the students would instigate discussion of their potential idea and subsequently gather and work with the results of using the tools lead to consideration of the sequencing of their use. This resulted in the selection of the following tools and their order of planned use:

- Storytell
- Brainstorm
- Voting
- Feedback Capture

4.4.2 Planning the design thinking workshop

The selected tools were integrated into a visual 'maps' , Figures 4.7 and 4.8 below, of the planned workshop, these documents were used in discussion with Jo Conlon, fellow workshop facilitator and observer. The first 'map' was constructed for the two-hour workshop on the first day of the first action, to include 'Storytelling', 'Brainstorm' and 'Voting'. The second day was planned to include the tool 'Feedback Capture'.

Discussion centred on; the arrangement of participants into groups, facilitation of the groups, timing of activities, recording of observations.

In order to both facilitate and observe, two groups were planned, one to be facilitated by the researcher and the other to be facilitated by Jo. It was agreed that the groups would be arranged informally and to be in approximately equal size groups. Those sitting at the front of the room were to gather with one tutor and those towards the back of the room with the other tutor. It was acknowledged that it was likely that small groups of friends were likely to be included within each group, which was considered to potentially be a positive attribute in that in this initial use of the tools the students may be more supportive of each other.

The timing of each activity was discussed and agreed, the timing of the 'brainstorming' activity in particular was critical to ensure each student had equal opportunity. A varied schedule of timings was devised according to the number of participants, the facilitators agreeing to act as timekeepers.

It was agreed that observations would be recorded by means of a pro-forma, and that photographs would be taken of the results of the workshop.

Figure 4.7 Design thinking workshop - First action: Day One

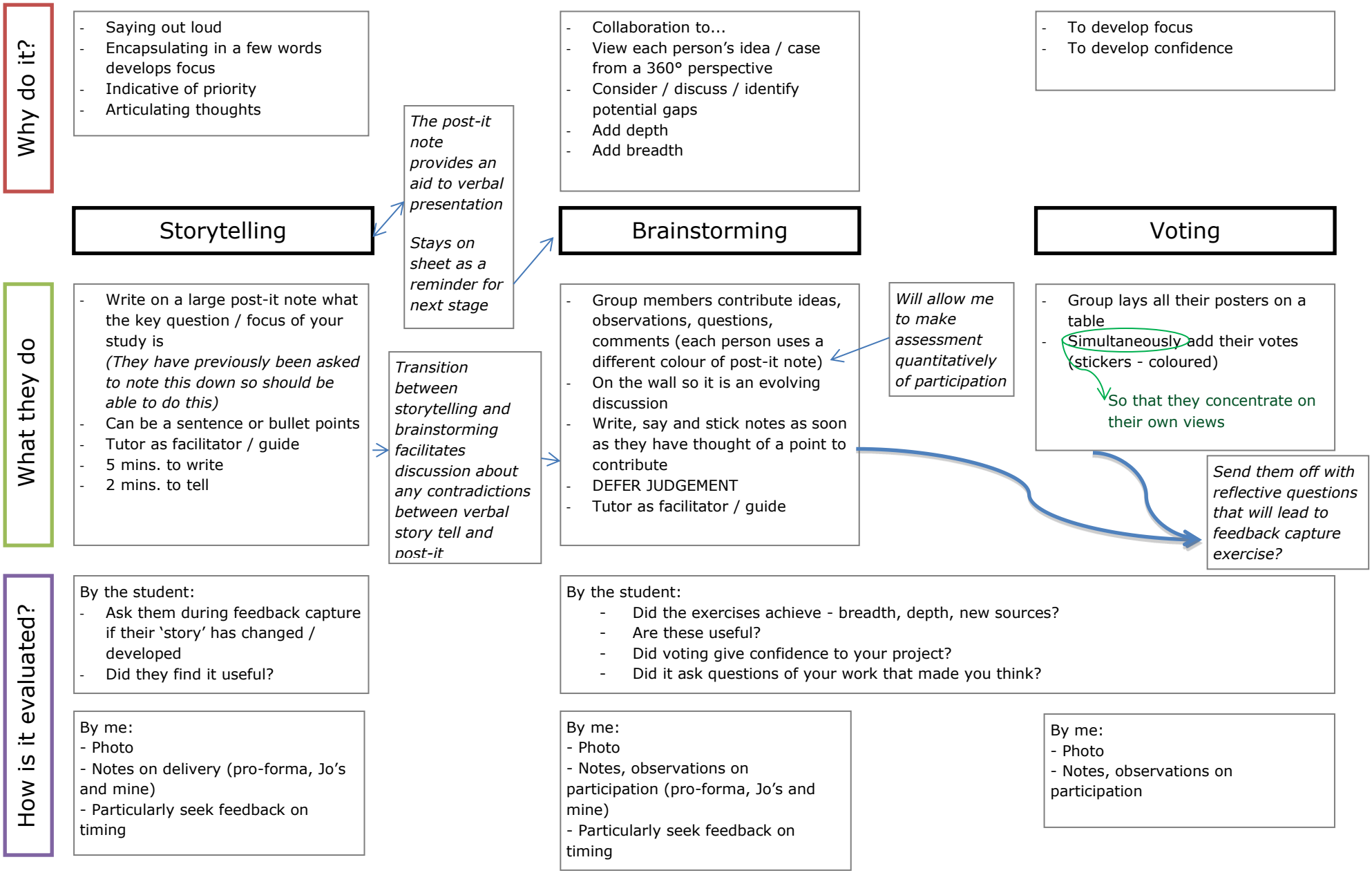


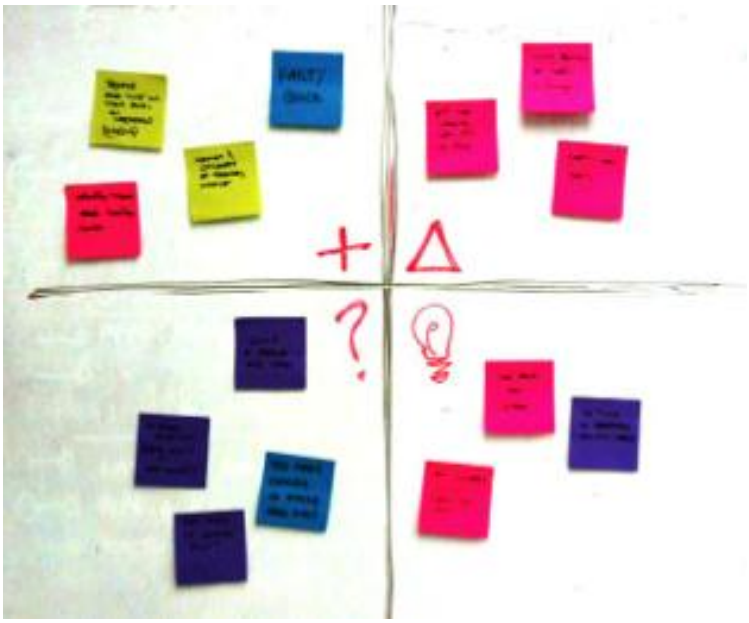
Figure 4.8 Design thinking workshop - First action: Day Two, Feedback Capture

Why do it?

- useful for 'unpacking' feedback
- systematic
- prompts reflection on feedback
- helps think about what has been learned

What they do

This could be started overnight,
between day one and day two but might need tutor guidance on how to use?



Tell students –
Although an individual activity you are still carrying this out in a supportive environment of the group. So free discussion / confirmation of points is absolutely right.

Feedback Capture Grid method from the d.school bootcamp bootleg toolkit

- using the brainstorm sheet and taking note of the voting develop an analysis of information gathered
- section off a sheet of paper into quadrants
- Draw a **+** in the upper left quadrant, a **Δ** in the upper right quadrant, a**?** in the lower left quadrant and a in the lower right quadrant.

Then put:

- Things you like, find notable / **positive** put in the upper left (+)
- **Constructive criticism** in the upper right (**Δ)**
- **Questions** that have been raised go in the lower left (?)

Ideas that have emerged go into the lower right ( )

How is it evaluated?

By the student:
- Ask them if as a result of feedback capture if their 'story' has changed / developed
- Did they find it useful, did they need more or less time?

By me:
- photos
- observation

Summary of planning the design thinking workshop

The analysis of four models of design thinking process together with 'toolkits' of methods resulted in the selection of the following tools and their order of planned use:

- Storytell (Day one) – (To prompt…)
- Brainstorm (Day one) – (To generate…)
- Voting (Day one) – (To gather feedback…)
- Feedback Capture (Day two) – (To organise feedback…)

Informed by consultation with the fellow tutor the workshop activities were planned over a two-day period, with the intention of providing a 'reflective pause' for students between day one and day two. Two groups for the brainstorming exercise would be informally arranged, in approximately equal numbers, and facilitated and observed by tutors.

4.5 – Evaluation of First action

Data was gathered to evaluate the first action step, which took place over two days in November 2012, in the form of student participant feedback and tutor observations and photographs. A reprise, mini-cycle, of this first action was provided for students in a workshop that took place in January 2013, intended to support the development of student dissertation subjects and topics. Data gathered to evaluate this workshop was in the form of student feedback and researcher observations.

The design thinking tools and techniques implemented were as follows: 'Storytell', 'Brainstorm', 'Voting' and 'Feedback Capture'.

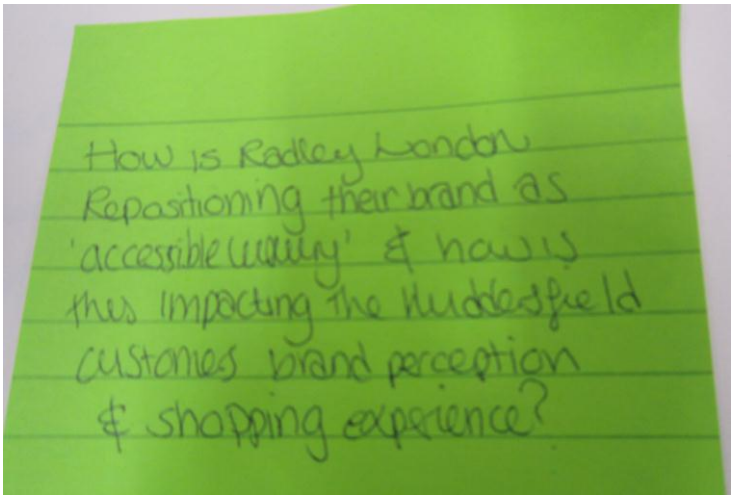


Figure 4.9 Storytell (Day one)

Figure 4.10 Brainstorm (Day one)

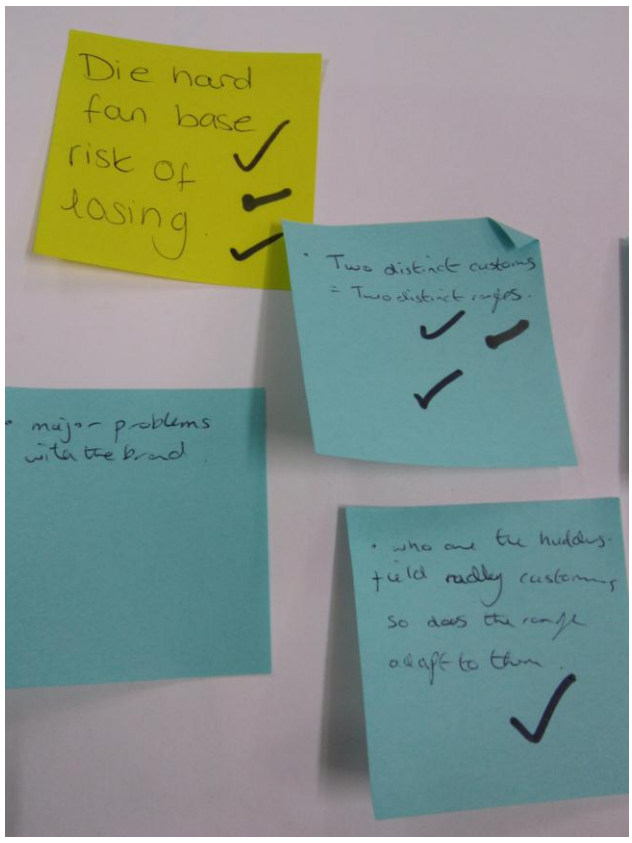


Figure 4.11 Voting (Day one)

Figure 4.12 Feedback Capture (Day two)

Figure 4.13 Feedback Capture Grid (Day two)

4.5.1 Student feedback: First action step, 28–29 November 2012

Eighteen students in total attended over the two days of workshops, twelve attending day one and a further six on day two.

At the end of the activities, students were invited to give feedback on their experience of the workshop. Large 'Post-it' notes were supplied to the students in order to reflect the open-ended, un-restricted approach of the workshop. There was no limit to the number or type of comments that a student could contribute. Responses were anonymous and individual although collective discussion whilst compiling the responses was evident.

Thirteen students (72%) contributed feedback using the post-it notes. Thematic coding analysis was used to analyse the qualitative data submitted. Upon reviewing the text higher order codes (Level 1) emerged related firstly to the practical aspects of the management and tools of the workshop and secondly to the student perception of the impact of participation. Further lower-order codes (Levels 2 and 3) were established to establish connections. The findings from the student feedback are presented in the frequency Table 4.27 (see appendix 4 for data).

Table 4.27 Student feedback: First action step, 28–29 November 2012

Feedback that informs development of tools and process **Level 1**			Frequency
	When the activities take place (Level 2)	Should be earlier in module / year / course (Level 3)	3
		Timing is good (or not) (Level 3)	
		Should be repeated in module / for other modules (Level 3)	12
	How are the workshops managed (Level 2)	Timing of activities within workshops (Level 3)	3
		Room size / space to work in (Level 3)	
	The nature of the design thinking 'tools' /activities (Level 2)		4
	The nature of the groups (Level 2)	Feedback / recommendations on size of group (Level 3)	3
		Feedback / recommendations on including new people (Level 3)	1
		Feedback / recommendations on tutor input (Level 3)	
		Total comments **Feedback that informs development of tools and process**	**26**
Student perceptions of impact of the activities **Level 1**			
	Helpful / useful (Level 2)		2
	Generation and development of ideas (Level 2)	The generation of ideas for student's own work (Level 3)	6
		Developing ideas for student's own work (clarify / develop focus) (Level 3)	6
		Feedback on ideas for student's own project (Level 3)	1
	Collaboration (Level 2)	Gaining others perspectives / ideas / feedback (Level 3)	4
		Giving others support / ideas / feedback (Level 3)	1
		Valuing the opportunity to see others ideas and concepts (Level 3)	
		Sharing experience (placement / work, in particular) (Level 3)	1
		Sharing contacts / resources (Level 3)	1
		Demonstrating empathy for others views / positions (Level 3)	1
	Students' perception of affects on their motivation (Level 2)		2
	Students' perception of changes in own levels of confidence (Level 2)		
	Learning (Level 2)	Students perception of the activities as a learning approach (Level 3)	
		Students perception of benefits to their personal learning / development (Level 3)	
		Students reflection on their own skills; management of information, communication (Level 3)	1
		Total comments **Student perceptions of impact of the activities**	**26**

Total number of comments = 52

n=13

It is evident from the frequency of comments within 'Feedback that informs development of tools and process', that recommended repetition of the activities that students

perceived value in the use of design thinking tools. This was exemplified by the student comment "Really helpful exercise. I think it would be useful for dissertation and major project early on". Other students noted the potential benefits of using the tools during projects as well as at the beginning. "Could be done a couple of times to help at different stages of the project". All three comments regarding timing of the first workshops specifically recommended that they be run in one four hour session rather than separated into two sessions. Feedback on the nature of the tools was both generally positive and two comments were specific, one requesting more opportunity to see the ideas of the whole class, the second commenting on the feedback capture tool, "Feedback capture grid – very easy way to [show] new results and to put points in categories and relevance e.g. solution points not for case study but useful for Major Project."

In respect of generating ideas, participants made positive comments exemplified by two student comments. "Really helpful, I came away with lots of new ideas" and "Gives new directions and focus points". Student comments related to the development and management of their ideas and information were positive, one student offered a clearly considered view, "A mechanism to strategically organise all your thoughts that are circulating and manage your progression". The collaborative nature of the brainstorming tool was commented on positively by nine students, in particular students valued contributions that expanded and developed their work, one comment captured the breadth of this, "Talking through ideas with peers helps anticipate limitations / areas to focus on."

The positive nature of student response indicated that the design thinking tools had proved to be a useful experience, and one that they wished to repeat to support the development of further projects.

4.5.2 Researcher and observer participant feedback: First action step, 28 - 29 November 2012

The researcher and fellow tutor, Jo Conlon, facilitated and observed the activities for the first action. A pro-forma was designed and trialled in order to record observations, however this mechanism proved to be impractical due to the difficulty of facilitating and recording simultaneously. As a consequence, observation notes were made less formally and an unstructured interview with Jo Conlon was carried out after the session. From the interview three themes emerged for reflection and development:

Feedback that informs the development of design thinking tools and process

The simplicity of the tools enabled students to easily understand the basic elements of the activities, students engaged quickly and with few questions. However, the storytelling tool would have benefitted from more explicit description. The large lined post – it notes allow, perhaps prompt, the students to write in an overly wordy and 'small scale' way. There is opportunity to develop this further, which potentially might benefit students when writing the aim(s) for their dissertations. Jo suggested that the "story tell could be developed to invite participation" suggesting that it could end in a question.

Tutors were facilitators for the two brainstorming groups. Jo had concerns about the students "deferring to us [tutors] as experts". Where staff facilitate the group there are "expectations of the tutor as leader / expert / contributor", and consequently undue weight may be accorded to their contributions.

It was observed that the students worked very intensely throughout the session. As facilitators and observers there was agreement that the two-hour session was too short, a four-hour session to include all the tools and techniques including the feedback capture method has potential to be more successful. The voting exercise was rushed and needed more natural progression.

Jo observed the tendency to be drawn towards post-its that had previously attracted votes "do we vote like sheep?"

Feedback that informs understanding of student participation and engagement in design thinking workshops

Jo observed that "participation, contribution and engagement worked extremely well".

It was observed that some students were naturally curious and asked questions, genuinely interested to know more. Jo observed one student who asked what might be perceived as naïve questions, Jo noted that these questions in particular prompted a high quality of subsequent discussion.

Some students 'sneak' post-it notes onto the brainstorming sheet under discussion without verbally articulating their point, thus allowing them to make a contribution even if they lack confidence to verbalise their point. Some wrote notes, acting as scribe, for others to allow them to talk more easily, practically this aided the discussion but prevented any quantification of contribution.

The post-it notes were very varied in style, some just wrote key words, others included questions. The method suits a variety of student styles because there is no right or wrong, the requirement to defer judgement helps this.

Students said that they felt it was useful because they were working on their own, very different, projects / ideas and therefore there was no competition or sense of a threat of 'stealing ideas'.

Feedback for our own learning

Jointly reflecting on the student ideas and project concepts that had been developed during the workshop, the memory of individual student project was notably clear, Jo commented that she "could visualise individual post-it notes.

Researcher observations – First action Day two

Six students attended the day two 'feedback capture' session having not attended the first, day one, session They asked to set themselves up as a group to carry out the activities from the first session. Unlike the first groups, this group conducted their own session without the presence of a tutor. They adopted an approach of a round table of talking and writing at the same time, recording key points in conversations. They allotted each participant time, which was monitored carefully, but allowed for interjection. They questioned each other about their research, sharing experiences and information gained from previous placement experiences. The researcher observed that this group worked very effectively.

The feedback and capture workshop ran smoothly, taking less time than anticipated. Although working individually students discussed and reflected amongst themselves on the ideas that they were working with. Students commented that they really liked knowing about each other's projects. They felt that they could continue to pass on ideas and sources of information, and that they could continue to offer help.

4.5.3 Amendments to design thinking workshop

The feedback from all participants clearly indicated that it was appropriate to firstly confirm repetition of the activities to support students in the development of their projects for dissertation and major project. Secondly to make amendments to the timing of the workshop implementing the practical recommendation of developing the activities into one session for the second action step.

The experience of the group who facilitated their own brainstorming experience during day two taken in conjunction with the fellow tutor's (as facilitator) observations, regarding deference to tutors, indicated that all groups should be self-facilitating.

It was decided that the introduction to and instructions for the 'story tell' method to be developed to be more explicit and to suggest that students integrate a question within their post-it note 'storytell'.

4.5.4 Student feedback: First action step reprise, 15 January 2013

In response to student feedback a mini cycle of the first action, including the tools 'story tell', 'brainstorm' and 'voting', was planned to support students in the development of their dissertation topics. The time available for this session was two hours, students elected to use the time available for the first three methods, implementing 'feedback capture' independently.

Of a possible 18 students, 16 participated. Groups organised themselves into one group of six students and two groups of five students. In this activity all groups were self-facilitating, tutor input was for guidance on timing only. Data gathered to evaluate this workshop was in the form of student feedback and researcher observations. Two students (12.5%) provided feedback comments. The findings from the student feedback are presented in the frequency Table 4.28 (see appendix 5 for data).

Table 4.28 Student feedback: First action step reprise, 15 January 2013

Feedback that informs development of tools and process Level 1			Frequency
	When the activities take place (Level 2)	Should be earlier in module / year / course (Level 3)	
		Timing is good (or not) (Level 3)	1
		Should be repeated in module / for other modules (Level 3)	
	How are the workshops managed (Level 2)	Timing of activities within workshops (Level 3)	
		Room size / space to work in (Level 3)	
	The nature of the design thinking 'tools' /activities (Level 2)		3
	The nature of the groups (Level 2)	Feedback / recommendations on size of group (Level 3)	
		Feedback / recommendations on including new people (Level 3)	
		Feedback / recommendations on tutor input (Level 3)	
		Total comments Feedback that informs development of tools and process	**4**
Student perceptions of impact of the activities Level 1			
	Helpful / useful (Level 2)		1
	Generation and development of ideas (Level 2)	The generation of ideas for student's own work (Level 3)	1
		Developing ideas for student's own work (clarify / develop focus) (Level 3)	
		Feedback on ideas for student's own project (Level 3)	
	Collaboration (Level 2)	Gaining others perspectives / ideas / feedback (Level 3)	
		Giving others support / ideas / feedback (Level 3)	
		Valuing the opportunity to see others ideas and concepts (Level 3)	
		Sharing experience (placement / work, in particular) (Level 3)	
		Sharing contacts / resources (Level 3)	
		Demonstrating empathy for others views / positions (Level 3)	
	Students' perception of affects on their motivation (Level 2)		
	Students' perception of changes in own levels of confidence (Level 2)		
	Learning (Level 2)	Students perception of the activities as a learning approach (Level 3)	
		Students perception of benefits to their personal learning / development (Level 3)	
		Students reflection on their own skills; management of information, communication (Level 3)	
		Total comments Student perceptions of impact of the activities	**2**

Total comments = 6

n=2

The student feedback on this session was limited, only two students offered comments; this may have been as a result of the brevity of the session. Positive feedback was given

in respect of structure and the benefits of each method. One student suggested that 'voting' is not needed.

4.5.5 Researcher observation feedback: First action step reprise, 15 January 2013

Following a brief introduction to the methods, although most were familiar with these, individuals wrote their 'story tell' post-its, then commenced group discussion. All three groups worked in a manner that demonstrated clear focus, allowing each member time to gain feedback. One of the groups of five completed their discussion in one hour, the remaining two groups took one hour forty-five minutes. Notably, no groups chose to take a break.

There was no peer observer due to field trip commitments.

4.5.6 Summary of first action

Findings indicated that the design thinking workshops in the first action were perceived to have value to participants, indicative of this were the recommendations to repeat them for future projects. The objective of the workshops to support the early stages of student project development is met as evidenced by the positive comments regarding the generation of ideas and the management of information. The lack of complexity of the design thinking tools allowed participants to use them easily and to quickly engage with the activities.

The use of different methods offered opportunities for students with different approaches to contribute and add richness to the workshops. The intensity of the participation in the use of the tools and techniques was notable; the collaborative nature of the activities encouraged and supported engagement.

A significant number of participants recommended amendment to the structure of the first two sessions, to be delivered in a single session rather than two. A further recommendation indicated that groups during the 'brainstorm' exercise should be self-facilitating.

4.6 – Evaluation of Second action

The second action step was planned and delivered to support students in the development of their major projects. The design thinking workshop took place in one four-hour session on the 13th February 2013, incorporating the tools of 'story tell', 'brainstorm', 'voting' and 'feedback capture'.

To encourage and support students to reflect and further develop the outcomes of the 'feedback capture' method an extension to this tool was developed by the researcher and offered to students, described as 'The Story so Far'. In preparation for 'the story so far' students were asked to bring in the outcomes of their feedback capture method together with any further reflection that they had carried out. In small groups, including participants they had not worked with recently, they were asked to summarise their 'story so far'.

Data was gathered to evaluate the second action step, in the form of student participant feedback and tutor observations.

Two further activities were associated with supporting the development of student major projects, 'Pecha Kucha' and 'Poster'. These were existing activities used in the previous academic year, and as such were not the subject of this research. However, in order to evaluate the integration of the design thinking tools with the existing activities, all were included within the final questionnaire completed by the first action set of students.

4.6.1 Student feedback: Second action step, 13 February 2013

Fourteen students out of a possible eighteen participated in the design thinking workshop, nine students (64%) contributed feedback comments. The findings from the student feedback are presented in the frequency Table 4.29 below (see appendix 6 for data).

Table 4.29 Student feedback: Second action step, 13 February 2013

Feedback that informs development of tools and process Level 1			Frequency
	When the activities take place (Level 2)	Should be earlier in module / year / course (Level 3)	
		Timing is good (or not) (Level 3)	2
		Should be repeated in module / for other modules (Level 3)	2
	How are the workshops managed (Level 2)	Timing of activities within workshops (Level 3)	
		Room size / space to work in (Level 3)	
	The nature of the design thinking 'tools' /activities (Level 2)		12
	The nature of the groups (Level 2)	Feedback / recommendations on size of group (Level 3)	
		Feedback / recommendations on including new people (Level 3)	
		Feedback / recommendations on tutor input (Level 3)	1
		Total comments Feedback that informs development of tools and process	**17**
Student perceptions of impact of the activities Level 1			
	Helpful / useful (Level 2)		1
	Generation and development of ideas (Level 2)	The generation of ideas for student's own work (Level 3)	1
		Developing ideas for student's own work (clarify / develop focus) (Level 3)	2
		Feedback on ideas for student's own project (Level 3)	
	Collaboration (Level 2)	Gaining others perspectives / ideas / feedback (Level 3)	1
		Giving others support / ideas / feedback (Level 3)	
		Valuing the opportunity to see others ideas and concepts (Level 3)	1
		Sharing experience (placement / work, in particular) (Level 3)	
		Sharing contacts / resources (Level 3)	
		Demonstrating empathy for others views / positions (Level 3)	
	Students' perception of affects on their motivation (Level 2)		
	Students' perception of changes in own levels of confidence (Level 2)		2
	Learning (Level 2)	Students perception of the activities as a learning approach (Level 3)	
		Students perception of benefits to their personal learning / development (Level 3)	
		Students reflection on their own skills; management of information, communication (Level 3)	
		Total comments Student perceptions of impact of the activities	**8**

Total comments = 25

n=9

Although there were only two comments, feedback on timing noted that the changes made were perceived as an improvement, "timing much better". The majority of

comments related to the nature of the design thinking tools and techniques, they included positive comments, "best idea generating tool I've ever used" as well as feedback on amendments and suggestions of further improvements. The value of collaboration was identified, "Extremely beneficial to gain alternative views and ideas on your subject." At the start of the voting activity, one student asked on behalf of the students if they could contribute additional post-its at the voting stage; all participants agreed that they would value this. Subsequent feedback comments recorded positive responses to this development, "Useful to let other people add ideas when voting" and "like that the whole group gives feedback." Although not participating as facilitators, tutors continued to contribute during the voting activity, also adding post-it notes; this was commented on favourably by one student. Two comments illustrate the benefits to student confidence, "Helps to make us more confident about our idea and shape it better."

Suggestions for developments to the tools related to the naming of the four quadrants of the feedback capture grid. The collaborative nature of the process is positively regarded; however one student comments on the importance of the workshops being followed up with individual tutorials.

4.6.2 Researcher and observer participant feedback: Second action step, 13 February 2013

Students arranged themselves in three groups. Without prompting they established a timekeeper and allocated equal opportunities for each participant to present their idea and gain feedback. Groups have become very capable in managing themselves, using smartphones as timers, pausing to let the 'story teller' write their own notes and choosing appropriate times to take breaks.

Jo Conlon observed a "very positive energy" and a "sense of growing confidence and excitement." Additionally, she observed a tendency to 'focus down', to discuss ideas in more detail to adopt a more convergent than divergent approach. She proposed that this might be about the timing of the session as they had a project management session the day before.

Students proposed that people could add further post-it notes of ideas that occurred to them as they were voting, this was adopted and proved extremely successful, encouraging greater engagement in the process. Adding post-it notes at the same time

as voting prompted cross group ideas to develop. Voting this time involved the whole group and included tutors. People appeared very thoughtful when reading the post-its and adding more notes; the atmosphere was one of quiet concentration.

The four-hour session allowed a more relaxed approach; the groups went at their own pace. However the students worked intensively throughout, choosing to take minimal breaks. Jo noted that there were "positive contributions throughout."

4.6.3 Participant feedback: second action step extension

'The Story So Far' was a two-hour session in which the researcher and twelve, out of a possible eighteen, students participated. The groups self-selected but accommodated the given criteria of including a person who had not participated in their group the previous day. Students wrote studiously but there was a lively atmosphere.

It was anticipated that this would be a short reflective session; however this was not the case. Some students had done intensive reflection and created further visual maps (see figure 4.14 below) in preparation. It was notable that this element was still able to accommodate students who had not attended the previous workshop.

Student comments:

"I feel I know what I'm talking about [today], yesterday I couldn't say what I wanted to say."

"From seed ideas we've all got something to work with."

"I think other courses should do this".

Figure 4.14 Student visual map

4.6.4 Final student questionnaire – first action set

Seventeen students completed this survey after submission of their final project (see appendix 7 for questionnaire and 8 for full results).
Fifteen respondents stated that they were final year undergraduate student on the BA (Hons) Fashion & Textile Buying / Management / Retailing pathway, two students omitted this question. Eleven indicated that they had undertaken a placement year, one stating that they progressed directly from year 2 to final year, three omitted to respond to this question.

Question 1

The first set of questions required respondents to reflect on the design thinking workshops, tools and techniques. Question 1 aimed to discover the students' perception of which piece of work, if any, is most 'helped' by using design thinking techniques.

Table 4.30 Benefits to final year projects of using design thinking techniques

	Very helpful	*Helpful*	*Neutral*	*Not very helpful*	*Unhelpful*	*Didn't participate*
Case Study	10 58.8%	4 23.5%	3 17.7%	0 0%	0 0%	0 0%
Dissertation	8 47%	7 41.2%	2 11.8%	0 0%	0 0%	0 0%
Major Project	11 64.7%	5 29.4%	1 5.9%	0 0%	0 0%	0 0%

n=17

A considerable majority of respondents (82.3%) found the techniques helpful or very helpful for the case study, for the dissertation (88.2%) this rose slightly and for the major project (94.1%) a more notable increase was recorded.

Question 2

This section aimed to establish the students' perception of which, if any, tool they found most helpful.

Table 4.31 'Story tell'

Very helpful	*Helpful*	*Neutral*	*Not very helpful*	*Unhelpful*
11 64.7%	6 35.3%	0 0%	0 0%	0 0%

n=17

All respondents considered the 'story tell' to be helpful or very helpful. Comments indicated that students perceived it to be helpful to articulate their ideas to others, prompting the formulation and development of their ideas, "Encouraged to think in terms of a viable idea".

Table 4.32 – 'Brainstorm'

Very helpful	*Helpful*	*Neutral*	*Not very helpful*	*Unhelpful*
13	4	0	0	0
76.5%	23.5%	0%	0%	0%

n=17

All respondents found the 'brainstorm' to helpful or very helpful. In comparison with the 'story tell', a higher percentage of respondents (76.5%) found this activity to be very helpful. Comment on the brainstorm were very positive, "Loved it. Should do this on every project – even first year stuff". In particular, the collaborative nature was valued, "It was great to get feedback from other classmates to see what their opinions were and to build ideas".

Table 4.33 – 'Voting'

Very helpful	*Helpful*	*Neutral*	*Not very helpful*	*Unhelpful*
3	4	10	0	0
17.7%	23.5%	58.8%	0%	0%

n=17

The 'voting' tool was considered helpful or very helpful by a minority (41.2%) of respondents; a majority (58.8%) recorded their perception of benefits as neutral. The student comments indicated that they considered all feedback to be valid, "All points were valid, I needed to go home and think about them". Further comments suggested that voting "provided more focus".

Table 4.34 – 'Feedback Capture'

Very helpful	*Helpful*	*Neutral*	*Not very helpful*	*Unhelpful*
7	7	2	1	0
41.2%	41.2%	11.8%	5.8%	0%

n=17

The 'feedback capture' tool received the most varied response, although the majority of respondents (82.4%) considered it to be helpful or very helpful. Comments on 'feedback capture' supported its effectiveness as a tool to structure and organise ideas; "Excellent. Allowed ideas to be organised from the beginning." "Gave my idea structure." "Very relevant framework". Some students perceived difficulties with the categories of the grid, "It was sometimes hard to categorize ideas in these four areas".

Table 4.35 – 'Pecha Kucha'

Very helpful	*Helpful*	*Neutral*	*Not very helpful*	*Unhelpful*
8	5	4	0	0
47.1%	29.4%	23.5%	0%	0%

n=17

The majority of respondents (76.5%) found the Pecha Kucha activity to be helpful or very helpful. Comments indicated the perception of value in this activity as supporting the development and presentation of ideas, "Encouraged a story to be created and developed presentation technique."

Table 4.36 – 'Pecha Kucha feedback'

Very helpful	*Helpful*	*Neutral*	*Not very helpful*	*Unhelpful*
6	9	2	0	0
35.3%	52.9%	11.8%	0%	0%

n=17

The majority of respondents (88.4%) found the 'Pecha Kucha feedback' activity to be helpful or very helpful. Comments indicated that this feedback aided the development of projects, "Good, allowed ideas that didn't work to be changed.

Table 4.37 – 'Poster'

Very helpful	*Helpful*	*Neutral*	*Not very helpful*	*Unhelpful*
10	5	1	0	0
62.5%	31.3%	6.2%	0%	0%

n=16

Two students omitted this question as they had not participated in this activity. The majority of respondents (93.8%) found the 'poster' activity to be helpful or very helpful. Comments indicated that this was supportive of the development of the project and presentation skills, "Got much more clarity to project".

Table 4.38 – 'Poster feedback'

Very helpful	*Helpful*	*Neutral*	*Not very helpful*	*Unhelpful*
8	8	0	0	0
50%	50%	0%	0%	0%

n=16

Two students omitted this question as they hadn't participated in this activity. All respondents found the 'poster' activity to be helpful or very helpful. Comments indicated an appreciation of feedback, "Great to get more feedback on project" and the support to project development, "Already had main ideas but this helped to clarify".

Question 3

This section aimed to find out the students' perception of the way in which design thinking techniques might have benefitted their work and the way that they work. Respondents were asked to reflect on seven aspects; the generation of ideas, impact on the gathering and management of information, the development of ideas, the development of focus to projects, motivation, identifying strengths and weaknesses and finally the impact on anticipation of limitations to ideas and concepts.

Table 4.39 Generation of ideas

Impact on the **quantity** of ideas generated	Very helpful	Helpful	No impact	Not helpful	Negative
	10	7	0	0	0
	58.8%	41.2%	0	0%	0%
Impact on the **quality** of ideas generated	Very helpful	Helpful	No impact	Not helpful	Negative
	8	8	1	0	0
	47.1%	47.1%	5.8%	0%	0%
Impact on the **speed** of generating ideas	Very helpful	Helpful	No impact	Not helpful	Negative
	9	8	0	0	0
	52.9%	47.1%	0%	0%	0%

n=17

All the respondents indicated that the activities were helpful or very helpful in respect of the quantity of ideas generated and the speed with which this was accomplished. The majority of respondents (94.2%) recorded that the impact on quality of ideas was positive. Comments noted in particular the expansion of ideas; "It all helped me think of alternative ideas and not have tunnel vision." "Great to get ideas from people with different experiences in the industry."

Table 4.40 Information

Impact on **expanding** sources of information	Very helpful 7 41.18%	Helpful 9 52.94%	No impact 1 5.88%	Not helpful 0 0%	Negative 0 0%
Impact on **quality** of information gathered	Very helpful 2 11.8%	Helpful 13 76.4%	No impact 2 11.8%	Not helpful 0 0%	Negative 0 0%
Impact on **organising / managing** your information	Very helpful 9 52.9%	Helpful 6 35.3%	No impact 2 11.8%	Not helpful 0 0%	Negative 0 0%

n=17

The majority of respondents indicated that they found the activities helpful or very helpful, specifically on the expansion of sources of information (94.12%), on the quality of information gathered (88.2%) and in relation to the organisation and management of information (88.2%). Additional comments recorded that some students felt that to be of benefit in this respect, the activities needed to be earlier. Others noted the usefulness in relation to organisation, "Very useful organisational tool" "Really helped to organise information in the way that we did."

Table 4.41 Development of ideas

Impact on **expanding** your original ideas	Very helpful 13 76.5%	Helpful 4 23.5%	No impact 0 0%	Not helpful 0 0%	Negative 0 0%
Impact on the **speed** of development of your ideas	Very helpful 8 47.1%	Helpful 9 52.9%	No impact 0 0%	Not helpful 0 0%	Negative 0 0%
Impact on **organising** your ideas	Very helpful 12 70.6%	Helpful 4 23.5%	No impact 1 5.9%	Not helpful 0 0%	Negative 0 0%
Impact on your **confidence** in your idea	Very helpful 14 82.4%	Helpful 3 17.6%	No impact 0 0%	Not helpful 0 0%	Negative 0 0%

n=17

In respect of the expansion, speed of development and confidence in the development of ideas, all respondents found the activities to be helpful or very helpful. The majority of respondents (94.1%) considered that the activities were helpful or very helpful in their impact on the organisation of ideas. The impact on confidence was most notable with all respondents recording this as helpful / very helpful and specifically 82.4% of

respondents indicating the activities were very helpful; a student comment supports this "Confidence in the idea encourages emphasis and confidence in the presentation of the work". Another comment indicates the opportunity for reflection in the development of ideas, "Your project is personal and sometimes your thoughts can be biased but this method allows you to take a step back".

Table 4.42 Development of focus

Very helpful	Helpful	No impact	Not helpful	Negative
12	3	1	1	0
70.6%	17.6%	5.9%	5.9%	0%

n=17

A range of responses were elicited, and although the majority of respondents (88.2%) found the activities to be helpful or very helpful in the development of focus, one respondent did not find them helpful in this respect. One comment uses a visual analogy to describe the impact, "Like a big funnel of ideas leading to a main one". Viability was an objective indicated by a further comment, "My ideas were very broad before these but it helped me see which looked best and most viable".

Table 4.43 Motivation

Very helpful	Helpful	No impact	Not helpful	Negative
8	9	0	0	0
47.1%	52.9%	0%	0%	0%

n=17

All respondents noted that the activities had been helpful or very helpful in motivating them to develop their projects. One student comment noted the practical impact, "Very pro-active after the sessions". Another student noted the impetus the activities provided, "It got us more involved and pushed us into starting to develop ideas in an enjoyable way."

Table 4.44 Identifying strengths and weaknesses

Impact on your ability to identify the **strengths** to your work	Very helpful 6 35.3%	Helpful 9 52.9%	No impact 2 11.8%	Not helpful 0 0%	Negative 0 0%
Impact on your ability to identify any **weaknesses** to your work	Very helpful 4 23.5%	Helpful 12 70.6%	No impact 1 5.9%	Not helpful 0 0%	Negative 0 0%

n=17

Although the majority of respondents (88.2%) regarded the activities as beneficial in respect of identifying strengths in their work, more considered this to be helpful rather than very helpful. This was similarly the case for the identification of weaknesses.
An interesting comment saw the value in varied feedback, "Negative feedback was the most helpful to see what I should avoid."

Table 4.45 Anticipation of limitations to your idea

Impact on anticipating any limitations to your idea	Very helpful 5 29.4%	Helpful 12 70.6%	No impact 0 0%	Not helpful 0 0%	Negative 0 0%
Impact on solving research problems	Very helpful 5 29.4%	Helpful 12 70.6%	No impact 0 0%	Not helpful 0 0%	Negative 0 0%

n=17

All respondents noted that the activities were helpful or very helpful in the anticipation of limitations to their idea. The response to the impact on problem solving was the same. Student comments illustrated the benefits and challenges of the identification of limitations, "If someone put an idea that was off tangent, I would know that was a boundary", "This framework always you to consider limitless avenues for exploration therefore may prove difficult in anticipating the limitations of possibly a weaker idea due to volume of ideas…"

Question 4

This section aimed to find out the students' perception of what they will 'take away' from the experience that they perceive might be beneficial to them.

The students were firstly asked if they now did anything differently in the way that they worked. Sixteen comments were recorded; some made multiple points within their comment:

Eight related to the use of the tools and techniques, the majority made reference to the use of brainstorming and the mapping of ideas visually using post-it notes. "I use post-it notes a lot more now and always keep a research diary when I didn't before."
"Brainstorm more, [I] explore idea generation strategies in more detail."

Six noted the impact on the development and organisation of their projects, "It encouraged idea generation and formulation" "Get an idea a.s.a.p. and allow it to develop through testing and evaluation, peer review works well, show others."
Three made reference to collaboration, "Yes, think the design thinking has opened up more research methods and 'community' thinking" "I will definitely ask for other people's contributions in future as I feel this has helped develop my project."

The students were then asked if their ability to develop ideas had changed in any way. Fourteen comments were recorded; some made multiple points within their comment:

Eleven noted positive improvement in their development of ideas. Of these, four used specific tools, "I definitely use voting and consider my main points".
Two specifically described that they were more open in their perspective, "I am much more creative, open to think outside of box…" "I am more open to more ideas now, before if I had an idea I would stick with it and not consider better ideas."
Four made reference to collaboration, noting that the views and opinions of others were important to the development of their ideas. "it has helped me realise how important it is to ask other people's opinions at the ideas stage and not just at the end of the project."
Three specifically noted the importance of feedback " I get an idea down and use others to develop through feedback".

The next question asked students if their ability to communicate ideas had changed in any way. Sixteen comments were recorded; some made multiple points within their comment:

Six made reference to the development of increased experience of presentation and particularly in their confidence to communicate ideas. "Much more confident, believe in my ideas more as all resources used support lots" "…more confidence in presenting and sharing after doing so regularly."
Six made reference to collaboration and communication with others, listening to others, sharing ideas, giving feedback and consideration of what others want to know, "By listening to the way others expressed ideas has allowed me to communicate mine more clearly." "…it encouraged me to share ideas in a presentation style".
Three noted the value of visual elements in communication, "communicate via visuals".
One student indicated that they had developed less in this aspect less than in other areas.

Students were asked about their experience of collaborating with others on their work. Sixteen comments were recorded; some made multiple points within their comment:

Thirteen students made reference to the positive experience of collaboration, several comments describing it as helpful and beneficial, "It really helped me to develop my ideas and come up with new ones with help of teammates" "I found this very useful as it helped you gain different insights." One student comment was cautionary; "It was really helpful at the initial point of thinking, but less towards the end as people concentrate on tangents that are not the main point of projects."
Three students noted their initial difficulty and apprehension with the idea of collaborating, "I thought I wouldn't like it, but I found it really helpful and enabled me to grow my projects in ways I didn't expect" "I was unsure at first but now that I see the benefits I think it is a great thing to do."
Two students related the importance and value of collaboration to the work place, "Collaboration is the most important aspect of project management" "Love it! Going to continue this in my work life".

The final question in this section asked students whether they had learned anything about themselves and the way that they work as a result of the experience of using the design thinking techniques. Fifteen comments were recorded; some made multiple points within their comment:

Four students referred to aspects of collaboration, "I believe I really enjoy helping others with their projects and believe with the useful help I have given I have got it back from them in return." "I can take feedback well and I am often able to respond accordingly."
Five students reflected on aspects of preparation and planning, "I work best under pressure the design techniques deadlines forced me to project ideas" "I start projects a lot earlier and think about them earlier than I did in first and second year."
Five respondents commented on the development and management of ideas, "Found it useful to brainstorm all thoughts in order to evaluate them collectively." "I have learned to take a step back and have become very analytical of my ideas"
Three students reflected on their presentation and communication skills, "It has improved my presentation skills." "It's given me more confidence in presenting and change my openness about sharing ideas."
Two noted the impact on their confidence "My confidence in the ability to develop ideas has improved, this is a great confidence builder!"

The final question in the survey gave students the opportunity to contribute any further thoughts that they had on their experience of using the design thinking techniques. Nine comments were recorded, some comments made multiple points.

Four comments related positively to generating ideas, planning and the development of projects. "Got me thinking about ideas I probably wouldn't have had on my own" "it enabled me to develop and focus my projects" "over the course of final year my planning has improved loads".
Four students described their experience and use of design thinking techniques positively; as being helpful and one as enjoyable. "They were really helpful." "I really enjoyed it".
One student identified it specifically as a skill, "Really a very valuable skill to have".
Another comment referred to relationships within the cohort, "Good [to] have two groups, so you discuss different areas and helps create a good course environment and relationships between students."
Three comments related to the management of the design thinking workshops, making observations and recommendations. "I think whilst helpful there were too many sessions like this and not enough direct [contact] with tutors for major project" "I felt working in the smaller groups for dissertation and utilizing the framework was most successful, when doing it for the entire class people only had a limited amount of time so feedback was less considered however when the group was split more consideration and time was spent on supporting everybody within the group!"
Two students made recommendation of earlier inclusion of the design thinking techniques within the course. "They could be incorporated into second year to get into the habit of generating ideas this way and done at earlier points of second year" "should be taught in first year".

4.6.5 Summary of second action

<u>The second action design thinking workshop</u>

The objective of this design thinking workshop was to provide support for the development of student major projects. Students commented positively on the tools as effective mechanisms for generating ideas. As the major project is centred on identifying opportunities and problem-solving, it is unsurprising that the aspect of idea generation was a focus for students.

The development of the workshop into one four-hour session, in response to participant feedback, was a positive amendment as evidenced by student and staff comments. The implementation of self-facilitating groups received no feedback. Observation indicated that the student groups were very capable and effective in managing time and had equal opportunity to contribute and gain from feedback. As noted in student feedback, tutor input was still valued in the 'voting' method. Amendment to the 'voting' method to involve all participants in all projects was observed to engage students.

The extension of the 'feedback capture' tool to develop 'the story so far' offered participants a further iteration of the process. One student's initiative to prepare extensively for this activity was a positive development of particular interest.

The student feedback on ideas that they gained from the collaborative elements indicated that they were particularly valued. Observation and student feedback demonstrated a positive effect on student confidence.

Final student questionnaire – first action set

Evaluation of the design thinking tools was positive overall; a considerable majority of respondents viewed the design thinking tools as being beneficial for all three assignments. However the methods were most valued for the major project. The tools of 'story tell' and in particular 'brainstorm' were identified as being the most helpful for projects. The 'voting' tool was regarded as 'neutral' by the majority of respondents, 'feedback capture' received the greatest range of responses but the majority in this considered it as helpful overall. In comparison to the responses for the existing activities of Pecha Kucha and Poster the design thinking tools compare favourably.

Overall, responses were positive to the way in which design thinking techniques impacted on students' work and the way that they work. In particular, the majority regarded the improvement to the quality and speed of idea generation as very helpful. Respondents noted positive benefits in the expansion of their original ideas, and commented on the positive developments to their organisation of information. A considerable majority, worthy of note, identified a very positive impact on their confidence to develop ideas. The effect on student motivation was positive, as was their anticipation of limitations to concepts and ideas. Students' perception of the impact on the development of focus of their ideas was more varied but still with a significant majority who regarded this as very helpful. Still regarded as helpful by the majority, the impact on identifying strengths and weaknesses was less positive.

The benefits to students' learning and skills were explored in the last section of the survey. Several themes emerged. The responses indicated that students perceived benefits to the tools and several indicated an intention to use them in the future. They noted that their skills had improved; in generating and developing ideas, planning and managing projects, presentation. Many students noted the value of the collaborative experience. An appreciation of both the benefits of contributing to the projects of others, as well as gaining feedback on their own, was remarked upon very enthusiastically. Confidence in their own abilities has developed further according to their responses.

4.7 – Reconnaissance for second action set

4.7.1 Second action set student questionnaire

Student data was gathered prior to the implementation of the third action (see appendix 9 for questionnaire, appendix 10 for full results). The aim of the questionnaire was to gain an understanding of student management of information and their perceptions of the impact this has on their project work.

Questionnaire, November 2013

Twenty three students in their final year of the BA (Hons) Fashion and Textile Buying Management course completed the survey, of these; thirteen students had completed a placement year prior to entering the final year, eight students had progressed directly from the second to the final year of the course, one student took a year out which was not a placement, one student made no statement regarding placement.
The first section of the survey was designed to identify the breadth and format of sources of information accessed and, or used by students.

Table 4.46 Sources of information accessed / used

Books	23	100%
Websites	23	100%
Lecture notes	23	100%
Journals / journal articles	21	91.3%
Newspapers / magazines	20	87.0%
Observation (e.g. store / consumer) results	17	73.9%
Questionnaire /survey results	12	52.2%
Interviews	11	47.8%

n=23

Other: 1 student used /accessed conferences, 1 student accessed / used Apps. E.g. Nike Making App, 1 student accessed YouTube video channels, I student accessed Industry talks, 1 student accessed reports, 2 students accessed / used blogs, 2 students accessed / used forums, 2 students accessed / used social websites, 1 student accessed documentaries.

Table 4.47 Number of sources of information accessed / used for project work

Number of sources accessed / used	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Number of students	1	4	4	4	6	4	0
	4.3%	17.4%	17.4%	17.4%	26.1%	17.4%	0%

n=23

Students accessed varied sources of information (seventeen are identified) weighted more towards secondary sources, over 60% of students worked with seven sources or more.

The next question concerned information presented in different formats that students may have accessed or used for project work.

Table 4.48 Formats of information accessed / used for project work

Your own notes	21	91.3%
Printouts from websites	21	91.3%
Copies of journal articles	18	78.3%
Copies of articles from Newspapers / magazines	16	69.6%
Copies of illustrations / images	16	69.6%
Questionnaire /survey results	14	60.9%
Observation results – visuals e.g. photographs	13	56.5%
Observation results - text	11	47.8%
Interview transcripts	9	39.1%

Other - Within this section: no comment

n=23

Table 4.49 Number of formats of information accessed / used for project work

Number of formats accessed / used	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Number of students	1	1	2	2	1	6	1	6	3
	4.35%	4.35%	8.7%	8.7%	4.35%	26.1%	4.35%	26.1%	13%

n=23

The responses indicate that the students' work with information presented in varied styles and formats, principally text based but also including visual elements. Students work with a varying range of formats the majority with multiple formats.
Additional student comment "Sometimes organizing digital and handwritten data can be challenging – not being able to organize it at times can be a nightmare and leave me in a bit of a rut. I find it difficult to focus when this occurs."

The second section of the survey sought to identify whether the students had previously used brainstorming / mind mapping within project work, additionally to establish if this was a technique that they would choose to repeat.

Table 4.50 Previous use of mind map / brainstorm exercise at the start of projects

Always	Usually	Sometimes	Seldom	Never
4	5	13	0	1
17.4%	21.73%	56.52%	0%	4.35%

n=23

Twenty-one students would use this method again. The respondents noted that the content of these exercises was principally text based, ten students stated that they included diagrams and eight included illustrations with a minority of three including photographs. One student offered an additional comment noting the inclusion of 'page layout' within their mind map / brainstorm.

A further question asked students to comment on whether they had used the techniques of brainstorming / mind mapping at intervals during a project.

Table 4.51 Previous use of mind map / brainstorm exercise during projects

Always	Usually	Sometimes	Seldom	Never
1	1	7	6	8
4.35%	4.35%	30.43%	26.09%	34.78%

n=23

Fewer students regularly used brainstorming / mind maps during a project, of those who did, 13 said that they would use this technique again. The content was principally text based; five students stated that they included diagrams and four included illustrations with one student including photographs. Two respondents noted the inclusion of references and sources. Additional student comment, "Brainstorming and note taking, particularly throughout the project in the form of 'still left to do' lists really helps me. My brain is not able to retain information, it has to be recorded. Applications geared up to filing away on line research is helpful – helps organise a reading list / bookmarked page, into folders. E.g. Evernote. A keyword search can then be used."

The survey asked students to consider how they organised the information gathered, whether by nature of the source or by the subject / objectives of their project.

The majority of students have organised work according to the source, for example by book or by journal article.

Table 4.52 Organisation of information by source

Always	Usually	Sometimes	Seldom	Never
3	5	5	1	9
13.04%	21.74%	21.74%	4.35%	39.13%

n=23

Of these varied responses twelve students said that they would repeat this method, three would not.

Table 4.53 Organisation of information by subject / objectives of the project

Always	Usually	Sometimes	Seldom	Never
4	6	6	5	2
17.4%	26.08%	26.08%	21.74%	8.7%

n=23

It was more common for respondents to organise information according to the objectives / sub topics of their research subject. Twenty students indicated that they would repeat this approach to managing information.

Respondents were then asked to indicate whether they used research proposals in order to manage their projects.

Table 4.54 Use of research proposals to manage projects

Frequently	Usually	Sometimes	Occasionally	Never
1	4	6	5	7
4.4%	17.4%	26.1%	21.7%	30.4%

n=23

The majority of students had made use of proposals although varied in the frequency of their usage; of the respondents thirteen indicated that they would use this approach again. The majority of proposals were text based with seven respondents including diagrams and five including illustrations.

Table 4.55 Reference to research proposals during projects

Frequently	Often	Sometimes	Occasionally	Never
2	5	2	4	3
12.5%	31.25%	12.5%	25%	18.75%
16 responses, 7 respondents omitted this question				

n=16

The majority of students who developed research proposals did refer to their proposal during the relevant project but with very varying frequency.

Action plans are a mechanism used by students to manage projects; in response to the question 'have you ever made a plan of action to manage your research for a project?' all the respondents indicated that they had used action plans but with varying frequency.

Table 4.56 Use of action plans to manage research for a project

Always	Usually	Sometimes	Seldom	Never
5	4	7	4	3
21.74%	17.39%	30.44%	17.39%	13.04%

n=23

The majority make use of action plans; twenty respondents indicated that they would use this approach again. The format of the action plans was predominantly text based, eight respondents indicated the use of diagrams, four respondents included illustrations and three included photographs.

Table 4.57 Use of action plans to manage research during a project

Frequently	Often	Sometimes	Occasionally	Never
8	4	3	4	2
38.1%	19.05%	14.29%	19.05%	9.51%
21 responses, 2 respondents omitted this question				

n=21

The majority of respondents who used action plans did refer to them during their projects often or frequently.

The next section of the questionnaire requested information on the networks of people that they sought help from in order to manage information. Twenty-one out of twenty-three respondents talked to people in order to gain help in this respect.

Table 4.58 People students sought help from in order to manage information

Subject / course tutors	21	91.3%
Fellow students on the course	17	73.9%
Friends (not students) / family	16	69.6%
Fellow students out with the course	8	34.8%
Placement workplace colleagues	7	30.4%
Graduated students from the course	3	13%
Tutors / university staff outside the course	3	13%
Acknowledged experts in your subject	3	13%
Academic skills tutors	1	4.3%

n=23

Other: One student indicated workplace colleagues, one student work experience [colleagues]

Students principally sought support from those involved with the course, tutors and peers, although their immediate family and friends are of notable importance. The

subsequent questions asked respondents to indicate the type of support they gained from individuals in different roles.

Table 4.59 People students sought guidance from on the subject of their research

Subject / course tutors	19	82.6%
Fellow students on the course	7	30.4%
Tutors / university staff outside the course	4	17.4%
Academic skills tutors	3	13.0%
Acknowledged experts in your subject	2	8.7%
Graduated students from the course	2	8.7%
Placement workplace colleagues	1	4.3%
Friends (not students) / family	1	4.3%
Fellow students outside the course	1	4.3%

n=23

For support and guidance related to their research subject students predominantly sought help from those most closely connected with the course, tutors and fellow students on the course.

Table 4.60 People students sought guidance on research methods

Subject / course tutors	15	65.2%
Academic skills tutors	5	21.7%
Fellow students on the course	4	17.4%
Acknowledged experts in your subject	3	13.0%
Tutors / university staff outside the course	2	8.7%
Friends (not students) / family	1	4.3%
Placement workplace colleagues	1	4.3%
Fellow students outside the course	1	4.3%

n=23

As previously for subject research students sought help from those closely connected to the course, increasing in importance are members of staff within the university able to offer support specifically academic skills tutors.

Students were then asked whom they sought advice from when they wanted to test out concepts or ideas for projects.

Table 4.61 People students sought guidance from on 'sounding out ideas'

Subject / course tutors	15	65.2%
Friends (not students) / family	12	52.2%
Fellow students on the course	11	47.8%
Placement workplace colleagues	5	21.7%
Fellow students outside the course	3	13.0%
Academic skills tutors	3	13.0%
Acknowledged experts in your subject	3	13.0%

Graduated students from the course	2	8.7%
Tutors / university staff outside the course	2	8.7%

n=23

An increasing breadth of networks are used by students to gain feedback on their ideas, including; friends and family and placement work colleagues.
In terms of broader and more personal support the respondents identified the following as providing help.

Table 4.62 People students sought 'moral support' from

Friends (not students) / family	16	69.6%
Fellow students on the course	11	47.8%
Subject / course tutors	8	34.8%
Fellow students outside the course	4	17.4%
Graduated students from the course	3	13.0%
Placement workplace colleagues	2	8.7%
Tutors / university staff outside the course	1	4.3%
Acknowledged experts in your subject	1	4.3%

n=23

The results are as might be expected, that students turn to those they are closest to for help and encouragement of a more personal nature.

The next question required respondents to give information on their use of study skills books and websites or research methods books and websites.

Table 4.63 Use of study skills books and websites

Study skills book	7	30.4%%
Study skills website	7	30.4%%
Research methods book	6	26.1%
Research methods website	2	8.7%

n=23

Although books were more frequently accessed than websites there was more evidence of use of websites than in the November 2012 survey. Publications identified by students were as follows, some were those recommended in course literature.

- How to write your undergraduate dissertation (Palgrave) [Bryan Greetham]
- Cite it right
- Study Skills Handbook [Stella Cottrell]

The majority of students identifying that they accessed this form of support indicated that they would use this again.

In the final section students were asked to think about their experience of managing information; a Likert scale was used to categorize responses. All respondents completed responses for this set of questions. In the first two questions the respondents were asked to consider their perceptions of the implications of working with a large amount of research information.

Table 4.64 Working with a large amount of research information improves my chances of a good outcome?

Strongly agree	*Agree*	*Neutral*	*Disagree*	*Strongly disagree*
6 26.09%	13 56.52%	3 13.04%	1 4.35%	0 0%

n=23

The majority of students (82.6%) perceived it to be the case that a greater quantity of information improved their chances of a good outcome. Additional student comments, "I start by collecting as much as I can that could be relevant and choose the most relevant afterwards but never throw away gathered information." "It's about how well you collate your research, it doesn't matter if you have loads and expect a good grade, you need to be able to join your research together."

The second question was designed to identify whether a greater quantity of information might be perceived as challenging.

Table 4.65 Working with a large amount of research information is overwhelming?

Strongly agree	*Agree*	*Neutral*	*Disagree*	*Strongly disagree*
1 4.55%	13 59.09%	4 18.18%	4 18.18%	0 0%
One respondent omitted this question				

n=22

A majority of students agreed or strongly agreed that they found that working with a large amount of research information was overwhelming.

Table 4.66 Working with a small amount of focused information improves my chances of a good grade?

Strongly agree	*Agree*	*Neutral*	*Disagree*	*Strongly disagree*
2 9.1%	5 22.72%	11 50%	3 13.63%	1 4.55%
One respondent omitted this question				

n=22

There was no clear consensus in the responses to this question, a broad range of views were expressed.

Table 4.67 Working with a small amount of focused information limits my opportunities for a good outcome?

Strongly agree	*Agree*	*Neutral*	*Disagree*	*Strongly disagree*
1 4.55%	12 54.55%	4 18.18%	5 22.72%	0 0%
One respondent omitted this question				

n=22

The majority of responses indicated that students perceived that working with a small amount of information would not limit their opportunities for a good outcome.

The next two questions were concerned with the perceptions of managing information from diverse sources.

Table 4.68 Working with diverse sources of information improves my opportunities for a good outcome?

Strongly agree	*Agree*	*Neutral*	*Disagree*	*Strongly disagree*
14 63.6%	8 36.4%	0 0%	0 0%	0 0%
One respondent omitted this question				

n=22

The responses clearly indicated that students perceived valued diversity within the sources that they worked with. Additional student comment, "I think wide source[s] of information improves outcome results. Especially on [a] fashion course."

The subsequent question sought to establish whether they perceived that this might be challenging.

Table 4.69 Working with diverse sources of information is challenging?

Strongly agree	*Agree*	*Neutral*	*Disagree*	*Strongly disagree*
2 9.1%	4 18.2%	12 54.5%	4 18.2%	0 0%
One respondent omitted this question				

n=22

The respondents are varied in their views regarding the challenges in working with these diverse sources. Additional student comment, "Sometimes it is hard to find information from a diverse range of sources and this depends on the research topic."

4.7.2 Summary

Students are accessing and using multiple sources of information, seventeen sources are identified. This in turn results in students working with different formats of information. The challenges of working with different presentation style of information in addition to different media are noted by respondents.

Most students had used brainstorming techniques previously, however with varying frequency. Fewer students had repeated the activity during projects. The development of research proposals and action plans was adopted within projects by more than half of the students however this was with varying consistency. The frequency of subsequent reference to these during projects was less.

The people students turn to for support include varied groups. However the results are unsurprising and aligned to skills, knowledge and attributes and empathy for the student. The use of study skill resources is acknowledged by less than a third of students.

A considerable majority of respondents considered that working with a large amount of research information was beneficial to the outcome. Almost two thirds noted that there were challenges in working with large quantities of information, student comment recognised the importance of organisation of data. Diversity of information was valued by all the respondents; a minority of students perceived managing this diversity to be challenging.

4.8 – Evaluation of third action

The third action step was planned and delivered to support the second action set of students in the development of their case studies. The design thinking workshop took place in one four-hour session on the 27th November 2013, incorporating the tools of 'story tell', 'brainstorm', 'voting' and 'feedback capture' (see figure 4.15).

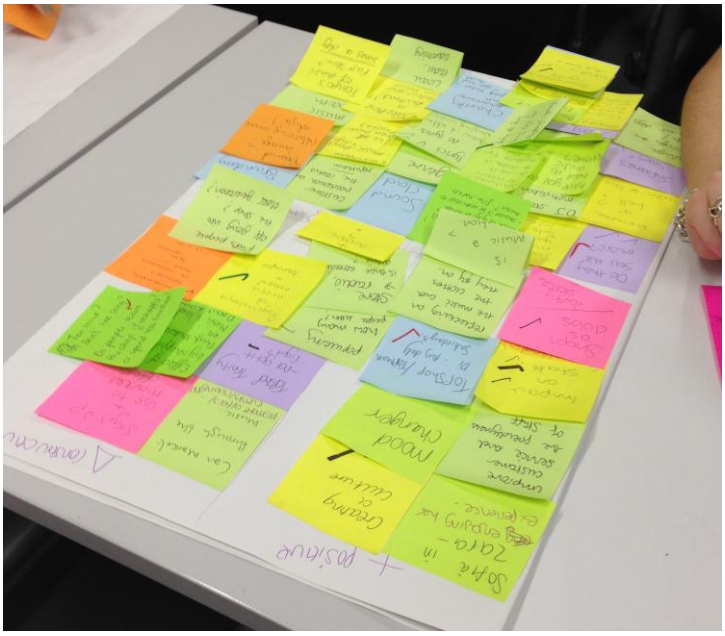


Figure 4.15 'Feedback Capture' tool, 27th November 2013

This reprise of the third action step, was designed to support the development of their dissertations, taking place in one four-hour session on the 10th December 2013, incorporating the tools of 'story tell', 'brainstorm', 'voting' and 'feedback capture'.

Data was gathered to evaluate the third action step, in the form of student participant feedback and researcher, tutor observations.

4.8.1 Student feedback: Third action step, 27 November 2013

Twenty-two students participated in the workshop. At the end of the activities, students were invited to give feedback on their experience of the workshop. The collection of this data was, as previously, on large 'Post-it' notes. There was no limit to the number or type of comments that a student could contribute. Responses were anonymous and individual although collective discussion whilst compiling the responses was again evident. Twenty-two students (100%) contributed feedback using the post-it notes. The thematic coding analysis was the same as for the first and second actions.

The findings from the student feedback are presented in the frequency Table 4.70 (see appendix 11 for data).

Table 4.70 Student feedback: Third action step, 27 November 2013

Feedback that informs development of tools and process Level 1			Frequency
	When the activities take place (Level 2)	Should be earlier in module / year / course (Level 3)	5
		Timing is good (or not) (Level 3)	
		Should be repeated in module / for other modules (Level 3)	20
	How are the workshops managed (Level 2)	Timing of activities within workshops (Level 3)	3
		Room size / space to work in (Level 3)	4
	The nature of the design thinking 'tools' activities (Level 2)		11
	The nature of the groups (Level 2)	Feedback / recommendations on size of group (Level 3)	4
		Feedback / recommendations on including new people (Level 3)	1
		Feedback / recommendations on tutor input (Level 3)	3
		Total comments Feedback that informs development of tools and process	**51**
Student perceptions of impact of the activities Level 1			
	Helpful / useful (Level 2)		8
	Generation and development of ideas (Level 2)	The generation of ideas for student's own work (Level 3)	6
		Developing ideas for student's own work (clarify / develop focus) (Level 3)	14
		Feedback on ideas for student's own project (Level 3)	3
	Collaboration (Level 2)	Gaining others perspectives / ideas / feedback (Level 3)	14
		Giving others support / ideas / feedback (Level 3)	4
		Valuing the opportunity to see others ideas and concepts (Level 3)	6
		Sharing experience (placement / work, in particular) (Level 3)	1
		Sharing contacts / resources (Level 3)	2
		Demonstrating empathy for others views / positions (Level 3)	3
	Students' perception of affects on their motivation (Level 2)		1
	Students' perception of changes in own levels of confidence (Level 2)		3
	Learning (Level 2)	Students perception of the activities as a learning approach (Level 3)	1
		Students perception of benefits to their personal learning / development (Level 3)	
		Students reflection on their own skills; management of information, communication (Level 3)	5
		Total comments Student perceptions of impact of the activities	**71**

Total comments = 122

n=22

Student feedback in relation to when the activities take place are concerned with two aspects, two respondents suggested that the activities could additionally be included earlier in the course, three that they should be earlier within the final year. Twenty comments recommended repetition of the activities, typical of these was, "would definitely like to do it again for other projects". Concerned with the management of the workshop three students remarked that the amount of time available was insufficient, "would have liked more time to see what others are doing [re] cross over / collaboration". The limitations of the small room size were noted.
The feedback on the tools and techniques focused on centred on 'voting' and 'feedback capture'. The benefits of 'voting' were commented on, "The tick [voting] exercise was good as it highlighted important points", as well as recommendations for development, "class review [voting] would have liked more time to get around everyone's [ideas sheets]". There was additionally a recommendation for the development of 'feedback capture', "maybe ask people to start in groups about thinking of the four grid [feedback and capture] categories, so can look at in [from] all angles".

An ideal group size of five or six was recommended, including new members in groups was valued as evidenced by the comment, "group [work] really good - especially from people not worked with [before] from differing perspectives". Three comments noted the importance of tutor input.

In relation to the student perception of the impact of the activities, eight comments noted that the methods were constructive and helpful. The activities were perceived to be helpful in the generation of ideas, however there were fourteen comments noting the positive impact on the development of ideas; four noted that they gained clarity.

Thirty comments related to aspects of collaboration, with two exceptions they all regarded the experience positively and recognised benefits. Typical of these comments was, "provided valuable support and feedback". The exceptional comments were cautionary, "people may be reluctant to criticise" and a recognition that some students "already have a very set idea."

The development of motivation and confidence were also commented on positively. One student recognised the activities as "a very positive learning approach". Five comments recorded student reflection on their own experience; two considered that they found it difficult to present, or had an insufficiently developed idea to present. Confidence in their idea when seeing others present similar ideas, or being offered other options was a challenge for two students. Another student saw the opportunity to build on the

experience of interacting with others to prepare primary interview questions with industry experts.

4.8.2 Researcher and observer participant feedback: Third action step, 27 November 2013

For this workshop the room layout was not as successful as previously, one group would have benefitted from a clearer 'round table' layout. The importance of the physical environment has become more evident.

The introduction needs development, Jo Conlon as observer commented that the students would benefit from a more extensive explanation of "why do this". It may help them to be more explicit about activities. The introduction to 'story tell' was developed in response to recommendations, as a result it was more concise in the main, some did a mini mind map, some a three word phrase.

Students self-facilitated their groups effectively, tutors intermittently observed and asked questions of the group. Smart phones are ideal as timers; most groups adopted the use of these to good effect. The researcher observed that the students whose topic is under discussion, is 'in the chair' and has to informally manage the short session. It was observed by both the researcher and observer that all group members made contributions verbally, including those not normally vocal in class. All groups appeared to keep to time and to use the full time available.

A suggestion was made for the 'voting' tool, - that an x instead of a ✓ be added to indicate that you don't agree with the point made.

Jo Conlon suggested that more time for student reflection on feedback and for feedback be considered.

4.8.3 Student feedback: Third action step reprise, 10 December 2013

A 'mini cycle' or reprise of the third action was implemented to support students in the development of their dissertation topics. 18 students participated. Groups organised themselves into three groups, each with six students. All groups were self-facilitating. Data gathered to evaluate this workshop was in the form of student feedback and researcher observations.

Five students (27.8%) provided feedback comments. The findings from the student feedback are presented in the frequency Table 4.71 (see appendix 12 for data).

Table 4.71 Student feedback: Third action step, 10 December 2013

Feedback that informs development of tools and process **Level 1**			Frequency
	When the activities take place (Level 2)	Should be earlier in module / year / course (Level 3)	
		Timing is good (or not) (Level 3)	
		Should be repeated in module / for other modules (Level 3)	
	How are the workshops managed (Level 2)	Timing of activities within workshops (Level 3)	
		Room size / space to work in (Level 3)	
	The nature of the design thinking 'tools' activities (Level 2)		2
	The nature of the groups (Level 2)	Feedback / recommendations on size of group (Level 3)	
		Feedback / recommendations on including new people (Level 3)	1
		Feedback / recommendations on tutor input (Level 3)	
		Total comments **Feedback that informs development of tools and process**	**3**
Student perceptions of impact of the activities **Level 1**			
	Helpful / useful (Level 2)		1
	Generation and development of ideas (Level 2)	The generation of ideas for student's own work (Level 3)	
		Developing ideas for student's own work (clarify / develop focus) (Level 3)	
		Feedback on ideas for student's own project (Level 3)	
	Collaboration (Level 2)	Gaining others perspectives / ideas / feedback (Level 3)	
		Giving others support / ideas / feedback (Level 3)	1
		Valuing the opportunity to see others ideas and concepts (Level 3)	
		Sharing experience (placement / work, in particular) (Level 3)	
		Sharing contacts / resources (Level 3)	
		Demonstrating empathy for others views / positions (Level 3)	
	Students' perception of affects on their motivation (Level 2)		
	Students' perception of changes in own levels of confidence (Level 2)		2
	Learning (Level 2)	Students perception of the activities as a learning approach (Level 3)	
		Students perception of benefits to their personal learning / development (Level 3)	
		Students reflection on their own skills; management of information, communication (Level 3)	3
		Total comments **Student perceptions of impact of the activities**	**7**

Total comments = 10

n=5

There was limited student feedback, five students provided comments. In relation to feedback that informs the development of the design thinking workshop and the tools used, two comments noted difficulties in reading the 'story tell', "Too much written as

the initial idea, not very clear." One student valued changing group members, "Working with new people has given me even more examples to build on".
Development in their confidence was commented on by two students; in particular confidence in their ideas, "This session has given me a lot of confidence that this is a topic worth pursuing".
Reflecting on their experience two students questioned how to manage the increased amount of ideas that they had gathered, a third comment considered the problem from a different perspective, "Even though I didn't get as many post-its as last time I do feel the session was more focussed".

4.8.4 Researcher and observer participant feedback: Third action step reprise, 10 December 2013

This workshop implemented amendments that were developed from participant feedback:

- Group sizes were recommended to be no larger than six.
- Groups were encouraged to include new members, people you haven't worked with before.
- Students were given the option to add to / to amend their original 'story tell' between the 'brainstorm' and 'voting' elements.
- In the introductory talk students were made aware of the feedback capture quadrants so that they could, if appropriate consider them during 'brainstorm'
- Participants were advised to use orange post-its for notes added during voting stage in order that they could be identified separately from those contributed during the brainstorm.

The researcher observed that the repetition of workshops and of the relatively simple tasks makes the introduction brief and efficient. The inclusion of new members in groups was encouraged and the students responded positively. The groups self-facilitated, making effective use of time and managing equal opportunities for contribution well. After a break, collectively the group voted on ideas they felt positive about (with a maximum of three votes per sheet). Although 45 minutes were allowed this was completed in 30 minutes. A further 30 minutes was allowed for 'feedback and capture'. Verbally a number offered the observation that they felt that they had developed an idea for dissertation.

4.8.5 Design thinking workshop for student development of their major projects

A third workshop was provided on the 19th February 2014 to support the second action set of students in the development of ideas for their major project.
The planned collection of data for the current research had concluded therefore no student feedback and observations were collected. However, within the final student questionnaire the students do reflect on the experience of these workshops and their application to major project.

4.8.6 Final student questionnaire – second action set

Questionnaire – February 2014
Sixteen students completed the questionnaire during the second term of their final year at a mid point during the development of their major projects (see appendix 13 for questionnaire, appendix 14 for full results). All the respondents stated that they were final year undergraduate student on the BA (Hons) Fashion & Textile Buying / Management / Retailing pathway. Eleven indicated that they had undertaken a placement year, three stated that they had progressed directly from year 2 to final year, two omitted to respond to this question.

Question 1

The first set of questions required respondents to reflecting on the design thinking workshops, tools and techniques. Question 1 aimed to find out the students' perception of which piece of work, if any, is most 'helped' by using design thinking techniques

Table 4.72 Benefits to final year projects of using design thinking techniques

	Very helpful	*Helpful*	*Neutral*	*Not very helpful*	*Unhelpful*	*Didn't participate*
Case Study	8 50%	4 25%	1 6.25%	0 0%	1* 6.25%	2 12.5%
* "because I changed my idea"						
Dissertation	6 37.5%	6 37.5%	3 18.75%	0 0%	0 0%	1 6.25%
Major Project	10 62.5%	6 37.5%	0 0%	0 0%	0 0%	0 0%

n=16

A majority of respondents (75%) found the techniques helpful or very helpful for the case study, the same was recorded for the dissertation (75%) this rose significantly for the major project (100%).

Question 2

This section aimed to establish the students' perception of which, if any, tool they found most helpful.

Table 4.73 'Story tell'

Very helpful	*Helpful*	*Neutral*	*Not very helpful*	*Unhelpful*
7	8	0	1	0
43.75%	50%	0%	6.25%	0%

n=16

The respondents, with one exception, considered the 'story tell' to be helpful or very helpful. Comments indicated that students perceived that articulating their idea was beneficial as evidenced by the comment, "Helps to structure the idea in your head by explaining it aloud".

Table 4.74 – 'Brainstorm'

Very helpful	*Helpful*	*Neutral*	*Not very helpful*	*Unhelpful*
13	3	0	0	0
81.25%	18.75%	0%	0%	0%

n=16

All respondents found the 'brainstorm' to helpful or very helpful. In comparison with the 'story tell', a higher percentage of respondents (81.25%) found this activity, to be very helpful. Comments on the brainstorm "Gathers different opinions and perspectives previously not thought [of]".

Table 4.75 – 'Voting'

Very helpful	*Helpful*	*Neutral*	*Not very helpful*	*Unhelpful*
2	11	3	0	0
12.5%	68.75%	18.75%	0%	0%

n=16

The voting tool was considered helpful or very helpful by a majority of respondents (81.25%). The majority of additional comments refer to the opportunity of the whole class to vote on ideas where they have not been involved in 'story tell' or 'brainstorm', "A

little more difficult for others to understand the full idea / concept when did not first hear the 'story tell'", "[it would be] better if the initial idea is written out to explain idea more instead of one or two words. Get more of an understanding to input additional ideas."

Table 4.76 – 'Feedback Capture'

Very helpful	*Helpful*	*Neutral*	*Not very helpful*	*Unhelpful*
3	12	0	1	0
18.75%	75%	0%	6.25%	0%

n=16

The respondents (93.75%), with one exception, considered the 'feedback capture' tool to be helpful or very helpful. The additional comments on perceived a number benefits, "See common themes and areas that need further development", "Develop[s] triangulation". One comment suggested a development, "I feel it is helpful to organise into areas of related points not into + **Δ ?** 

Question 3

This section aimed to find out the students' perception of the way in which design thinking techniques might have benefitted their work and the way that they work. Respondents were asked to reflect on seven aspects; the generation of ideas, impact on the gathering and management of information, the development of ideas, the development of focus to projects, motivation, identifying strengths and weaknesses and finally the impact on anticipation of limitations to ideas and concepts.

Table 4.77 Generation of ideas

Impact on the **quantity** of ideas generated	Positive	Helpful	No impact	Not helpful	Negative
	8	8	0	0	0
	50%	50%	0%	0%	0%
Impact on the **quality** of ideas generated	Positive	Helpful	No impact	Not helpful	Negative
	9	7	0	0	0
	56.25%	43.75%	0%	0%	0%
Impact on the **speed** of generating ideas	Positive	Helpful	No impact	Not helpful	Negative
	10	5	1	0	0
	62.5%	31.25%	6.25%	0%	0%

n=16

All the respondents indicated that the activities were helpful or very helpful in respect of the quantity and the quality of ideas generated. The majority perceived a positive impact on the speed with which this was accomplished. Comments noted that not only were ideas generated but limitations were also considered, "Very helpful in generating a lot of initial ideas as well as [identifying] problems".

Table 4.78 Information

Impact on **expanding** sources of information	Positive	Helpful	No impact	Not helpful	Negative
	7	9	0	0	0
	43.75%	56.25%	0%	0%	0%
Impact on **quality** of information gathered	Positive	Helpful	No impact	Not helpful	Negative
	5	8	3	0	0
	31.25%	50%	18.75%	0%	0%
Impact on **organising / managing** your information	Positive	Helpful	No impact	Not helpful	Negative
	7	8	1	0	0
	43.75%	50%	6.25%	0%	0%

n=16

All the respondents considered that there was a positive impact on the expansion of their sources of information. A significant majority (93.75%) identified that the activities were beneficial to their organisation and management of information. Slightly fewer students perceived benefit to the quality of information gathered. The additional comments were very varied, one stating that it "expands your mind", another noting the value of collaboration "Ideas from other people's experiences" and a final comment that noted there was little impact.

Table 4.79 Development of ideas

Impact on **expanding** your original ideas	Positive	Helpful	No impact	Not helpful	Negative
	14	2	0	0	0
	87.5%	12.5%	0%	0%	0%
Impact on the **speed** of development of your ideas	Positive	Helpful	No impact	Not helpful	Negative
	11	3	2	0	0
	68.75%	18.75%	12.5%	0%	0%
Impact on **organising** your ideas	Positive	Helpful	No impact	Not helpful	Negative
	8	8	0	0	0
	50%	50%	0%	0%	0%
Impact on your **confidence** in your idea	Positive	Helpful	No impact	Not helpful	Negative
	10	5	1	0	0
	62.5%	31.25%	6.25%	0%	0%

n=16

Reflecting on the impact of the activities on the development of their ideas the majority of respondents noted this as positive or helpful. This was most perceived as most beneficial in relation to the expansion of ideas and the organisation of ideas. Although a minority of students perceived no impact on the speed of development of ideas this was balanced by a majority (68.75%) perceiving this as positive. Similarly in respect of student confidence in their idea the majority (62.5%) identify positive impact.

Table 4.80 Development of focus

Positive	Helpful	No impact	Not helpful	Negative
8	8	0	0	0
50%	50%	0%	0%	0%

n=16

All respondents considered the impact on developing focus to be positive or helpful. The additional comments made offer a range of perspectives, "I was already focused but it helps [me] to remain focused and clear", "Gives more focus to idea", "With dissertation I found it slightly confusing and overwhelming having so much input".

Table 4.81 Motivation

Positive	Helpful	No impact	Not helpful	Negative
13	3	0	0	0
81.25%	18.75%	0%	0%	0%

n=16

A significant majority noted that the impact of the activities on their motivation was positive. The additional comments expanded on this, "I've got loads of ideas now and excited to start researching more", "Made me want to start, gave me motivation, "Excites you when people engage and are positive about your ideas".

Table 4.82 Identifying strengths and weaknesses

Impact on your ability to identify the **strengths** to your work	Positive	Helpful	No impact	Not helpful	Negative
	9	7	0	0	0
	56.25%	43.75%	0%	0%	0%
Impact on your ability to identify any **weaknesses** to your work	Positive	Helpful	No impact	Not helpful	Negative
	11	4	0	1*	0
	68.75%	25%	0%	6.25%	0%

n=16

All the respondents, with one exception recorded the activities as having a positive or helpful impact on the identification of strengths and weaknesses in their work. The student who regarded the identification of weaknesses added a further comment, "Didn't get any feedback on weak areas of my ideas only strengths". More typical was the comment, "I can really see the weaknesses and where I need to improve my idea".

Table 4.83 Anticipation of limitations to your idea

Impact on anticipating any limitations to your idea	Positive	Helpful	No impact	Not helpful	Negative
	7	9	0	0	0
	43.75%	56.25%	0%	0%	0%
Impact on solving research problems	Positive	Helpful	No impact	Not helpful	Negative
	6	9	1	0	0
	37.5%	56.25%	6.25%	0%	0%

n=16

All the respondents considered that the activities had a positive or helpful impact on their anticipation of limitations to their idea. A majority perceived benefits to their ability to solve research problems. n=16

Question 4

This section aimed to find out the students' perception of what they will 'take away' from the experience that they perceive might be beneficial to them.

The students were firstly asked if they now did anything differently in the way that they worked.

There were four comments recorded; some made multiple points within their comment: Two referred to the generation and development of ideas, "[I] Found that I am open to new ideas, whereas before I was dead set on one specific topic", "[I] Think more about limitations / issues"

Two referred to the development of their organisational skills, "I feel more organized after the sessions, it gets you off to a good start", "I'm much more organised - I do more planning".

The next question asked students whether they had learned anything about themselves and the way that they work as a result of the experience of using the design thinking techniques.

Six responses were recorded; one response was a simple affirmative, one respondent stated they were unsure, a third perceived no difference. One respondent identified ways they felt that they needed to develop, "Take too much on initially[I] need to be more specific", a second noted that the activities had "Enabled me to think more critically". Another student reflected on their abilities, "I realise I handle criticism well, I appreciate the opinions of others to improve my work".

Students were asked about their experience of collaborating with others on their work. Nine comments were recorded;

Five comments related to the generation and development of ideas. One comment noted a changing perspective on the benefits of collaboration, "The first one I didn't want to do it as people may 'steal' ideas but now I understand it's a positive". Additional comments relate to the generation and development of ideas, "It is good if I am stuck on an idea - feedback / collaboration helps connect my ideas", "I find it useful to find out people's views about my ideas and enjoy hearing other people's ideas".

Two comments noted the impact on confidence, "Very good, helpful, confidence boosting, interesting to hear other's ideas - very good!" "Very helpful and positive - gives a confidence boost". A final comment noted the positive impact on teamwork.

Within this section respondents were provided with an opportunity to expand on and beyond the aspects described in the question.

From the seven comments received two themes emerged, collaboration and the generation and management of ideas. The challenges and benefits of collaboration are illustrated in two comments, "Initially sharing your idea is daunting however once discussed it gives you confidence in your idea and makes you want to do it again for the next project." "It's worrying sometimes because you are being judged on your ideas but at the same time it's nice to hear people's feedback." The comments in relation to ideas referred to the development and organisation of ideas, "Expands ideas further".

Question 5

The final question in the survey gave students the opportunity to contribute any further thoughts that they had on their experience of using the design thinking techniques. Nine comments were recorded, some comments made multiple points.
Of the nine comments contributed, eight were recommendations for the development of the activities, one an observation on contribution. Two themes were identified in the recommendations, the management of the activities and the membership and participation in groups.

In respect of management of the activities respondents noted that; they would recommend repetition of the activities, that a group of six people is the optimum and that more time is needed for the 'brainstorm' activity. "More discussion time would be preferred over looking at everyone else's ideas, to stick with my group - ideas were flowing but had to stop because of fitting in the final activity." The repetition of instructions within each workshop was considered to be unnecessary

Students identified the democratic nature of the activities; "This should be used in team projects as an effective way for everyone's ideas to be heard". They valued working with different people to gain new perspectives, one student recommended extending the activities beyond their own course, "Collaborating with different courses would be a good idea. The case study was great because we hadn't done this before but now we have done this three times people's ideas are starting to get the same - new people would be useful". More explicit instruction for the 'story tell', to indicate a structure, was recommended.

The observation reflected on the contribution of students with different prior experience, "Placement students have more effective ideas and suggestions".

4.8.7 Summary of third action

The third action design thinking workshops

In the third action the design thinking workshops supported the second action set of students . Student feedback was positive overall. Demonstrating active participation in the action research process the students included a significant number of recommendations for the development of the workshops and the design thinking tools. The recommendations were broad ranging, from consideration of the timing of the workshops within the course curriculum to practical suggestions for the development of specific design thinking tools.

In respect of repetition the participants perceived value in repetition during their final year. The development of timing within the workshops was recommended; participants proposed that more time be allowed for fuller discussion of ideas and to allow for more reflection.

The collaborative elements were commented on very positively by a majority of students noting the support it provided and the value of feedback. The slightly cramped physical space was a limitation, although minor, to the delivery of the workshops. Students reflected that a group size of six participants was the most effective.

In respect of the design thinking tools there were a number of specific recommendations. Development to the 'story tell' tool, to encourage participants to be clearer and more concise. The 'voting' tool was perceived by some to be helpful in identifying key points. An earlier description of the categories for 'feedback capture' was recommended, in order that they could be considered within the 'brainstorm' tool.

Participants noted the benefit of the tools to the generation of ideas, however a greater number of comments reflected positively on the benefits to the development of ideas. The subsequent positive impact on motivation and in confidence in their topic was noted.

Final student questionnaire – second action set

The majority of students found the design thinking activities helpful for the case study and dissertation, however all the students perceived it as helpful to the major project. Of the design thinking tools, the participants perceived 'brainstorm' as the most beneficial and 'voting' the least, however all were considered helpful by the majority of students.

The impact on ideas and information was regarded as positive for the majority, in particular the generation of ideas. In terms of the development of their ideas a considerable majority noted the positive impact on the expansion of their ideas.

The motivation of students was notably enhanced through their engagement with the design thinking activities.

This questionnaire provided the students an opportunity to reflect on what they have gained from their participation. Several respondents described benefits to the generation and development of ideas, typically through the collaborative processes. For some the experience of collaboration was initially a challenge however in their feedback they noted that the benefits had become evident to them. Prior experience of placement was regarded by some to be an advantage. The value of including new members in groups was identified in conjunction with this was the recommendation to explore future collaboration with other courses.

4.9 Fellow tutor observer reflection

An interview was conducted with Jo Conlon, following the third action step, to reflect on the overall experience of introducing design thinking tools and techniques to students. Reflecting on the impact on student work, Jo believes that "the activities have empowered the students, they have grown in confidence and therefore delivered some outstanding projects". Jo believes that the students are happy to work collaboratively on each other's individual projects "as long as it is reciprocal" however she noted that it is not guaranteed that they will 'reap what they sow'. Although the students are "…competitive, benchmarking themselves against one another", they "…share their resources and pool resources really successfully". Underpinning this is her view that "the culture of the course is to be generous in support of others and to be generous with sharing resources". Jo noted that "the nature of the support [given] within the activities was aligned with mentoring, and that as with mentoring there are benefits for the supporter / mentor as well as the mentee. They gain the benefits of being a mentor, growing in their own confidence [by] being generous with their resources". The student engagement in this reflection was discussed, "This type of mentoring process is reflective in nature, a positive process for the students".

Commenting on the recording of observation of the workshops, "The formal mechanism of recording the workings of groups through the pro-forma we used didn't work. As a peer observer she considered that the "reflection on observation that was carried out in

informal discussion immediately after the sessions was more effective, particularly within the time constraints of other work commitments". In managing the membership of groups for the activities Jo observes that there is a very delicate balance to try to achieve, "There are benefits to allowing groups to become established and to build as well as re-energizing groups with new members". "It is important to change membership of group at points". Reflecting on the facilitation of groups Jo observed that self-facilitation is more effective, stating that it is "the right way to go" she observed that "the presence of tutors has an enormous effect".

Reflecting on the design thinking workshops and the tools used, Jo commented that the longer session over four hours worked better. She considered that the 'Story tell' tool could still be further improved. She likes the 'Voting' activity, but has concerns that we are drawn to the post-it notes that already have votes noting that "I do it myself". She added the point that "they don't have to use the feedback from voting". Jo noted that she had subsequently used the 'Feedback capture' grid in other modules for other year groups.

The effect of placement and workplace experience on students contribution was discussed, "You can see them reflecting on the resources that they have, they filter it, drawing on this wealth of resources, sieving out the best bits to contribute". It was observed that the students talk very freely, building on their own and others ideas. Jo commented on the amount and currency of information that the students bring, "we [staff] couldn't hope to stay as up to date as the [collective body] of students can and in relation to the diverse subject areas they are interested in". Jo observes that "students who had experience of placement get off to a better start, however those that had no placement experience get the benefit [of placement students sharing their experience], therefore it balances out." She proposed that there may be "a mindset of students that failed to grasp the placement opportunity' that might also fail to grasp the opportunities afforded by the design thinking activities".

The impact of the activities on the ability of students to manage information was discussed; Jo believes that the activities have enhanced this. Her evidence for this is in the impact on subsequent project management sessions that she delivers to these groups of students. Increasingly Jo needs to "do less on project management, the development of the student's ideas is further on." Jo states that previously precepts of project management had to be delivered because the students had no concepts / ideas to apply it to. "Before this project [the activities] started there were a number of students who underperformed in both the description of their idea and their project

management". She observes that they have now developed tangible skills in project management, notably in managing their resources.

Jo's personal reflection formed the conclusion to the interview. She reflected on the alignment of models of design thinking to the aims of the course, in particular the development of the ability to solve problems. "I always come back to the concept of design thinking – it really sums up what we are trying to do with our students; the Tim Brown concept – 'what is feasible, viable and desirable' (and I add sustainable)." She added, I think it continues to encourage me to make the learning process as active as possible and to challenge our students to think for the future not for today.

Jo reflected that collaboration was inherent in her previous experience of industry and that she liked to work collaboratively. Reflecting on her own educational experience Jo commented,

> However, this is not how I studied for my A-levels or degree. It is interesting to reflect on my approach to my on-going studies and think about the legacy of 'what worked' 20 years ago. Although I am comfortable working collaboratively, learning collaboratively is new to me. I now recognise this is a useful way to learn although I wish I was more comfortable with it. Perhaps I need to practice the storytelling, feedback and capture actively in support of my own learning.

Jo discussed the integration of design thinking within the curriculum for year two of the course, "the concept of design thinking was introduced in TID1120 for the collaborative project. I have now added a taught session on it and a workshop into TID1121. I think we should do more."

4.10 Summary of chapter

The opportunity was identified to develop the support for final year undergraduate students who are in the very early stages of development of their projects. Reconnaissance suggested that these students have increasing opportunities in the amount and type of information that is available to support their research. The students perceived that greater quantities and diversity of information sources are to be valued, many also perceived that there are challenges associated with these benefits. Although introduced to a number of strategies and techniques for the organisation of information in the early stages of the course there is variable application of these to develop and manage project work. The opportunity identified is to develop the students' abilities to

work with information and knowledge to develop and manage their ideas more effectively.

Design thinking is a collaborative and iterative process to identify opportunities and to devise solutions to problems. The importance of placing emphasis on problem setting, 'asking the right question' was identified. There are several models of design thinking process, each with rich resources available to support the facilitation of design thinking in varied contexts. These offer an opportunity for adaption to suit other contexts. Four tools; 'Story tell', 'Brainstorm', 'Voting' and 'Feedback Capture' were selected to provide a sequence of activities to support students in the generation and development of information and ideas.

The design thinking workshops were integrated within existing final year modules, to be delivered prior to the existing activities of 'Pecha Kucha' and 'Poster'. The workshops were situated in three action cycles. The participants in the first and second cycle were the first action set of students, in the third cycle the second action set of students participated.

The design thinking workshops were perceived to have value to participants, indicative of this were the recommendations form each action set to repeat them for future projects. The objective of the workshops to support the early stages of student project development was met as evidenced by the positive comments regarding the generation and development of ideas and the management of information.

The student feedback was positive, however within the comments and survey differences in response to different design thinking tools were evident as well as some differences in the type of benefits gained. Taken together with tutor observations of different styles of student contribution to the activities this suggests that a varied range of tools is of value.

Data was gathered from the participants after each design thinking workshop, the immediacy of the feedback supported the further development of subsequent workshops. A further questionnaire was completed by each action set after the conclusion of the workshops. The nature of the data received indicated that these points of feedback were also an important point of self-reflection.

The nature of the developments varied and included, the development of a single session for the workshops, the self-facilitation of groups, the involvement of all the workshop participants in voting and the extension of 'feedback capture' to develop 'the story so far' that offered participants a further iteration of the process.

The students perceived the design thinking tools to be of most benefit to the major project, however a considerable majority found them to be beneficial for all the projects. The design thinking tools were found by the majority to be helpful, the collaborative 'brainstorm' was particularly valued. Students noted that their skills had improved; in generating and developing ideas, planning and managing projects and in the presentation of their concepts and ideas. The value of the collaborative experience was commented on frequently and very positively. The feedback noted a positive impact on their motivation and that confidence in their ideas and abilities had developed.

At the conclusion of the cycles the peer observer noted her reflections. She considers that the design thinking activities have empowered the students, noting the development in their confidence. Her observations are that the activities have enhanced their ability to manage information. As final year tutor she has observed a positive impact on the submissions of work.

She observed that the students were very happy to collaborate but that they had an expectation of reciprocal contribution. However she believes that the culture of the students on the course is to be generous and supportive of their peers.

Within modules in the second year of the course Jo has developed design thinking activities, she notes that her experience of the workshops has encouraged her to develop more active learning opportunities for students.

Chapter 5 Reflection and learning

5.1 Introduction

Reflection is a means to 'step back' and to make explicit to yourself the actions that you have planned and taken, what you have delivered and achieved in your practice and how it has impacted on others (Coghlan & Brannick, 2014 and McNiff & Whitehead, 2011). Reflection is the critical link between action and research (Coghlan & Brannick, 2014).

This chapter documents my reflection on the planning and delivery of design thinking tools and techniques and reflects on what the impact of the implementation has been on the learning of the participants and the researcher. Through reflection I aim to develop my understanding of how and why design thinking tools benefit student learning. In turn this will develop my own learning and will provide a framework on which to build for my future educational practice. For this research there are four elements that are the focus of the reflection; the researcher's personal practice in design and in education, the action research process, the implementation of design thinking tools and their effect on the learning of the participants.

5.2 Personal practice, in design and in education

According to McNiff and Whitehead (2011), there is a need for practitioners in Higher education to study their practice collaboratively, to relate educational theory to the practice of improvement. The perspective of the 'scholar-practitioner' is aligned with Schön's description of the 'reflective practitioner' (Coghlan & Brannick, 2014).

My practice has evolved in line with the developments in my career, from design practice situated within industry, to educational practice within Higher Education. The elements of collaboration, iteration and the impetus to effect change that are common to design thinking and an action research methodology are also aligned to my practice, past and present. Working with others to develop creative solutions and implement change to positive effect is central to my practice. I have reflected on my educational practice to establish a personal context for this research. As a result of teaching experience, over a number of years, my practice in education has become one that is heavily dependent on 'knowing-in-practice', as described by Schön (1991) this may have impact on the scope and depth of my reflection. The combination of research with reflection in action research offers opportunity for valuable learning (Somekh, 2006). Therefore, situating the

initiative to implement and evaluate design thinking tools for student learning within an action research methodology has offered me an opportunity to engage in deeper reflection and to use this reflection to develop my own learning.

Within my educational practice my reflection has occurred in different contexts; in the preparation of curricula, the development of teaching and learning materials, during delivery and in the assessment process. Some of this reflective practice has been in collaboration with colleagues, which has been valuable. However, my reflection has been concerned with incremental change to curricula, content and mechanisms of delivery and assessment. This current research has encouraged and motivated me to reflect on my approach in more depth, particularly in relation to student learning and to reflect on how my practice is situated within a theoretical context. Gaining insight into my personal 'knowing-in-practice' (Schön, 1991) is important to my continued development as an educational practitioner.

5.3 Reflection on the action research process

Reflection is situated both within the cycles of action research and on the steps of the action research process. Argyris (2003) states that inquiry into the steps is critical in order to develop actionable knowledge (in Coghlan & Brannick, 2014) and, that it is this reflection on reflection, described as meta-learning, that develops action research beyond commonplace problem solving.

An action research methodology was particularly suited to the implementation of design thinking tools and techniques, the common characteristics of collaboration, iteration, reflexivity and concern with effecting positive change, identified in 3.1 of the methodology, supported a constructive developmental ethos for all participants. Reflecting on the first action step, the first workshops established the validity and the potential of the tools for development, the recommendations of the participants prompting reflection and subsequent development for the second action step. The second action step refined and extended the tools in preparation for the next workshops. Participant feedback made further recommendations for development. A new cohort of students, the second action set, participated in the third action step, the feedback from

these participants was positive, extending the validation of the activities beyond a single cohort of students.

The most significant aspect for me has been the engagement of the participants in the action research process; this was both encouraging and constructive. The recommendations were considered and valuable to the development of the tools and the management of the workshops.

5.4 The implementation of design thinking tools

Reflection on my previous delivery of tutorials to support the final year students in the development of their projects suggested that there was an opportunity to develop this to engage students better. Research into the processes, tools and techniques of design thinking suggested that they could enhance student skills in the generation and development of ideas to help students in the activities of problem solving, or perhaps more specifically problem setting.

I planned and delivered three action research cycles of design thinking workshops, the participants were undergraduate students, a fellow tutor and the researcher. The design thinking workshops supported students in the early stages of development of their projects, for case study, dissertation and major project. Within the workshops design thinking tools and techniques, selected by the researcher, were used by the students to develop their ideas and concepts for projects. I made adaptions to the design thinking process and tools in order to be appropriate to the educational purposes of this research, throughout the three action cycles I continually reflected on these adaptions. Design thinking is more usually practised in a context that involves all stakeholders, often multi-disciplinary, in the identification of a problem or opportunity and the subsequent development of a solution.

In my adaption I have:

- Focused on the early stages of the process rather than undertaking all stages of the process to devise a solution.

- Worked with students on a single course, although it could be argued that they have differing perspectives particularly as many have very different placement experiences to draw from.

- Facilitated students to work collaboratively on individual projects, rather than a common problem. This last adaption is the most significant departure from the usual approach.

Although these adaptions are significant the subsequent feedback from students and from the peer observer has validated and supported these developments.

The students engaged with the activities in a positive and constructive manner.

The first tool, 'Story tell' requires students to articulate their idea to a small group of fellow students, leading on to the second tool 'Brainstorm' where fellow students contribute any observations, comments, ideas or questions they have in relation to the idea presented. In the first step workshop the fellow tutor and the researcher facilitated these tools. However it became evident during the first action that the groups were equally, if not more effective when self-facilitating, aligned with Revans perspective (Pedlar, Burgoyne & Brook, 2005) and Drew's (2012) view that peer-to-peer facilitation is less hierarchical. As the workshops progressed it was evident that the students became increasingly engaged, choosing not to take breaks and managing each student's opportunity to gain feedback with fairness and generosity of support. In using their experience, particularly from work experience and placement experience, students reflected on and shared the knowledge that they had previously acquired. This reflection, illustrating Schön's process of reflection in action, is an intrinsic element of design thinking (Drew, 2012)

The gathering of student feedback on the design thinking workshops was constructed to be as immediate and open as possible, students were made aware that their responses would be used to develop and improve the tools therefore a wide range of responses was encouraged. As the context was one of their tutor seeking feedback it is possible that students avoided negative comments, however my reflection on the comments received would suggest that rather than comment negatively students offered constructive suggestions for change or development. The student feedback contributed at the end of each workshop by each action set of students was positive, as was the feedback from the fellow tutor who also acted as peer observer. A dominant recommendation was for the

repetition of the activities. The feedback from each action step included recommendations for future delivery of the workshops, an indication of the willingness of participants to support repetition and to encourage improvement to the tools.

5.5 The effect on the learning of the participants.

Reflecting on your actions and their subsequent influence on other people's lives is of considerable importance (McNiff & Whitehead, 2011). All the participants, the students, the fellow tutor and the researcher had potential to be influenced by this research.

The collaborative aspect of the process supported the development of the students' ability to generate and develop ideas, resulting in greater confidence in their ideas. The student feedback demonstrated that they enjoyed collaborating with their peers, that they perceived value in articulating their ideas, gaining feedback from others and contributing feedback to others. I have noted from the feedback that the tools most valued are those that involve collaboration and articulation of ideas.

The iterative nature of the process provided students with the opportunity to articulate and present their ideas and concepts several times, this improved their skills of communication and presentation. The students recognised that this repetition was valuable, the observer and researcher recognised this development in subsequent submissions for assessment.

Participating in the role of a fellow tutor and peer observer Jo Conlon shared her reflection with the researcher. She places value on the core elements of design thinking, 'Desirability, Feasibility and Viability' as identified by Brown (2009), she believes that this 'sums up' what we are trying to do with our students, to engender a creative problem-solving mindset. The activities have encouraged her to develop her own educational practice, specifically to make the learning process as active as possible.

I have developed my understanding of the contribution of design thinking techniques to student learning. The experience of conducting action research to implement design thinking workshops has been beneficial to my own learning. The most significant adaption of the design thinking process was the use of the tools to support collaborative working towards the goal of each individual member of the group rather than a collective goal. The students were evidently comfortable with this aspect; they participated with fairness in the way that they managed the activities and with generosity in their contributions. They demonstrated that self-facilitation of groups was less hierarchical which prompted my own reflection on the intervention of tutors in student group work.

My educational practice has long involved collaboration with colleagues, which I consider to be an essential element in maintaining and developing quality in my teaching and learning. However this research has widened my perspective to recognise the opportunity and value in collaborating with students. I believe that this 'mirrors' the student experience, gained through the design thinking activities, of appreciating the value of collaboration, receiving and gaining feedback to generate, develop and manage our ideas and concepts.

I have become more aware of the knowledge and experience that the students themselves have to offer each other. Their placement experience / workplace experience supports their contributions to the projects of others. They reflect on their experience as they recount it for the benefit of others and this in turn benefits them. Where we have an increasing number of students undertaking placement there is an increasing wealth of contemporary experience to share. The design thinking workshops are a natural and constructive way to share this experience for the benefit of all. The iterative nature of design thinking, the repetition of articulating concepts and ideas, which can be associated with reflection-in-action, is beneficial to the generation and development of ideas. It is also valuable in building the skills of presentation and communication of ideas and projects at developmental stages.

5.6 Contribution to knowledge

As a practitioner-researcher the connecting the improvement of your practice to your educational theory is of prime importance (McNiff & Whitehead, 2011). From reflection within and on this research I have developed my understanding of the contribution of design thinking techniques to student learning. The elements of design thinking, collaboration, iteration, reflexivity and concern with effecting positive change provided opportunity for students to develop their skills and enhance their learning. The collaboration required within the activities supported students in the generation and development of their ideas and concepts, and in turn this built their confidence. The opportunity to share their knowledge and particularly their experience developed their capacity for reflection. The iterative nature of design thinking allows students to develop and build on their experience of articulating their ideas and concepts, to develop their

skills in presentation and communication. The ability to present concepts that are in the developmental stages is notably enhanced.

Reflexivity is inherent in the design thinking process, both individually and in collaboration with others. The design thinking tools encourage students to reflect instinctively, however their subsequent recognition of their reflection enhances their learning. Students participate in the design thinking activities with a motivation to effect change, to develop their ideas and concepts, to enhance the quality of their work. The design thinking tools offer this opportunity, but more than this they offer an opportunity to reflect collaboratively on the idea in more depth, to 'ask the right question', to develop their problem setting. As such, the implementation of design thinking tools and techniques offers a valuable means to support and enhance student learning.

5.7 Summary

This chapter has established the value of reflection to all participants. Reflection is part of my educational practice; this research has supported greater depth of reflection and the opportunity to set my educational practice within a theoretical context. As an observer to the implementation of design thinking tools and techniques, my fellow tutor has reflected on her practice, prompting encouragement to develop more active learning within her educational practice.

Reflection is an integral element of an action research methodology, both within the action steps cycles and on the action research process. Reflection on this action research process to introduce and develop design thinking tools, the engagement of participants and their feedback has validated the tools as a valuable addition to the student learning experience. The recommendations offered within the participants' feedback has served to further develop and improve the tools.

It has been established that the design thinking tools enhance student learning through the elements of collaboration, iteration, reflection and the impetus to effect positive change. Engaging in the design thinking workshops has offered students the opportunity to; enhance their skills in the generation and development of ideas, to develop their communication skills, to become more reflective, to understand the importance of setting the right problem. My reflection has established that design thinking tools are a valuable element within my teaching practice, and that reflection, particularly in collaboration with colleagues and students, is a critical and developing aspect of my educational practice.

Chapter 6 Discussion

6.1 Introduction

This chapter will discuss the findings from the secondary and primary research. A framework will be used to structure this discussion. Levin's (2003, cited in Coghlan & Brannick, 2014 p. 167) framework devised to explore quality in action research has equal application to the evaluation of quality in design thinking. This framework identifies four criteria for evaluation: participation, real-life problems, joint-meaning construction and workable outcomes.

The parallels between action research, action learning and design thinking were considered in Chapter 3; collaboration, iteration, reflexivity and a concern for change were identified as common characteristics. The close alignment of Levin's framework to these characteristics, the foundational elements of this research, confirm that it is an appropriate mechanism for the discussion of the data.

Participation will be discussed in section 6.2, specifically the cooperation between the participants in the action research and their collaboration within the design thinking activities will be considered. The practical outcomes of the action research will be reflected on in section 6.3, considering the real-life problem of developing student skills and enhancing their learning. Working and reflecting collaboratively an understanding of the effects of implementing design thinking was established, this will be discussed in section 6.4. That the action research resulted in a workable outcome with potential for repetition and further development will be discussed in section 6.5.

6.2 Participation

The importance of cooperation between the participants is a requirement of both action research, as evidenced in Chapter 3, and design thinking, as identified in the literature in Chapter 2. Within this research successful collaboration was evident in both respects.

6.2.1 Collaboration in the action research process

Collaboration in the action research process involved the perspectives of the researcher, the fellow tutor observer and the two action sets of students. The initial idea for implementation of design thinking to support the development of student learning arose

from discussion with the fellow tutor. The concern of the tutors was to improve the opportunities of students to manage an increasing amount and diversity of information available to them. This constructive discussion initiated this project to develop design thinking techniques to support the early stages of development of student projects. A collaborative approach to planning was adopted to ensure the effective integration of the design thinking tools with existing activities. The implementation of the activities was supported by the fellow tutor; in the first workshop the tutor and the researcher facilitated the 'brainstorm' activity. Subsequent student initiatives to self-facilitate groups indicated a more democratic and inclusive experience. On reflection, it became apparent that the tutor facilitation had created a hierarchy (Drew, 2012). The student feedback received at the end of each workshop was notable in the constructive nature of the comments, students reflected on the benefits they perceived but additionally made recommendations, for the process as a whole and practical suggestions for the development of the tools. These comments demonstrated effective engagement in the action research process. Reflective discussion between the fellow tutor and the researcher after each workshop added a further dimension to the feedback. Collectively the feedback informed the development both the management and the design thinking tools within the next workshop. Recognition that their feedback resulted in action may have encouraged further recommendations after subsequent workshops.

6.2.2 Collaboration in the design thinking activities

An action learning approach was taken in this research, the design thinking workshops provided a context for the students to engage actively and collaboratively in the development of their early ideas for projects. Design thinking is normally practised collaboratively by participants for the purposes of a common goal, the application of design thinking within this research developed collaborative working in support of individual outcomes i.e. student projects. The lack of evidence within the literature on design thinking for this development suggests that this is a new approach in design thinking education.

The feedback from participants indicated that the students both enjoyed collaborating and perceived benefits from the collaborative activities. The culture of the course as described by the fellow tutor is one where students are supportive of each other, which may have been a benefit to the introduction of the collaborative elements of the design thinking tools. It was observed that there is an expectation of reciprocity, which may or

may not be fulfilled, the student feedback did not elucidate on this. That there were benefits to the contributors as well as benefits for those that gained feedback was evident both through student comment and through observation. The students valued constructive both positive and negative feedback from their peers. The design thinking tools most valued by students were those that involved collaboration and the articulation of ideas to others. For the students, participating in group discussion allowed them to reflect on, and draw from their work or placement experience. This opportunity further enhances their learning by allowing them to build on this experience and the knowledge gained form it. The discussions within the 'brainstorm' activity supported students to both diverge and converge their thinking, the impact on the generation of ideas was evident. However the student engaged in the development ideas with both divergent and convergent approaches. The feedback from others helped students to 'build' on their individual ideas and to gain confidence in their ideas; this in turn built their confidence in collaboration.

The literature in Chapter 2 noted the importance of collaboration with the context of 21st Century skills, the design thinking techniques have provided students with opportunities to engage in collaboration, to reflect and to further develop their collaborative skills.

6.3 Real-life problems

A concern for real-life practical outcomes is common to both action research and to design thinking. The concern of this research is to enhance student learning and as such the research has potential impact on the lives of the students, the fellow tutor and the researcher. This impact is identified through an iterative process of reflection and feedback.

6.3.1 The real-life problem within this action research

The learning environment of students is continually evolving, notably they have access to, and use, a greater amount and diversity of information, in multiple formats. For some students this presents a challenge. There is also a need, identified in Chapter 2, for the development of skills to manage information and to use the knowledge derived to solve problems effectively. In this research the problem, or opportunity, is to provide learning environments and experiences to further develop these skills. The implementation of design thinking workshops provided students with varied tools with which to address

these issues. The iterative nature of reflection-in-action, and on action, by all participants provided considerable evidence of the positive effects of the activities. The findings indicated a broader range of benefits to students than had been anticipated. Although beneficial as a mechanism to reflect on information and to select and analyse information, the benefits perceived by students were broader ranging. The experience of the workshops also resulted in positive impact on their perception of collaboration, their confidence and motivation and their presentation skills.

6.3.2 Design thinking and real-life problems

What are often described as wicked problems, those that are complex or ill-defined, are at the heart of design thinking. Design thinking has evolved from a focus on the innovation and development of products and services to the application to business strategy and more recently to social innovation (Brown & Wyatt, 2010). Concern for establishing the nature of problems is demonstrated in the design thinking process models, discussed in Chapter 4. The importance of a design attitude (Boland & Collopy, 2004) or mindset (Fraser, 2014) to explore and reflect on the problem, to 'ask the right question' is considered paramount. Within the workshops students adopted this approach in relation to their own 'real-life' problems, which for them were the subjects of their research.

6.4 Joint meaning construction

Generating understanding collaboratively is the foundation of both action research and design thinking. Understanding of the potential of design thinking tools to enhance student learning was developed through the active engagement of all the participants in the action research process. The informality of the opportunity to feedback at the end of the workshops had potential risks, in that quantity might be limited and type of comment might have insufficient detail. However, the student responses, in particular following the first workshop, demonstrated enthusiasm and a constructive approach offering recommendations that would not only benefit them but potentially future students. The students were equally constructive in their feedback to others within the workshops, constructing meaning with and for their fellow group members.

6.5 Workable solutions

In the context of design thinking, in his framework Tim Brown (2009) identifies three 'constraints': Feasibility, what is functionally possible; Desirability, what makes sense to people and for people; Viability, what is likely to become part of a sustainable business model. This framework provides a valuable mechanism to assess the significance of the outcomes of this action research in terms of a workable solution.

6.5.1 Feasibility

The study sought to identify and to develop selected design thinking techniques to enhance students' learning, through the development of their ability to manage information and to identify problems more effectively. The analysis of the findings of the indicates that the implementation of design thinking workshops did develop student skills and enhance their learning. Two action sets of students experienced the workshops and provided feedback that was positive. The activities integrated effectively into existing modules, in this research they were repeated and were situated in successive modules. The timing and the repetition of the activities were a key element of student comment; the flexibility of the activities supported the inclusion of workshops in response to student recommendations. In respect of physical resources there are few requirements however, it is clear that sufficient space is required to support effective social interaction, to support students to present and to reflect on ideas effectively.

6.5.2 Desirability

Design thinking has previously been delivered to students in educational contexts however this has been within post-graduate education and principally for design and design related courses in undergraduate education. The participants in this research are fashion business students, they are not design practitioners but they do see themselves as creative problem solvers. With this approach they were receptive to techniques that had potential to develop their skills and provide support to their work. The design thinking tools are not complex, one student stated there was no need to repeat the instructions, therefore easily engaged with. The activities accommodated different personalities and styles of working and indeed were enriched by these differences. It was observed that questions that could be perceived as naïve were in fact the questions that generated notably constructive discussion in examination of the problem. Engagement with the design thinking tools was enthusiastic and the students committed themselves

to gaining from the experience, the response was in the main positive to all the techniques provided. There were variances, the tools of 'Story tell' and 'Brainstorm', those that involve most collaboration and articulation, were valued by all the participants. 'Voting' and 'Feedback Capture' received a broader range of responses, several comments however, were enthusiastic and provided suggestions for further development. The workshops have provided a natural opportunity for student to share their experience from placement and work. They reflect on their experience as they share it, recognising the knowledge gained through experience as they use it to inform others. The sharing of this wide-ranging contemporary information has been of considerable benefit to all participants.

6.5.3 Viability

The evidence of this action research supports the view that the implementation of design thinking tools and techniques develops student skills in the generation and development of ideas through a collaborative, iterative and reflective process. In their comments and survey responses they expressed positive views on the benefits of the activities and contributed recommendations for future development. That they proposed that design thinking tools and workshops be integrated earlier in the curriculum was an indication of their forward looking approach. The student views that the tools and techniques should continue to be used and potentially expanded for earlier year groups and to other courses is indicative of sustainability. The researcher and fellow tutor have identified the potential to develop the tools further, taking account of the final feedback received. The positive impact on the final year submissions of those students who engaged with the workshops demonstrates the development of their skills.

This research selected a small number of design thinking tools from the extensive range that have been devised by different organisations and practitioners, these resources offer opportunity to expand and to develop the workshops. In this research the 'Feedback Capture' tool was extended to develop 'The Story So Far…' the possibility to further extend and 'customise' tools offers additional opportunity to further develop the tools to meet the needs of the students.

6.6 Summary

This chapter used a framework to consider and discuss the research using four criteria: the participation in both the action research and design thinking activities, the problem addressed by the research and the problem-solving nature of design thinking, the

engagement of students and the benefits to participation in design thinking and finally the sustainability of the outcome.

The close alignment of the common characteristics of collaboration, iteration, reflexivity and a concern for change, between action research, action learning and design thinking have been of benefit to this research project. The participants have engaged constructively in both the action research process and the design thinking activities. For example, the request for individual reflection at the end of each activity is a natural extension of the design thinking process. Suggestions for development were contributed by many of the students, that some of these suggestions resulted in developments in the subsequent workshop may have encouraged the process of reflection and feedback. The willingness of students and fellow tutors to share their reflections and experience has been beneficial to the learning of all participants. The expectation of reciprocity is not articulated but observed, this expectation may be a difficulty for those less comfortable with collaboration however, student comments suggest that this apprehension can be overcome through iteration.

The problem addressed by this research, to enhance student skills and learning in the management of information and problem solving is directly related to the prominent issue of student employability, therefore a very 'real-life' issue. The problem solving and problem setting core of design thinking engages the students as they seek support to develop ideas for projects, the iterative reflection, selection and analytical elements has supported, not only the generation but also the development and organisation of ideas. Evaluating the outcomes as a workable solution, design thinking tools were found to be flexible, in that they could be integrated at the point of student need, they could be easily repeated and they could be extended and adapted in line with the development stage of student projects. The critical issue of whether the foundation of design thinking, collaborative working, could be adapted to suit individual outcomes reached a positive conclusion. Students enjoyed the activities, there commitment to contribute and in turn gain benefit was evident to those observing. The opportunity for students to reflect and draw from their experience in the workplace and during placement provided a wider view of current industry practice for all participants. The benefits extended beyond those intended, to develop confidence, motivation and communication skills, all equally valuable for subsequent employment. The number of comments received in relation to repetition support the view that the design thinking workshops are sustainable. The students themselves identify opportunities for further development, both incrementally

to the tools and more fundamentally to introduce other courses to become multi-disciplinary, aligned with the traditions of design thinking.

Chapter 7 Conclusion

This study set out to determine whether the implementation of design thinking tools and techniques had potential to enhance undergraduate student skills in the context of knowledge management. The action research project enabled an understanding of how students managed information, an analysis of design thinking and in particular within an educational context.

The concept of design as a way of thinking has evolved from the practices of designers and architects to become an approach practiced by many professionals seeking to understand and address 'wicked problems'. The work of practitioners, IDEO in particular, has done much to broaden the scope of the application of design thinking and to disseminate design thinking tools and techniques. Central to the development of design thinking is the understanding that it is above all a collaborative, iterative and reflexive process. Management theorists have acknowledged the value of these methods, building on the principals for application to strategic business problems. Within Higher Education teaching of design thinking has predominantly been in undergraduate design and design related programmes, for post-graduate it has been associated with MBA programmes. There is no evidence for the integration of the practice of design thinking techniques in undergraduate management programmes. However, the study of design thinking has grown, particularly in relation to the management context. The ethos for dissemination of design thinking methods, in the work of Tim Brown and David Kelley at IDEO and the d.school, has provided rich resources for professionals and academics to develop their own understanding and practice of design thinking.

In the context of their learning environment students have access to an ever-increasing quantity and diversity of information, presented to them in multiple formats. The challenge for them is to identify and use this data effectively in their projects. A need to support students to manage information and knowledge in the earliest stages of project development was identified by tutors. In response to this, task based scenarios were planned using design thinking techniques. There are commonalities to the established design thinking process models, there is also much in common in the principals of the tools that have been published within 'toolkits'. However these toolkits are designed for different contexts and different users. In education David Kelley has been instrumental in developing design thinking in the d.school, both for use within the d.school and for use in

schools. IDEO have published toolkits for education and for application in social contexts. The flexibility and adaptability of the d.school bootcamp bootleg, originated to support post-graduate students working in multi-disciplinary teams, offered a basis from which to work.

An action learning approach was used to develop workshops to engage students in the practice of design thinking, to facilitate the students to learn collaboratively from using the design thinking tools and techniques. The selection of design thinking tools took account that the students needed support at the earliest stages of project work and that there was a need to integrate them into existing modules. The selected tools of 'Storytell", 'Brainstorm', 'Voting' and 'Feedback Capture' supported a logical developmental sequence of activities. It was anticipated that multiple, divergent ideas would be generated in the 'Brainstorm' tool, therefore this was followed by the convergent tools of 'Voting' to develop selection and 'Feedback Capture' to prompt analysis. Within the cycles of action, an opportunity to extend 'Feedback Capture' to further develop the analysis and synthesis of student ideas, resulting in a new tool 'The story so far'.

The parallel characteristics of participation, iteration and reflexivity have provided a strong foundation to the research. The iterative action cycles have aligned with the development of the students' practice of the design thinking tools, prompting reflection and subsequent development in the learning of all the participants. The feedback provided constructive recommendation for the development of the tools and workshops in subsequent action steps. As an action research project, effective change was achieved through collaboration, iteration and reflection. The benefits to students were broader than had been anticipated. Students perceived benefits to their management of knowledge through the generation of ideas and in particular the development of their ideas. The iterative experience of participation in the workshops additionally resulted in positive impact on their perception of collaboration, their confidence and motivation and their presentation skills. These benefits are closely aligned with the skills valued for their future employment. Reflecting overall the design thinking tools and techniques can be said to enhance the learning of undergraduate students.

Contribution

Design thinking is more usually practised involving all stakeholders, often multi-disciplinary, in the identification of a problem and the subsequent development of a solution. The design thinking workshops developed adapted this approach significantly, facilitating students to work collaboratively on individual projects, rather than a common goal of the group. This departure is significant in that it opens opportunities for the support of undergraduate students in Higher Education, many of whom are undertaking individual projects that would benefit from the experience of collaboration in design thinking.

Through the cycles of action, the process of reflection and feedback from all participants a need arose to develop and extend the tool used for reflection and analysis, 'Feedback Capture'. A further iteration of this stage was deemed to be helpful, prompting the development of an existing design thinking tool to create a new tool to encapsulate a further stage of reflection through articulation of the development of ideas. This has contributed the understanding that the design thinking tools have flexibility to be developed to suit the needs of the learner.

Future research

As identified by the participants, including the students, there is a clear opportunity to develop the use of design thinking techniques by including students from other courses, to become multi-disciplinary teams. This would align the activities more closely with the more established use of design thinking which describes the advantages of a multi-disciplinary approach.

The effective contribution of students with differing personalities and approaches was observed by tutors, from this observation, the opportunity to examine whether design thinking and particular design thinking tools suit different student types and learning styles has been identified.

There has been a continual evolution in the application of design thinking from an innovative approach to product, a creative approach to the strategic issues of management, to the emerging support for global social issues. The opportunities for further development within education are considerable. Although still in its infancy, this research has established a foundation for the use of design thinking to support individual student projects and to enhance student learning.

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Appendix 1 - Ethics forms

Section 4: FORM 4

University of Huddersfield
Art, Design and Architecture
Research Ethics Review

TITLE OF PROJECT

An investigation into the effectiveness of design thinking techniques to enhance undergraduate student learning

NAME OF RESEARCHER **Jane Ritchie**

Participant consent form

Please tick

I have been fully informed of the nature and aims of this research by reading Form 3 and I consent to taking part in it. ☑

I understand that I have the right to withdraw from the project/research at any time without giving any reason, and a right to withdraw my data if I wish. ☑

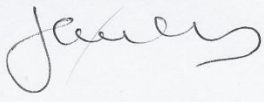
I give permission to be quoted (by use of pseudonym). ☑

I understand that any visual, audio documented material will be held in accordance with the University of Huddersfield's data protection policy. ☑

Declaration: I, the participant, confirm that I consent to take part in the project/research and hereby assign to the University all copyright in my contribution for use in all and any media. I understand that this will not affect my moral right to be identified as the "participant" in accordance with the Copyright, Designs and Patents Act 1988. ☑

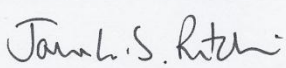
I understand I have the right to request that my identity be protected by the use of pseudonym in the project/research and that no information that could lead to my being identified will be included in any report or publication resulting from this research. ☑

Name of participant JO CONLON

Signature 

Date 23.1.2012

Name of student/staff/researcher (please delete as applicable)

Signature 

Date 23.1.2012

Two copies of this consent from should be completed: One copy to be retained by the participant and one copy to be retained by the researcher.

Section 4: FORM 4

University of Huddersfield
Art, Design and Architecture
Research Ethics Review

TITLE OF PROJECT

An investigation into the effectiveness of design thinking techniques to enhance undergraduate student learning

NAME OF RESEARCHER **Jane Ritchie**

Participant consent form

Please tick

I have been fully informed of the nature and aims of this research by reading Form 3 and I consent to taking part in it. ☑

I understand that I have the right to withdraw from the project/research at any time without giving any reason, and a right to withdraw my data if I wish. ☑

I give permission to be quoted (by use of pseudonym). ☑

I understand that any visual, audio documented material will be held in accordance with the University of Huddersfield's data protection policy. ☑

Declaration: I, the participant, confirm that I consent to take part in the project/research and hereby assign to the University all copyright in my contribution for use in all and any media. I understand that this will not affect my moral right to be identified as the "participant" in accordance with the Copyright, Designs and Patents Act 1988. ☑

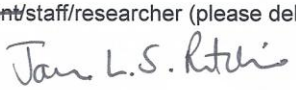
I understand I have the right to request that my identity be protected by the use of pseudonym in the project/research and that no information that could lead to my being identified will be included in any report or publication resulting from this research. ☑

Name of participant STEVE HERON

Signature 

Date 7.8.2012

Name of ~~student~~/staff/researcher (please delete as applicable)

Signature 

Date 7.8.2012

Two copies of this consent from should be completed: One copy to be retained by the participant and one copy to be retained by the researcher.

1

FINAL YEAR 12/13

15 Nov. 12

1.	BENNEY	Rebecca L	
2.	BREWIS	Roxanne	
3.	BROOKFIELD	Laurey	
4.	CONNER	Charlotte	
5.	DERRINGER	Amy	
6.	FRANCIS-SMITHSON	Hannah	
7.	GALLON	Rachel	
8.	GRAINGER	Nicola J	
9.	HARVEY	Sophie	
10.	ILYAS	Momina	
11.	KAYE	Abigail	
12.	MCLELLAN	Kirsten E	
13.	NEALE	Sally	
14.	OGDEN	Frankie	
15.	PHILLIPS	Gemma	
16.	PISACANE	Rebecca	
17.	WHITE	Vikki	
18.	WIETESKA	Hanna L	

Fashion & Textiles BMR - Final Year

1	ASHMORE, NATALIE		Management
2	BAILEY, NICOLA		Buying
3	BALCIUTE, GABIJA		Retailing
4	BRIGGS, HAYLEY		Management
5	BROUGH, JASMINE		Buying
6	BROWN, AIMEE		Management
7	DIEU LINH, TRAN		Management
8	FLYNN, SOPHIE		Buying
9	GALLOWAY, RACHEL		Buying
10	GRAY, SARAH		Management
11	HALE, JESSICA		Management
12	HARDY, REBECCA		Buying
13	HARRISON, CARINA		Buying
14	HASTINGS, SOPHIE		Management
15	HAYES, LAURA		Buying
16	HILL, JESSICA		Retailing
17	MCCORMICK, MELANIE		Management
18	OLDROYD, JESSICA		~~Retailing~~ Buying
19	SARWAR, SOFIA		Buying
20	SMITH, JENNIFER		Buying
21	STEER, SARAH		Management
22	VAUSE, KIMBERLEY		Buying
23	WILSON, NIAOMI		Management
24	YATES, BETHANY		Buying

Appendix 2 - Questionnaire - first action set - November 2012

Questionnaire – November 2012

Introduction

These questions are designed to help the researcher develop a greater understanding of how students manage the diversity and the quantity of research that they collect in the early stages of a project.

Data collected will be used for research purposes and comments themes generated may be published

Your individual responses will remain anonymous.

Please use your experiences of your undergraduate course so far, and where appropriate your placement.

Firstly about you

Please tick (✓) as appropriate

I am a final year undergraduate student on the BA (Hons) Fashion & Textile Buying / Management / Retailing pathway ☐

I have progressed directly from year 2 to final year ☐

I have undertaken a placement year ☐

I have undertaken a year out (not placement) ☐

First section:

Thinking about information gathered –

1. The following is a list of **sources** of information, please tick (✓) all those that you have used for previous projects or have accessed for current projects

Books	☐
Journals / journal articles	☐
Newspapers / magazines	☐
Websites	☐
Lecture notes	☐
Questionnaire /survey results	☐
Observation (e.g. store / consumer) results	☐
Interviews	☐
Other (please state below)	

……

……

……

……

2. The following is a list of **different formats** of information, please tick (✓) all those that you have used for previous projects or have accessed for current projects

Your own notes	☐
Copies of journal articles	☐
Copies of articles from Newspapers / magazines	☐
Printouts from websites	☐
Copies of illustrations / images	☐

Questionnaire /survey results ☐
Interview transcripts ☐
Observation results - text ☐
Observation results – visuals e.g. photographs ☐
Other (please state below)

……
……

……
……

Second section:

Thinking about methods you have used to organise and further develop your research –

3. At the **start** of a project do you use a mind map / brainstorm exercise?

Always	Usually	Sometimes	Seldom	Never
☐	☐	☐	☐	☐

3a. If so would you use this method again?

Yes ☐
No ☐

3b. If you have previously made a brainstorm / mind map did it include:

Text ☐
Diagrams ☐
Illustrations ☐
Diagrams ☐
Photographs ☐
Other (please state below)

……
……
……

4. Do you use mind map / brainstorm exercises **at intervals during a project**?

Always	Usually	Sometimes	Seldom	Never
☐	☐	☐	☐	☐

4a. If so would you use this method again?

Yes ☐
No ☐

4b. If you have previously made a brainstorm / mind map did it include:

Text ☐
Diagrams ☐
Illustrations ☐
Diagrams ☐
Photographs ☐
Other (please state below)

……

……

……

……

5. Have you organised information you have gathered (e.g. Books, Journal articles, notes) in files / folders / 'piles' according to the source of your information i.e. all books together, all journal articles together?

Always	Usually	Sometimes	Seldom	Never
☐	☐	☐	☐	☐

5a. If so would you use this method again?

Yes ☐
No ☐

6. Have you organised information you have gathered (e.g. Books, Journal articles, notes) in files / folders / 'piles' according to objectives / sub topics of your research subject?

Always	Usually	Sometimes	Seldom	Never
☐	☐	☐	☐	☐

6a. If so would you use this method again?

Yes ☐
No ☐

7. Have you ever written a research proposal to manage a project?

Frequently	Usually	Sometimes	Occasionally	Never
☐	☐	☐	☐	☐

7a. If so would you use this method again?

Yes ☐
No ☐

7b. If you have previously made a proposal did it include:

Text ☐
Diagrams ☐
Illustrations ☐
Diagrams ☐
Photographs ☐
Other (please state below)

……

……

……

7c. If you previously made a proposal did you refer to it during your project?

Frequently	Often	Sometimes	Occasionally	Never
☐	☐	☐	☐	☐

8. Have you ever made a plan of action to manage your research for a project?

Always	Usually	Sometimes	Seldom	Never
☐	☐	☐	☐	☐

8a. If so would you use this method again?

Yes ☐

No ☐

8b. If you have previously made a plan did it include:

Text ☐

Diagrams ☐

Illustrations ☐

Diagrams ☐

Photographs ☐

Other (please state below)

……

……

……

8c. If you previously made a plan of action did you refer to it during your project?

Frequently	Often	Sometimes	Occasionally	Never
☐	☐	☐	☐	☐

9. Have you talked to people to help you manage your research information?

Yes ☐

No ☐

9a. If yes, please tick (✓) all those that apply.

Subject / course tutors ☐

Tutors / university staff out with the course ☐

Academic skills tutors ☐

Placement workplace colleagues ☐

Graduated students from the course ☐

Fellow students on the course ☐

Fellow students out with the course ☐

Acknowledged experts in your subject ☐

Friends (not students) / family ☐
Other (please state below)

……

……

……

9b. If you ticked any of the above please tick (✓) all those which are appropriate below to indicate the type of support you gained

	Guidance on research subject	***Practical guidance on research methods***	***'Sounding out ideas'***	***Moral support***
Subject / course tutors	☐	☐	☐	☐
Tutors / university staff out with the course	☐	☐	☐	☐
Academic skills tutors	☐	☐	☐	☐
Placement workplace colleagues	☐	☐	☐	☐
Graduated students from the course	☐	☐	☐	☐
Fellow students on the course	☐	☐	☐	☐
Fellow students outside the course	☐	☐	☐	☐
Acknowledged experts in your subject	☐	☐	☐	☐
Friends (not students) / family	☐	☐	☐	☐

10. Have you ever used a study skills book / website or research methods book / website to help you manage your research information? Please tick (✓) all that apply.

Study skills book ☐
Study skills website ☐
Research methods book ☐
Research methods website ☐

If possible state titles / authors of those used……..

……

……

……

10a. If so would you use this method again?

Yes ☐
No ☐

Third section:

Thinking about how you feel about managing information you have researched –

11. The following is a set of statements about experiences of managing information.
Thinking about <u>your</u> experience of managing information -
For each statement please say whether you agree strongly, agree, are neutral, disagree or disagree strongly with it – please tick the appropriate box

	Strongly agree	***Agree***	***Neutral***	***Disagree***	***Strongly disagree***
Working with a large amount of research information improves my chances of a good outcome	☐	☐	☐	☐	☐
Working with a large amount of research information is overwhelming	☐	☐	☐	☐	☐
Working with a small amount of focused information improves my chances of a good grade	☐	☐	☐	☐	☐
Working with a small amount of focused information limits my opportunities for a good outcome	☐	☐	☐	☐	☐
Working with diverse sources of information improves my opportunities for a good outcome	☐	☐	☐	☐	☐

Working with diverse sources of information is challenging	☐	☐	☐	☐	☐

12. Is there anything else you wish to add regarding your thoughts on collecting and working with data (please state below)?

……

……

……

……..

Thank you for completing this questionnaire

Appendix 3 - Questionnaire - first action set - November 2012, Results

Questionnaire – November 2012

RESULTS - Responses recorded in blue

Introduction

These questions are designed to help the researcher develop a greater understanding of how students manage the diversity and the quantity of research that they collect in the early stages of a project.

Data collected will be used for research purposes and comments themes generated may be published

Your individual responses will remain anonymous.

Please use your experiences of your undergraduate course so far, and where appropriate your placement.

Firstly about you

Please tick (✓) as appropriate

I am a final year undergraduate student on the BA (Hons) Fashion & Textile Buying / Management / Retailing pathway ☐ 1

I have progressed directly from year 2 to final year ☐ 2

I have undertaken a placement year ☐ 3

I have undertaken a year out (not placement) ☐ 4

14 students completed the survey stating that they were in the final year of the course.

3 students progressed directly form year 2 to final year.

11 students have undertaken a placement year.

First section:

Thinking about information gathered –

12. The following is a list of **sources** of information, please tick (✓) all those that you have used for previous projects or have accessed for current projects

Books	☐	5	**= 14**
Journals / journal articles	☐	6	**= 12**
Newspapers / magazines	☐	7	**= 13**
Websites	☐	8	**= 14**
Lecture notes	☐	9	**= 13**
Questionnaire /survey results	☐	10	**= 4**
Observation (e.g. store / consumer) results	☐	11	**= 6**
Interviews	☐	12	**= 3**
Other (please state below)			

Within the section 'other': 1 student used /accessed television programmes, 1 student accessed YouTube channels, I student accessed Unitube, 1 student accessed DVD.

Number of sources accessed / used	4	5	6	7	8	9	10
Number of students	2	4	4	3			1

13. The following is a list of **different formats** of information, please tick (✓) all those that you have used for previous projects or have accessed for current projects

Your own notes	☐	13 **= 13**
Copies of journal articles	☐	14 **= 14**
Copies of articles from Newspapers / magazines	☐	15 **= 13**
Printouts from websites	☐	16 **= 13**
Copies of illustrations / images	☐	17 **= 9**
Questionnaire /survey results	☐	18 **= 3**
Interview transcripts	☐	19 **= 4**
Observation results - text	☐	20 **= 5**
Observation results – visuals e.g. photographs	☐	21 **= 4**
Other (please state below)		

Within the section 'other': 1 student used /accessed video

Number of formats accessed / used	3	4	5	6	7	8	9
Number of students	1	1	4	5	3		

Second section:

Thinking about methods you have used to organise and further develop your research –

14. At the **start** of a project do you use a mind map / brainstorm exercise?

Always	Usually	Sometimes	Seldom	Never
☐	☐	☐	☐	☐
22 = **4**	23 = **4**	24 = **3**	25 = **1**	26 = **3**

3a. If so would you use this method again?

Yes ☐ 27 = **12**
No ☐ 28

3b. If you have previously made a brainstorm / mind map did it include:

Text ☐ 29 = **12**
Diagrams ☐ 30 = **2**
Illustrations ☐ 31
Diagrams ☐ 32
Photographs ☐ 33
Other (please state below)

- Brainstorm ideas then write a to do list
- Write a to do list and plan out different sections of project needed

15. Do you use mind map / brainstorm exercises **at intervals during a project**?

Always	Usually	Sometimes	Seldom	Never
☐	☐	☐	☐	☐
34 = **1**	35 = **3**	36 = **4**	37 = **2**	38 = **4**

4a. If so would you use this method again?

Yes ☐ 39 = **10**
No ☐ 40

4b. If you have previously made a brainstorm / mind map did it include:

Text ☐ 41 = **9**
Diagrams ☐ 42 = **3**
Illustrations ☐ 43 = **3**
Diagrams ☐ 44
Photographs ☐ 45
Other (please state below)

16. Have you organised information you have gathered (e.g. Books, Journal articles, notes) in files / folders / 'piles' according to the source of your information i.e. all books together, all journal articles together?

Always	Usually	Sometimes	Seldom	Never
☐	☐	☐	☐	☐
46 = **2**	47 = **3**	48 = **3**	49 = **4**	50 = **2**

5a. If so would you use this method again?

Yes ☐ 51 = **11**

No ☐ 52

17. Have you organised information you have gathered (e.g. Books, Journal articles, notes) in files / folders / 'piles' according to objectives / sub topics of your research subject?

Always	Usually	Sometimes	Seldom	Never
☐	☐	☐	☐	☐
53 = **2**	54 = **7**	55 = **3**	56	57 = **2**

6a. If so would you use this method again?

Yes ☐ 58 = **10**

No ☐ 59

18. Have you ever written a research proposal to manage a project?

Frequently	Usually	Sometimes	Occasionally	Never
☐	☐	☐	☐	☐
60 = **1**	61 = **5**	62 = **2**	63 = **4**	64 = **2**

7a. If so would you use this method again?

Yes ☐ 65 = **12**

No ☐ 66

7b. If you have previously made a proposal did it include:

Text ☐ 67 = **12**

Diagrams ☐ 68 = **3**
Illustrations ☐ 69 = **1**
Diagrams ☐ 70
Photographs ☐ 71
Other (please state below)

7c. If you previously made a proposal did you refer to it during your project?

Frequently	Often	Sometimes	Occasionally	Never
☐	☐	☐	☐	☐
72 = **3**	73 = **1**	74 = **1**	75 = **6**	76 = **1**

19. Have you ever made a plan of action to manage your research for a project?

Always	Usually	Sometimes	Seldom	Never
☐	☐	☐	☐	☐
77 = **6**	78 = **4**	79 = **4**	80	81

8a. If so would you use this method again?

Yes ☐ 82 = **14**
No ☐ 83

8b. If you have previously made a plan did it include:

Text ☐ 84 = **14**
Diagrams ☐ 85 = **4**
Illustrations ☐ 86
Diagrams ☐ 87
Photographs ☐ 88
Other (please state below)

- Lists

8c. If you previously made a plan of action did you refer to it during your project?

Frequently	Often	Sometimes	Occasionally	Never
☐	☐	☐	☐	☐
89 = **7**	90 = **3**	91 = **2**	92	93 = **2**

20.

21. Have you talked to people to help you manage your research information?

Yes ☐ 94 = **13**

No ☐ 95 = **1**

9a. If yes, please tick (✓) all those that apply.

Subject / course tutors	☐ 96 = **13**	
Tutors / university staff out with the course	☐ 97 = **3**	
Academic skills tutors	☐ 98 = **2**	
Placement workplace colleagues	☐ 99 = **6**	
Graduated students from the course	☐ 100 = **4**	
Fellow students on the course		☐ 101 = **13**
Fellow students out with the course		☐ 102 = **6**
Acknowledged experts in your subject	☐ 103 = **3**	
Friends (not students) / family		☐ 104 = **11**
Other (please state below)		

9b. If you ticked any of the above please tick (✓) all those which are appropriate below to indicate the type of support you gained

	Guidance on research subject	***Practical guidance on research methods***	***'Sounding out ideas'***	***Moral support***
Subject / course tutors	☐ 105 = **11**	☐ 106 = **9**	☐ 107 = **7**	☐ 108 = **7**
Tutors / university staff out with the course	☐ 109 = **2**	☐ 110 = **3**	☐ 111 = **1**	☐ 112 = **1**
Academic skills tutors	☐ 113	☐ 114 = **2**	☐ 115	☐ 116
Placement workplace colleagues	☐ 117 = **3**	☐ 118 = **1**	☐ 119 = **3**	☐ 120 = **1**
Graduated students from the course	☐ 121	☐ 122 = **1**	☐ 123 = **2**	☐ 124 = **2**
Fellow students on the course	☐ 125 = **8**	☐ 126 = **8**	☐ 127 = **9**	☐ 128 = **7**
Fellow students outside the course	☐ 129 = **1**	☐ 130 = **1**	☐ 131 = **5**	☐ 132 = **7**
Acknowledged experts in your	☐ 133 = **2**	☐ 134 = **2**	☐ 135 = **1**	☐ 136 = **1**

subject				
Friends (not students) / family	☐ 137 = **3**	☐ 138	☐ 139 = **5**	☐ 140 = **10**

22. Have you ever used a study skills book / website or research methods book / website to help you manage your research information? Please tick (✓) all that apply.

Study skills book ☐ 141 = **6**
Study skills website ☐ 142 = **2**
Research methods book ☐ 143 = **2**
Research methods website ☐ 144

If possible state titles / authors of those used

- Business Skills Handbook [Roy Horn]
- Fashion Research Methodology
- Writing [Doing] your Dissertation in Business & Management [Reva Berman Brown]
- How to write your undergraduate dissertation (Palgrave) [Bryan Greetham]

10a. If so would you use this method again?

Yes ☐ 145 = **7**
No ☐ 146

Third section:

<u>Thinking about how you feel about managing information you have researched –</u>

23. The following is a set of statements about experiences of managing information.
Thinking about <u>your</u> experience of managing information -
For each statement please say whether you agree strongly, agree, are neutral, disagree or disagree strongly with it – please tick the appropriate box

	Strongly agree	***Agree***	***Neutral***	***Disagree***	***Strongly disagree***
Working with a large amount of research information improves my chances of a good outcome	☐ 147 = **2**	☐ 148 = **7**	☐ 149 = **4**	☐ 150 = **1**	☐ 151
Working with a large amount of research information is overwhelming	☐ 152 = **8**	☐ 153 = **4**	☐ 154 = **1**	☐ 155 = **1**	☐ 156

Working with a small amount of focused information improves my chances of a good grade	☐ 157 = **4**	☐ 158 = **4**	☐ 159 = **5**	☐ 160 = **1**	☐ 161
Working with a small amount of focused information limits my opportunities for a good outcome	☐ 162 = **1**	☐ 163 = **4**	☐ 164 = **3**	☐ 165 = **5**	☐ 166 = **1**
Working with diverse sources of information improves my opportunities for a good outcome	☐ 167 = **9**	☐ 168 = **5**	☐ 169	☐ 170	☐ 171
Working with diverse sources of information is challenging	☐ 172 = **4**	☐ 173 = **3**	☐ 174 = **1**	☐ 175 = **6**	☐ 176

12. Is there anything else you wish to add regarding your thoughts on collecting and working with data (please state below)? 177

- "The importance of networking (social, webinars, events) is so high on my list of research methodology as you never know who you might meet and might have expertise in your field!"
- "Although working with small amount of information would be beneficial when researching all the information you collect at beginning is overwhelming and sometimes overload."
- "Also depends on quality / authority of information / sources; I would rather have on really relevant piece of information than several pieces that are of no use to me."
- "I tend to write notes structured in the order they will feature in my report after constructing a mind map and research as I can find each point of the report".

Appendix 4 - Student feedback 28-29 November 2012

Student (first action set) feedback on post-it note and via email - 28 & 29 November 2012 session - Story tell - Brainstorm - Voting - Feedback & Capture
"Could do these at [the] beginning of projects"
"Only comment is I wish we had done these type of activities at the very beginning of the lecture series."
"Doing it earlier would help."
"Would like another session after Christmas (early on)"
"Would love to have another session before Christmas to help further with dissertation ideas."
"Will use for dissertation / major project."
"Use when we have initial idea and again after some research has been done would be useful."
"Would definitely do this again for dissertation and major project"
"Really helpful exercise. I think it would be useful for Dissertation and Major Project quite early on."
"As this is a smaller project the timing is good, but with larger projects I think it would be most beneficial about one week after the start to generate ideas to research into, rather than halfway through."
would be very useful for dissertation and major project
"Could be done a couple of times to help at different stages of the project."
"Could be done more than once
"Like we said earlier it may be a good ideas at the start of the final year to have a catch up to hear about everyone's experience on placement so that in case we use either their company in dissertation etc. we know who would be best to talk to or get information from."
" I would really like to do this task for my dissertation and major project."
"Could do the two sessions in one longer session"
"Would prefer one long session rather than separated."
"Would have been better to have more time on case study – feels like there's too much to complete in such a short time."
"Very effective"
maybe option of walking around other people's post-its after."
"Really fantastic tool
"Feedback capture grid – very easy way to [show] new results and to put points in categories and relevance e.g. solution points not for case study but useful for Major Project."
"Maybe larger groups"
"Liked small groups
"Group size was perfect at about five."
with different groups of people."
"It helped to find an idea for dissertation, would have been beneficial used in week 2 when idea was first formed but will benefit my dissertation greatly."
"Was very helpful"
"Gives new directions and focus points"
"Really fantastic tool, use to generate new ideas
"Great method of collaborating ideas
Really helpful to bounce off ideas and
"Really helpful, I came away with lots of new ideas."
"Will the post it notes from yesterday's session still be available for me to collect? I found yesterday's session very valuable and I wouldn't want to miss the information and ideas we collected yesterday."
"A mechanism to strategically organise all your thoughts that are circulating and manage your progression"
and also support and expand on existing ones!"
"Helps to focus your own ideas."
"It reinforced my ideas due to others agreeing."
"It helped me to have a clearer idea of everything I am doing."

“People raised helpful points to focus on.”
“Talking through ideas with peers helps anticipate limitations / areas to focus on.”
“Really useful to gain other people's opinions"
“Enjoyed hearing others opinions and feedback”
“Useful to collaborate ideas.”
“I found it really helpful today getting ideas from others on the course.
“Collaboration helped and I now feel free to help others too.”
It was really interesting to hear about what had happened on their placement in a bit more detail.”
“Great method of collaborating resources.”
“Encourages team spirit in class”
“It also motivates to find out more about a subject and to broaden your knowledge into new forms or research and exploration”
“It motivated me to do more research.”
As a result of the first activity she recognised that she wasn’t being “direct enough” in how she explained what she was doing (via the story tell) so she rewrote her case study to be more direct in order to explain her purpose more clearly.

Appendix 5 - Student feedback 15 January 2013

Student (first action set) feedback (via email) on 15 January 2013 session - Story tell - Brainstorm - Voting
The structure and the layout of the session was great
and each stage has its benefits.
The only thing I could suggest is that there is no need to vote at the end.
[I] found the dissertation session helpful but think this type of brainstorming works better for projects that can be a bit more creative.
Other than found it helpful and beneficial
All ideas discussed often have value and are worth looking into

Appendix 6 - Student feedback 13 February 2013

Student (first action set) feedback on post-it note - 13th February 2013 session - Story tell - Brainstorm - Voting - Feedback & Capture
"I have found it really useful having it this early as it lets you bounce ideas around."
"Time was much better too."
"Could be useful in a couple of weeks too to refine ideas."
"Might be useful to do again in 1 -2 weeks when idea is more formed as it may have changed."
it was hard to fully understand people's ideas and how far they are. A small introduction from everyone could be a good idea before everybody adds notes and votes."
"Good, worked really well for this subject."
"Useful to let other people add ideas when completing the voting."
"Prefer it being interactive rather than a taught lecture."
"Easier to be drawn to post-its which have most votes."
"Follow up individual tutorials to talk about what has been proposed."
"Best idea generating tool I've ever used."
"Can't fault the process at all."
"Feedback & Capture – maybe need to alter boxes, maybe a developments box instead of a constructive crit."
"Like that the whole group gives feedback."
"Love this method of brainstorming helps to form ideas."
"4 quadrants could be changed to (for example) Tasks / actions, Research, Questions, Ideas."
"Beneficial to have Jo & Jane adding ideas."
"Extremely helpful."
"Great for generating ideas."
"Extremely beneficial to gain alternative views and ideas on your subject."
"Interesting and useful to develop ideas when looking at other people's work."
"It was good involving the whole class to look at ideas and add notes,
"Really enjoyed going round seeing everybody else's ideas and getting feedback."
"Also gives you extra confidence with your idea to hear what others think."
"Helps to make us more confident about our idea and shape it better."

Appendix 7 - Final questionnaire action set 1 - Blank

Questionnaire – May 2013

Introduction

These questions are designed to help the researcher develop a greater understanding of the impact of undertaking design thinking techniques in the development of your work.
Data collected will be used for research purposes and comments themes generated may be published
Your individual responses will remain anonymous.

Please reflect upon your experiences of using design thinking techniques during your final year of the course, in the development of your case study, dissertation and major project.

Firstly about you

Please tick (✓) as appropriate
I am a final year undergraduate student on the BA (Hons) Fashion & Textile Buying / Management / Retailing pathway ☐
I have progressed directly from year 2 to final year ☐
I have undertaken a placement year ☐
I have undertaken a year out (not placement) ☐

Reflecting on the workshops / exercises

Question 1 aims to find out the students' perception of which piece of work, if any, is most 'helped' by using design thinking techniques

Question 1

We used design thinking techniques in the workshops to support the development of your final year work, please give feedback on your experience of each.
If you didn't participate in particular activities please indicate this in the right hand column.

	Very helpful	*Helpful*	*Neutral*	*Not very helpful*	*Unhelpful*	*Didn't participate*
Case Study	☐	☐	☐	☐	☐	☐
Dissertation	☐	☐	☐	☐	☐	☐
Major Project	☐	☐	☐	☐	☐	☐

Question 2 aims to find out the students' perception of which, if any, technique they found most helpful

Question 2

We used the following techniques in the workshops please give feedback on your experience of each.
If you didn't participate in particular activities please indicate this in the 'your comments' section.

	Very helpful	*Helpful*	*Neutral*	*Not very helpful*	*Unhelpful*
'Story tell' Where you wrote on the large post-it note what the key question / focus of your work was. Describing your subject to the group in 2 minutes.	☐	☐	☐	☐	☐

Your comments on the 'story tell':

Brainstorm Where your group contributed ideas, observations, comments and questions to your study.	☐	☐	☐	☐	☐

Your comments on the brainstorm:

Voting Where you and your group 'voted' for any of the notes / observations / comments that had been made that they felt had value.	☐	☐	☐	☐	☐

Your comments on voting:

Feedback & Capture Where you used the brainstorm ideas and voting to develop an analysis of the information gathered. Using a sheet divided into • Notable / **positive** points(+) • **Constructive criticism** (**Δ**) • **Questions** that were raised (?) • **Ideas** that have emerged ( )	☐	☐	☐	☐	☐

Your comments on the Feedback & Capture:

Pecha Kucha Where you presented a series of visual slides to the group	☐	☐	☐	☐	☐

Your comments on the Pecha Kucha:

Pecha Kucha feedback Where the group provided feedback in the form of comments, observations and questions	☐	☐	☐	☐	☐

Your comments on the Pecha Kucha feedback:

Poster Where you created a poster of 'slides' and presented this to the group	☐	☐	☐	☐	☐

Your comments on the poster:

Poster feedback Where the group provided feedback in the form of comments, observations and questions	☐	☐	☐	☐	☐

Your comments on the poster:

Question 3 aims to find out the students' perception of the way in which design thinking techniques may have benefitted their work and the way that they work

Question 3

Listed below are stages of development which are normally common to projects, please indicate the impact that the design thinking techniques you used had on your work and the way you have worked:

Generation of ideas					
Impact on the **quantity** of ideas generated	Positive ☐	Helpful ☐	No impact ☐	Not helpful ☐	Negative ☐
Impact on the **quality** of ideas generated	Positive ☐	Helpful ☐	No impact ☐	Not helpful ☐	Negative ☐
Impact on the **speed** of generating ideas	Positive ☐	Helpful ☐	No impact ☐	Not helpful ☐	Negative ☐
Comments:					
Information					

Impact on **expanding** sources of information	Positive □	Helpful □	No impact □	Not helpful □	Negative □
Impact on **quality** of information gathered	Positive □	Helpful □	No impact □	Not helpful □	Negative □
Impact on **organising / managing** your information	Positive □	Helpful □	No impact □	Not helpful □	Negative □
Comments:					
Development of ideas					
Impact on **expanding** your original ideas	Positive □	Helpful □	No impact □	Not helpful □	Negative □
Impact on the **speed** of development of your ideas	Positive □	Helpful □	No impact □	Not helpful □	Negative □
Impact on **organising** your ideas	Positive □	Helpful □	No impact □	Not helpful □	Negative □
Impact on your **confidence** in your idea	Positive □	Helpful □	No impact □	Not helpful	Negative □

				☐	
Comments:					
Development of focus					
Impact on the development of **focus** to your idea	Positive ☐	Helpful ☐	No impact ☐	Not helpful ☐	Negative ☐
Comments:					
Motivation					
Impact on your motivation to develop your work	Positive ☐	Helpful ☐	No impact ☐	Not helpful ☐	Negative ☐
Comments:					
Identifying strengths and weaknesses					
Impact on your ability to identify the **strengths** to your work	Positive ☐	Helpful ☐	No impact ☐	Not helpful ☐	Negative ☐
Impact on your ability to identify any **weaknesses** to	Positive ☐	Helpful ☐	No impact ☐	Not helpful	Negative ☐

your work				☐	
Comments:					
Anticipation of limitations to your idea					
Impact on anticipating any limitations to your idea	Positive ☐	Helpful ☐	No impact ☐	Not helpful ☐	Negative ☐
Impact on solving research problems	Positive ☐	Helpful ☐	No impact ☐	Not helpful ☐	Negative ☐

Question 4 aims to find out the students' perception of what they will 'take away' from the experience that they perceive may be beneficial to them

Question 4

Do you do things differently as a result of the experience of using the design thinking techniques?

Have you learned anything about yourself and the way that your work as a result of the experience of using the design thinking techniques?

How do you feel about the experience of collaborating with others on your work?

Question 5

Is there anything else you wish to add regarding your thoughts on using design thinking techniques (please state below)?

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Thank you for completing this questionnaire

Appendix 8 - Final questionnaire action set 1 - Results

Questionnaire – May 2013 – **Results – 17 completed**

Introduction

These questions are designed to help the researcher develop a greater understanding of the impact of undertaking design thinking techniques in the development of your work. Data collected will be used for research purposes and comments themes generated may be published

Your individual responses will remain anonymous.

Please reflect upon your experiences of using design thinking techniques during your final year of the course, in the development of your case study, dissertation and major project.

Firstly about you

Please tick (✓) as appropriate

I am a final year undergraduate student on the BA (Hons) Fashion & Textile Buying / Management / Retailing pathway ☐ **= 15 [2 left blank]**

I have progressed directly from year 2 to final year ☐ **= 1**

I have undertaken a placement year ☐ **= 11**

I have undertaken a year out (not placement) ☐

Reflecting on the workshops / exercises

Question 1 aims to find out the students' perception of which piece of work, if any, is most 'helped' by using design thinking techniques

Question 1

We used design thinking techniques in the workshops to support the development of your final year work, please give feedback on your experience of each.

If you didn't participate in particular activities please indicate this in the right hand column.

	Very helpful	***Helpful***	***Neutral***	***Not very helpful***	***Unhelpful***	***Didn't participate***
Case Study	**10** 58.8%	**4** 23.5%	**3** 17.7%	**0** 0%	**0** 0%	**0** 0%
Dissertation	**8** 47%	**7** 41.2%	**2** 11.8%	**0** 0%	**0** 0%	**0** 0%
Major Project	**11** 64.7%	**5** 29.4%	**1** 5.9%	**0** 0%	**0** 0%	**0** 0%

Question 2 aims to find out the students' perception of which, if any, technique they found most helpful

Question 2

We used the following techniques in the workshops please give feedback on your experience of each.
If you didn't participate in particular activities please indicate this in the 'your comments' section.

	Very helpful	*Helpful*	*Neutral*	*Not very helpful*	*Unhelpful*
'Story tell' Where you wrote on the large post-it note what the key question / focus of your work was. Describing your subject to the group in 2 minutes.	**11** 64.7%	**6** 35.3%	**0** 0%	**0** 0%	**0** 0%

Your comments on the 'story tell':

- Really good to get feedback and also helpful explaining what you want to do to other people

- Extremely helpful – when I was struggling it provided various ideas to get me thinking

- Helpful

- Helped formulate idea early on – made it easier to plan workload

- Allowed a personal summary of the idea. Encouraged to think in terms of a viable idea.

- Talking about my idea out loud helped me to expand on it.

- Contextualises what the main points are to your project

	Very helpful	*Helpful*	*Neutral*	*Not very helpful*	*Unhelpful*
Brainstorm Where your group contributed ideas, observations, comments and questions to your study.	**13** 76.5%	**4** 23.5%	**0** 0%	**0** 0%	**0** 0%

Your comments on the brainstorm:

- Great getting other ideas from people but also people spotting any missing information or research that needs to be done

- Was good to hear other people's thoughts on your idea

- Appreciated peoples contribution

- It was great to get feedback from other classmates to see what their opinions were and to build ideas

- Loved it. Should do this on every project – even first year stuff

- Excellent provided additional perspectives

- Fantastic!!!

	Very helpful	*Helpful*	*Neutral*	*Not very helpful*	*Unhelpful*
Voting Where you and your group 'voted' for any of the notes / observations / comments that had been made that they felt had value.	**3** 17.7%	**4** 23.5%	**10** 58.8%	**0** 0%	**0** 0%

Your comments on voting:

- I think I knew what notes were key myself

- Provided more focus

- Helped focus

- Helpful to see others' opinions but I didn't use that solely

- All ideas were valid and worth exploring. Voting didn't feel necessary.

- All points were valid, I needed to go home and think about them.

- Sometimes led to loss of focus – although very useful in determining others opinions

	Very helpful	*Helpful*	*Neutral*	*Not very helpful*	*Unhelpful*
Feedback & Capture Where you used the brainstorm ideas and voting to develop an analysis of the information gathered. Using a sheet divided into • Notable / **positive** points(+) • **Constructive criticism (Δ)** • **Questions** that were raised (?) • **Ideas** that have emerged ( )	**7** 41.2%	**7** 41.2%	**2** 11.8%	**1** 5.8%	**0** 0%

Your comments on the Feedback & Capture:

- Great way to organise feedback

- It was sometimes hard to categorize ideas in these four areas

- Some comments didn't fit into the groups, I found it easier to sort what needs to be investigated further

- Felt helpful when doing it and used it at home too!

- Excellent. Allowed ideas to be organised from the beginning.

- Gave my idea structure.

- Very relevant framework!

	Very helpful	*Helpful*	*Neutral*	*Not very helpful*	*Unhelpful*
Pecha Kucha Where you presented a series of visual slides to the group	**8** 47.1%	**5** 29.4%	**4** 23.5%	**0** 0%	**0** 0%

Your comments on the Pecha Kucha:

- Very helpful in getting idea down for how I will present my idea

- Great to focus your idea more and get comments from others of what to add / improve

- Helped put ideas together

- I felt this was quite good as it made us think about what the key points of our projects were

- Helped formulate idea early on – gave basis for feedback to make presentation well developed

- Encouraged a story to be created and developed presentation technique.

- Confidence building

- This is very useful as a support network to stop the use of prompts when presenting but difficult when presenting finance etc.

	Very helpful	*Helpful*	*Neutral*	*Not very helpful*	*Unhelpful*
Pecha Kucha feedback	**6**	**9**	**2**	**0**	**0**
Where the group provided feedback in the form of comments, observations and questions	35.3%	52.9%	11.8%	0%	0%

Your comments on the Pecha Kucha feedback:

- Great to getting more feedback on project

- Very constructive

- Good, allowed ideas that didn't work to be changed.

n=16	*Very helpful*	*Helpful*	*Neutral*	*Not very helpful*	*Unhelpful*
Poster	**10**	**5**	**1**	**0**	**0**
Where you created a poster of 'slides' and presented this to the group	62.5%	31.3%	6.2%	0%	0%

Your comments on the poster:

- Good for presentation skills

- Very useful

- Got much more clarity to project

n=16	*Very helpful*	*Helpful*	*Neutral*	*Not very helpful*	*Unhelpful*
Poster feedback Where the group provided feedback in the form of comments, observations and questions	**8** 50%	**8** 50%	**0** 0%	**0** 0%	**0** 0%

Your comments on the poster:

- Great to get more feedback on project

- Already had main ideas but this helped to clarify

Question 3 aims to find out the students' perception of the way in which design thinking techniques may have benefitted their work and the way that they work

Question 3

Listed below are stages of development which are normally common to projects, please indicate the impact that the design thinking techniques you used had on your work and the way you have worked:

Generation of ideas					
Impact on the **quantity** of ideas generated	**Very helpful** **10** 58.8%	**Helpful** **7** 41.2%	**No impact** **0** 0%	**Not helpful** **0** 0%	**Negative** **0** 0%
Impact on the **quality** of ideas generated	**Very helpful** **8** 47.1%	**Helpful** **8** 47.1%	**No impact** **1** 5.8%	**Not helpful** **0** 0%	**Negative** **0** 0%
Impact on the **speed** of generating ideas	**Very helpful** **9** 52.9%	**Helpful** **8** 47.1%	**No impact** **0** 0%	**Not helpful** **0** 0%	**Negative** **0** 0%

Comments: - Allows to source and clearly evaluate the strength of each idea which leads into the overall quality and speed of generating data - A lot of ideas at the beginning allow depth of a project to develop from the start. Time consuming narrowing them down. - Very beneficial as it allowed us to bounce off the ideas of others and develop more ideas - It all helped me think of alternative ideas and not have tunnel vision. - It helped me develop my idea a lot more and quickly! - Great to get ideas from people with different experiences in the industry. - Each stage helps development. - Collaborative thinking is much better than coming up with ideas on your own.					
Information					
Impact on **expanding** sources of information	**Very helpful** **7** 41.18%	**Helpful** **9** 52.94%	**No impact** **1** 5.88%	**Not helpful** **0** 0%	**Negative** **0** 0%
Impact on **quality** of information gathered	**Very helpful** **2** 11.8%	**Helpful** **13** 76.4%	**No impact** **2** 11.8%	**Not helpful** **0** 0%	**Negative** **0** 0%
Impact on **organising / managing** your information	**Very helpful** **9** 52.9%	**Helpful** **6** 35.3%	**No impact** **2**	**Not helpful** **0** 0%	**Negative** **0** 0%

			11.8%		
Comments: - Very useful organisational tool - Specifically managing and organising information is the key to successful completing work - Really helped to organise information in the way that we did. - Need to be done earlier in the year. - What to expect in writing would be helpful. - Helpful but this section of organisation I am able to do alone.					
Development of ideas					
Impact on **expanding** your original ideas	**Very helpful** **13** 76.5%	**Helpful** **4** 23.5%	**No impact** **0** 0%	**Not helpful** **0** 0%	**Negative** **0** 0%
Impact on the **speed** of development of your ideas	**Very helpful** **8** 47.1%	**Helpful** **9** 52.9%	**No impact** **0** 0%	**Not helpful** **0** 0%	**Negative** **0** 0%
Impact on **organising** your ideas	**Very helpful** **12** 70.6%	**Helpful** **4** 23.5%	**No impact** **1** 5.9%	**Not helpful** **0** 0%	**Negative** **0** 0%
Impact on your **confidence** in your idea	**Very helpful**	**Helpful**	**No impact**	**Not helpful**	**Negative**

	14 82.4%	**3** 17.6%	**0** 0%	**0** 0%	**0** 0%

Comments:

- Confidence in the idea encourages emphasis and confidence in the presentation of the work

- It was a great idea presenting to the class as everybody could see how the idea has grown and given more specific feedback.

- Always good to hear others liked your idea and good to hear how could be improved.

- Helpful projecting ideas and developing weekly tutor meetings allows meeting of deadlines.

- Your project is personal and sometimes your thoughts can be biased but this method allows you to take a step back.

Development of focus					
Impact on the development of **focus** to your idea	**Very helpful** **12** 70.6%	**Helpful** **3** 17.6%	**No impact** **1** 5.9%	**Not helpful** **1** 5.9%	**Negative** **0** 0%

Comments:

- Provided clarity and confidence in the focus

- My ideas were very broad before these but it helped me see which looked best and most viable

- Gave a chance to narrow ideas down for the project.

- Tutors supportive, give confidence.

- Like a big funnel of ideas leading to a main one.

Motivation					
Impact on your motivation to develop your work	**Very helpful** **8** 47.1%	**Helpful** **9** 52.9%	**No impact** **0** 0%	**Not helpful** **0** 0%	**Negative** **0** 0%
Comments: - Provides motivation to continue development - I have rubbish motivation anyway, but this definitely improved it! - I felt my idea is strong due to using it therefore I felt confident in my abilities and motivated to know more. - When motivated I get more work done, often of better quality. - It got us more involved and pushed us into starting to develop ideas in an enjoyable way. - Very pro-active after the sessions - Weekly tutor meetings help motivate - Great working with others to motivate					
Identifying strengths and weaknesses					
Impact on your ability to identify the **strengths** to your work	**Very helpful** **6** 35.3%	**Helpful** **9** 52.9%	**No impact** **2** 11.8%	**Not helpful** **0** 0%	**Negative** **0** 0%
Impact on your ability to identify any **weaknesses** to your work	**Very helpful** **4** 23.5%	**Helpful** **12** 70.6%	**No impact** **1** 5.9%	**Not helpful** **0** 0%	**Negative** **0** 0%

Comments:

- Useful to have other people's ideas to find areas you have not though [of].

- Self-evaluation of work goes hand in hand with feedback, allow aspects that don't work to be changed.

- Through discussing ideas, however this could be improved by identifying them more clearly, but this may impact motivation too.

- Negative feedback was the most helpful to see what I should avoid.

- Need more feedback when assignments get marked.

- Like I previously mentioned, allows you to step back and analyse.

Anticipation of limitations to your idea

Impact on anticipating any limitations to your idea	**Very helpful** **5** 29.4%	**Helpful** **12** 70.6%	**No impact** **0** 0%	**Not helpful** **0** 0%	**Negative** **0** 0%
Impact on solving research problems	**Positive** **5** 29.4%	**Helpful** **12** 70.6%	**No impact** **0** 0%	**Not helpful** **0** 0%	**Negative** **0** 0%

Comments:

- If someone put an idea that was off tangent, I would know that was a boundary

- This framework always you to consider limitless avenues for exploration therefore may prove difficult in anticipating the limitations of possibly a weaker idea due to volume of

ideas but not the quality of the output.

- Receiving contacts through people to ask research questions to.

- Tutors are supportive.

- Library resources

Question 4 aims to find out the students' perception of what they will 'take away' from the experience that they perceive may be beneficial to them

Question 4

Reflecting overall on your experience of using the design thinking techniques and considering what, if any, benefits you have gained that will be helpful to you in the future.

a) Do you do anything differently as a result of the experience of using the design thinking techniques? If yes, please give details:

- I always ask for others feedback anyway so this has reinforced this.
- The Pecha Kucha poster definitely would do again to project ideas and get feedback
- The system of organising feedback I have found very beneficial
- I followed the points on my sticky notes collected, this helped me to stay focused on the aim of my project.
- Get an idea a.s.a.p. and allow it to develop through testing and evaluation, peer review works well, show others.
- Increased use of spider diagrams and frameworks
- Brainstorm more, explore idea generation strategies in more detail.
- Yes, think the design thinkings has opened up more research methods and 'community' thinking
- I think they would have been much more useful if I had had ideas earlier on.
- Use of post-it notes to quickly generate ideas, whether you use them or not
- Use more visual notes when beginning to plan a project

- Interesting to map out any ideas on a large piece of paper using post-it notes. I will definitely ask for other people's contributions in future as I feel this has helped develop my project.
- Much more planned out
- It encouraged idea generation and formulation
- I use post-it notes a lot more now and always keep a research diary when I didn't before.
- Post-it notes to display all ideas

b) Has your ability to develop ideas changed in any way?
If yes, please give details:
- Brainstorming strengths have developed
- I am much more creative, open to think outside of box, feedback and support I received is helpful
- Yes, get an idea down and use others to develop through feedback
- Yes, I definitely use voting and consider my main points
- No, but I increasingly ask for feedback
- Yes, its more open and exploratory
- I would use these techniques as a way of managing ideas
- The use of post-its allows you to have similar concepts together and expand upon them.
- Yes, would always use post-it notes from now on
- Yes, it has helped me realise how important it is to ask other people's opinions at the ideas stage and not just at the end of the project.
- Yes, it encouraged me to ask others for opinions
- I am more open to more ideas now, before if I had an idea I would stick with it and not consider better ideas.
- I think more logically and if it can be achieved in the given time.
- Yes, asking people for their thoughts and ideas.

c) Has your ability to communicate ideas changed in any way?
If yes, please give details:
- Yes, more confident, clear and concise
- Much more confident, believe in my ideas more as all resources used support lots
- Yes, great to give post-it note feedback as the presenter can remember feedback
- By listening to the way others expressed ideas has allowed me to communicate mine more clearly.
- Yes, more confidence in presenting and sharing after doing so regularly.
- Less so than development of other areas
- Yes – Communicate what other want to know, not just what I think they want to know
- Yes, its made me more opening and sharing ideas and getting other people included in the development.
- I have more experience in presenting my ideas to others

- Pecha Kucha useful to simplify core messages
- Yes, communicate via visuals
- Yes, I have become more confident in sounding out any ideas on other people.
- Yes, it encouraged me to share ideas in a presentation style.
- Yes, I am much more confident in explaining ideas now.
- I give more detail on every aspect.
- Yes, Pecha Kucha presentation excellent way to show developing idea

d) How do you feel about the experience of collaborating with others on your work?
- Collaboration is the most important aspect of project management
- Happy to work with others
- I thought it was really beneficial and crucial to some of my ideas for the project.
- It really helped me to develop my ideas and come up with new ones with help of teammates.
- Brilliant input
- Love it! Going to continue this in my work life
- I thought I wouldn't like it, but I found it really helpful and enabled me to grow my projects in ways I didn't expect.
- It was really helpful at the initial point of thinking, but less towards the end as people concentrate on tangents that are not the main point of projects.
- I found this very useful as it helped you gain different insights.
- Very helpful and useful
- Collaborating with others helps push development of a project and can bring different skills and ideas to the table.
- I found it difficult but I got used to discussing ideas.
- Yes it was helpful to gain opinions and use these to improve.
- I was unsure at first but now that I see the benefits I think it is a great thing to do.
- Went well
- Good in the idea stage

e) Have you learned anything about yourself and the way that you work as a result of the experience of using the design thinking techniques?
If yes, please give details:
- I have learned to take a step back and have become very analytical of my ideas but also learned the importance of helping others with theirs.
- I work best under pressure the design techniques deadlines forced me to project ideas
- Yes, I believe I really enjoy helping others with their projects and believe with the useful help I have given I have got it back from them in return.

- I work better with a clear focus as I tend to go off-track sometimes.
- I can take feedback well and I am often able to respond accordingly.
- My confidence in the ability to develop ideas has improved, this is a great confidence builder!
- I always leave things very last minute – I like to work under pressure, so I make sure I plan as in depth as possible to help me and to stop me panicking as much.
- Its given me more confidence in presenting and change my openness about sharing ideas.
- I know that I can leave things till a bit late and I would generate better ideas if I started earlier. I also need to improve my decision making on ideas.
- Found it useful to brainstorm all thoughts in order to evaluate them collectively.
- Yes, using Pecha Kucha was interesting and allowed myself to practice presenting.
- It has improved my presentation skills.
- If I am enthusiastic about an idea I find it easier to communicate it to others.
- I start projects a lot earlier and think about them earlier than I did in first and second year.
- I work best when I am fully prepared and have all the research first before I start writing. To plan ahead because problems always occur which may cause issues.

Question 5

Is there anything else you wish to add regarding your thoughts on using design thinking techniques (please state below)?

- They were really helpful. They got me thinking about ideas I probably wouldn't have had on my own.
- I think whilst helpful there were too many sessions like this and not enough direct with tutors for major project.
- They could be incorporated into second year to get into the habit of generating ideas this way and done at earlier points of second year.
- I really enjoyed it, it enabled me to develop and focus my projects. In some cases design thinking techniques should be implemented earlier e.g. dissertation to gain most from the experience.
- Good have two groups, so you discuss different areas and helps create a good course environment and relationships between students.
- This should be taught in first year, as over the course of final year my planning has improved loads!
- I felt working in the smaller groups for dissertation and utilizing the framework was most successful when doing it for the entire class people only had a limited amount of time so feedback was less considered however when the group was split more consideration and time was spent on supporting everybody within the group!
- I think it should be carried out in all projects that are rather large in which an idea needs to be formed.
- I think I've said all I can think of! Really a very valuable skill to have though.

Appendix 9 – First questionnaire action set 2 – Blank

Questionnaire – November 2013

Introduction

These questions are designed to help the researcher develop a greater understanding of how students manage the diversity and the quantity of research that they collect in the early stages of a project.

Data collected will be used for research purposes and comments themes generated may be published

Your individual responses will remain anonymous.

Please use your experiences of your undergraduate course so far, and where appropriate your placement.

Firstly about you

Please tick (✓) as appropriate

I am a final year undergraduate student on the BA (Hons) Fashion & Textile Buying / Management / Retailing pathway ☐

I have progressed directly from year 2 to final year ☐

I have undertaken a placement year ☐

I have undertaken a year out (not placement) ☐

First section:

Thinking about information gathered –

1. The following is a list of **sources** of information, please tick (✓) all those that you have used for previous projects or have accessed for current projects

Books	☐
Journals / journal articles	☐
Newspapers / magazines	☐
Websites	☐
Lecture notes	☐
Questionnaire /survey results	☐
Observation (e.g. store / consumer) results	☐
Interviews	☐
Other (please state below)	

……

……

……

……

2. The following is a list of **different formats** of information, please tick (✓) all those that you have used for previous projects or have accessed for current projects

Your own notes	☐
Copies of journal articles	☐
Copies of articles from Newspapers / magazines	☐

Printouts from websites ☐
Copies of illustrations / images ☐
Questionnaire /survey results ☐
Interview transcripts ☐
Observation results - text ☐
Observation results – visuals e.g. photographs ☐
Other (please state below)

……

……

……

Second section:

Thinking about methods you have used to organise and further develop your research –

3. At the **start** of a project do you use a mind map / brainstorm exercise?

Always	Usually	Sometimes	Seldom	Never
☐	☐	☐	☐	☐

3a. If so would you use this method again?

Yes ☐
No ☐

3b. If you have previously made a brainstorm / mind map did it include:

Text ☐
Diagrams ☐
Illustrations ☐
Diagrams ☐
Photographs ☐
Other (please state below)

……

……

……

4. Do you use mind map / brainstorm exercises **at intervals during a project**?

Always	Usually	Sometimes	Seldom	Never
☐	☐	☐	☐	☐

4a. If so would you use this method again?

Yes ☐
No ☐

4b. If you have previously made a brainstorm / mind map did it include:

Text ☐
Diagrams ☐
Illustrations ☐
Diagrams ☐

Photographs ☐
Other (please state below)

……

……

……

……

5. Have you organised information you have gathered (e.g. Books, Journal articles, notes) in files / folders / 'piles' according to the source of your information i.e. all books together, all journal articles together?

Always	Usually	Sometimes	Seldom	Never
☐	☐	☐	☐	☐

5a. If so would you use this method again?

Yes ☐
No ☐

6. Have you organised information you have gathered (e.g. Books, Journal articles, notes) in files / folders / 'piles' according to objectives / sub topics of your research subject?

Always	Usually	Sometimes	Seldom	Never
☐	☐	☐	☐	☐

6a. If so would you use this method again?

Yes ☐
No ☐

7. Have you ever written a research proposal to manage a project?

Frequently	Usually	Sometimes	Occasionally	Never
☐	☐	☐	☐	☐

7a. If so would you use this method again?

Yes ☐
No ☐

7b. If you have previously made a proposal did it include:

Text ☐
Diagrams ☐
Illustrations ☐
Diagrams ☐
Photographs ☐

Other (please state below)

……

……

……

7c. If you previously made a proposal did you refer to it during your project?

Frequently	Often	Sometimes	Occasionally	Never
☐	☐	☐	☐	☐

8. Have you ever made a plan of action to manage your research for a project?

Always	Usually	Sometimes	Seldom	Never
☐	☐	☐	☐	☐

8a. If so would you use this method again?

Yes ☐

No ☐

8b. If you have previously made a plan did it include:

Text ☐

Diagrams ☐

Illustrations ☐

Diagrams ☐

Photographs ☐

Other (please state below)

……

……

……

8c. If you previously made a plan of action did you refer to it during your project?

Frequently	Often	Sometimes	Occasionally	Never
☐	☐	☐	☐	☐

9. Have you talked to people to help you manage your research information?

Yes ☐

No ☐

9a. If yes, please tick (✓) all those that apply.

Subject / course tutors ☐

Tutors / university staff out with the course ☐

Academic skills tutors ☐

Placement workplace colleagues ☐

Graduated students from the course ☐

Fellow students on the course ☐

Fellow students out with the course ☐
Acknowledged experts in your subject ☐
Friends (not students) / family ☐
Other (please state below)

……

……

……

9b. If you ticked any of the above please tick (✓) all those which are appropriate below to indicate the type of support you gained

	Guidance on research subject	***Practical guidance on research methods***	***'Sounding out ideas'***	***Moral support***
Subject / course tutors	☐	☐	☐	☐
Tutors / university staff out with the course	☐	☐	☐	☐
Academic skills tutors	☐	☐	☐	☐
Placement workplace colleagues	☐	☐	☐	☐
Graduated students from the course	☐	☐	☐	☐
Fellow students on the course	☐	☐	☐	☐
Fellow students outside the course	☐	☐	☐	☐
Acknowledged experts in your subject	☐	☐	☐	☐
Friends (not students) / family	☐	☐	☐	☐

10. Have you ever used a study skills book / website or research methods book / website to help you manage your research information? Please tick (✓) all that apply.
    Study skills book ☐
    Study skills website ☐

Research methods book ☐

Research methods website ☐

If possible state titles / authors of those used……..

……

……

……

10a. If so would you use this method again?

Yes ☐

No ☐

Third section:

Thinking about how you feel about managing information you have researched –

11. The following is a set of statements about experiences of managing information.
Thinking about <u>your</u> experience of managing information -
For each statement please say whether you agree strongly, agree, are neutral, disagree or disagree strongly with it – please tick the appropriate box

	Strongly agree	***Agree***	***Neutral***	***Disagree***	***Strongly disagree***
Working with a large amount of research information improves my chances of a good outcome	☐	☐	☐	☐	☐
Working with a large amount of research information is overwhelming	☐	☐	☐	☐	☐
Working with a small amount of focused information improves my chances of a good grade	☐	☐	☐	☐	☐
Working with a small amount of focused information limits my opportunities for a good outcome	☐	☐	☐	☐	☐
Working with diverse sources of information improves my opportunities for a good outcome	☐	☐	☐	☐	☐

Working with diverse sources of information is challenging	☐	☐	☐	☐	☐

12. Is there anything else you wish to add regarding your thoughts on collecting and working with data (please state below)?

……

……

……

……..

Thank you for completing this questionnaire

Appendix 10 – First questionnaire action set 2 - Results

Questionnaire – November 2013

Responses recorded in blue

Introduction

These questions are designed to help the researcher develop a greater understanding of how students manage the diversity and the quantity of research that they collect in the early stages of a project.

Data collected will be used for research purposes and comments themes generated may be published

Your individual responses will remain anonymous.

Please use your experiences of your undergraduate course so far, and where appropriate your placement.

Firstly about you

Please tick (✓) as appropriate

I am a final year undergraduate student on the BA (Hons) Fashion & Textile Buying / Management / Retailing pathway ☐ 1

I have progressed directly from year 2 to final year ☐ 2

I have undertaken a placement year ☐ 3

I have undertaken a year out (not placement) ☐ 4

23 students completed the survey stating that they were in the final year of the course.

8 students progressed directly form year 2 to final year.

13 students state that have undertaken a placement year.

1 student states that they have taken a year out (not placement)

1 student made no statement regarding placement or not.

First section:

Thinking about information gathered –

24. The following is a list of **sources** of information, please tick (✓) all those that you have used for previous projects or have accessed for current projects

Books	☐	5	**= 23**
Journals / journal articles	☐	6	**= 21**
Newspapers / magazines	☐	7	**= 20**
Websites	☐	8	**= 23**
Lecture notes	☐	9	**= 23**
Questionnaire /survey results	☐	10	**= 12**
Observation (e.g. store / consumer) results	☐	11	**= 17**
Interviews	☐	12	**= 11**
Other (please state below)			

Within the section 'other': 1 student used /accessed conferences, 1 student accessed / used Apps. E.g. Nike Making App, 1 student accessed YouTube video channels, I student accessed Industry talks, 1 student accessed reports, 2 students accessed / used blogs, 2 students accessed / used forums, 2 students accessed / used social websites, 1 student accessed documentaries.

1 student identified 4 sources, 4 students identified 5 sources, 4 students identified 6 sources, 4 students 7 sources, 6 students 8 sources and 4 students2 students accessed / used identified 9 sources.

25. The following is a list of **different formats** of information, please tick (✓) all those that you have used for previous projects or have accessed for current projects

Your own notes	☐	13 = **21**
Copies of journal articles	☐	14 = **18**
Copies of articles from Newspapers / magazines	☐	15 = **16**
Printouts from websites	☐	16 = **21**
Copies of illustrations / images	☐	17 = **16**
Questionnaire /survey results	☐	18 = **14**
Interview transcripts	☐	19 = **9**
Observation results - text	☐	20 = **11**
Observation results – visuals e.g. photographs	☐	21 = **13**
Other (please state below)		

1 student identified 1 format, 1 student identified 2 formats, 2 students identified 3 formats, 2 students identified 4 formats, 1 student identified 5 formats, 6 students identified 6 formats, 1 student identified 7 formats, 6 students identified 8 formats and 3 students identified 9 formats.

Second section:

Thinking about methods you have used to organise and further develop your research –

26. At the **start** of a project do you use a mind map / brainstorm exercise?

Always	Usually	Sometimes	Seldom	Never
☐	☐	☐	☐	☐
22 = **4**	23 = **5**	24 = **13**	25	26 = **1**

3a. If so would you use this method again?

Yes ☐ 27 = **21**

No ☐ 28 = **1**

3b. If you have previously made a brainstorm / mind map did it include:

Text	☐ 29 = **22**
Diagrams	☐ 30 = **10**
Illustrations	☐ 31 = **8**
Diagrams	☐ 32
Photographs	☐ 33 = **3**
Other (please state below)	

- Diagrams of page layout

27. Do you use mind map / brainstorm exercises **<u>at intervals during a project</u>**?

Always	Usually	Sometimes	Seldom	Never
☐	☐	☐	☐	☐
34 = **1**	35 = **1**	36 = **7**	37 = **6**	38 = **8**

4a. If so would you use this method again?

Yes ☐ 39 = **13**
No ☐ 40 = **4**

4b. If you have previously made a brainstorm / mind map did it include:

Text ☐ 41 = **13**
Diagrams ☐ 42 = **5**
Illustrations ☐ 43 = **4**
Diagrams ☐ 44
Photographs ☐ 45 = **1**
Other (please state below)

- References to use
- Sources to look at

28. Have you organised information you have gathered (e.g. Books, Journal articles, notes) in files / folders / 'piles' according to the source of your information i.e. all books together, all journal articles together?

Always	Usually	Sometimes	Seldom	Never
☐	☐	☐	☐	☐
46 = **3**	47 = **5**	48 = **5**	49 = **1**	50 = **9**

5a. If so would you use this method again?

Yes ☐ 51 = **12**
No ☐ 52 = **3**

29. Have you organised information you have gathered (e.g. Books, Journal articles, notes) in files / folders / 'piles' according to objectives / sub topics of your research subject?

Always	Usually	Sometimes	Seldom	Never
☐	☐	☐	☐	☐
53 = **4**	54 = **6**	55 = **6**	56 = **5**	57 = **2**

6a. If so would you use this method again?

Yes ☐ 58 = **20**
No ☐ 59

30. Have you ever written a research proposal to manage a project?

Frequently	Usually	Sometimes	Occasionally	Never
☐	☐	☐	☐	☐
60 = **1**	61 = **4**	62 = **6**	63 = **5**	64 = **7**

7a. If so would you use this method again?

Yes ☐ 65 = **13**
No ☐ 66

7b. If you have previously made a proposal did it include:

Text ☐ 67 = **17**
Diagrams ☐ 68 = **7**
Illustrations ☐ 69 = **5**
Diagrams ☐ 70
Photographs ☐ 71
Other (please state below)

7c. If you previously made a proposal did you refer to it during your project?

Frequently	Often	Sometimes	Occasionally	Never
☐	☐	☐	☐	☐
72 = **2**	73 = **5**	74 = **2**	75 = **4**	76 = **3**

31. Have you ever made a plan of action to manage your research for a project?

Always	Usually	Sometimes	Seldom	Never
☐	☐	☐	☐	☐
77 = **5**	78 = **4**	79 = **7**	80 = **4**	81 = **3**

8a. If so would you use this method again?

Yes ☐ 82 = **20**

No ☐ 83

8b. If you have previously made a plan did it include:

Text ☐ 84 = **20**
Diagrams ☐ 85 = **8**
Illustrations ☐ 86 = **4**
Diagrams ☐ 87
Photographs ☐ 88 = **3**
Other (please state below)

- Mainly plan of action is for my personal use to keep track on a project

8c. If you previously made a plan of action did you refer to it during your project?

Frequently	Often	Sometimes	Occasionally	Never
☐	☐	☐	☐	☐
89 = **8**	90 = **4**	91 = **3**	92 = **4**	93 = **2**

32. Have you talked to people to help you manage your research information?

Yes ☐ 94 = **21**
No ☐ 95 = **2**

9a. If yes, please tick (✓) all those that apply.

Subject / course tutors ☐ 96 = **21**
Tutors / university staff out with the course ☐ 97 = **3**
Academic skills tutors ☐ 98 = **1**
Placement workplace colleagues ☐ 99 = **7**
Graduated students from the course ☐ 100 = **3**
Fellow students on the course ☐ 101 = **17**
Fellow students out with the course ☐ 102 = **8**
Acknowledged experts in your subject ☐ 103 = **3**
Friends (not students) / family ☐ 104 = **16**
Other (please state below)

- Workplace colleagues
- Work experience

9b. If you ticked any of the above please tick (✓) all those which are appropriate below to indicate the type of support you gained

	Guidance on research subject	***Practical guidance on research methods***	***'Sounding out ideas'***	***Moral support***
Subject / course tutors	☐ 105 = **19**	☐ 106 = **15**	☐ 107 = **15**	☐ 108 = **8**

Tutors / university staff out with the course	☐ 109 = **4**	☐ 110 = **2**	☐ 111 = **2**	☐ 112 = **1**
Academic skills tutors	☐ 113 = **3**	☐ 114 = **5**	☐ 115 = **3**	☐ 116
Placement workplace colleagues	☐ 117 = **1**	☐ 118 = **1**	☐ 119 = **5**	☐ 120 = **2**
Graduated students from the course	☐ 121 = **2**	☐ 122	☐ 123 = **2**	☐ 124 = **3**
Fellow students on the course	☐ 125 = **7**	☐ 126 = **4**	☐ 127 = **11**	☐ 128 = **11**
Fellow students outside the course	☐ 129 = **1**	☐ 130 = **1**	☐ 131 = **3**	☐ 132 = **4**
Acknowledged experts in your subject	☐ 133 = **2**	☐ 134 = **3**	☐ 135 = **3**	☐ 136 = **1**
Friends (not students) / family	☐ 137 = **1**	☐ 138 = **1**	☐ 139 = **12**	☐ 140 = **16**

33. Have you ever used a study skills book / website or research methods book / website to help you manage your research information? Please tick (✓) all that apply.

Study skills book ☐ 141 = **7**
Study skills website ☐ 142 = **7**
Research methods book ☐ 143 = **6**
Research methods website ☐ 144 = **2**

If possible state titles / authors of those used

- Cite it right
- Study Skills Handbook [Stella Cottrell?]
- How to write your undergraduate dissertation (Palgrave) [Bryan Greetham]
- "don't know what it is"
- Planning to use a research methods book for major project

10a. If so would you use this method again?

Yes ☐ 145 = **15**
No ☐ 146

Third section:

Thinking about how you feel about managing information you have researched –

34. The following is a set of statements about experiences of managing information.
Thinking about your experience of managing information -
For each statement please say whether you agree strongly, agree, are neutral, disagree or disagree strongly with it – please tick the appropriate box

	Strongly agree	***Agree***	***Neutral***	***Disagree***	***Strongly disagree***
Working with a large amount of research information improves my chances of a good outcome	☐ 147 = **6**	☐ 148 = **13**	☐ 149 = **3**	☐ 150 = **1**	☐ 151
Working with a large amount of research information is overwhelming	☐ 152 = **1**	☐ 153 = **13**	☐ 154 = **4**	☐ 155 = **4**	☐ 156
Working with a small amount of focused information improves my chances of a good grade	☐ 157 = **2**	☐ 158 = **5**	☐ 159 = **11**	☐ 160 = **3**	☐ 161 = **1**
Working with a small amount of focused information limits my opportunities for a good outcome	☐ 162 = **1**	☐ 163 = **12**	☐ 164 = **4**	☐ 165 = **5**	☐ 166
Working with diverse sources of information improves my opportunities for a good outcome	☐ 167 = **14**	☐ 168 = **8**	☐ 169	☐ 170	☐ 171
Working with diverse sources of information is challenging	☐ 172 = **2**	☐ 173 = **4**	☐ 174 = **12**	☐ 175 = **4**	☐ 176

12. Is there anything else you wish to add regarding your thoughts on collecting and working with data (please state below)? 177

- "Sometimes organizing digital and handwritten data can be challenging – not being able to organize it at times can be a nightmare and leave me in a bit of a rut. I find it difficult to focus when this occurs."

- “Sometimes it is hard to find information from a diverse range of sources and this depends on the research topic.”
- “I start by collecting as much as I can that could be relevant and choose the most relevant afterwards but never throw away gathered information.”
- “It’s about how well you collate your research, it doesn’t matter if you have loads and expect a good grade, you need to be able to join your research together.”
- “Question 11 depends on the type of project or assignment you are working on.”
- “Brainstorming and note taking, particularly throughout the project in the form of ‘still left to do’ lists really helps me. My brain is not able to retain information, it has to be recorded. Applications geared up to filing away on line research is helpful – helps organise a reading list / bookmarked page, into folders. E.g. Evernote. A keyword search can then be used.”
- “I think wide source of information improves outcome results. Especially on fashion course.”

Appendix 11 - Student feedback - 27 November 2013

Student (second action set) feedback on post-it note and via email – 27 November 2013 session - Story tell - Brainstorm - Voting - Feedback & Capture
wish we could have done it for past projects
could be done earlier so that [in the] first session everybody does it for case study, then this one could be for just dissertation topics
would [have] been more useful earlier in the case study process - good as and initial idea process
too late in the course, would have benfitted more if taken earlier in the course
would have been useful a little earlier in the project i.e. last week
would definitely like to do another one
would be beneficial for dissertation and major project
would definitely like to do it again for other projects
would be useful [to do] again in the new year for final major project ideas
would definitely do again for final major project
this would definitely work again, possibly after case study is handed in, and for major project and / or dissertation
excited to do this at home
repeat third time for major project
future session after holiday would be useful
definitely want to do again
be useful for major project
would benefit fo major project - undertaken in the early development stages
would like another session for dissertation and final major project
please can you do this again Jane - loved it
would be useful for dissertation - two weeks time?
for every project
useful to do agian - personally feel this especially for major project
would definitely like to do this again
would definitely love to do it again
really think it shoud be done for dissertation and major project
would have liked more time to see what others are doing [re] cross over / collaboration
would have liked more time so I got more feedback from others
not enough time to rate everyone's ideas
a larger toom [is needed] frustrating working in a smaller room
[needs a] room with more space to move around
The tick [voting] exercise was good as it highlighted important points
Once a strong link is made maybe a one to one chat would be a good idea and may gain more from this
orange post-its [ideas added at voting stage] / voting gave me even more inspiration
class review [voting] would have liked more time to get around everyone's [ideas sheets]
in depth analysis [feedback and capture] the length of time this is carried out for is good
maybe ask people to start in groups about thinking of the four grid [feedback and capture] categories, so can look at in [from] all angles
coud use these to help in discussion in individual tutorials
[suggestion to] advise / vote for favourite idea if have more than one
very surprised how successful this task was!
getting different ideas from the whole group at the end worked well
Little space to organise post-its and give feedback on the groups sheets
groups of seven worked well - good pool of ideas
one thing would [be] to maybe have more groups but smaller e.g. groups of five

as I was in the group of seven towards the end it became rushed and I felt like I couldn't get all my opinions across
worked well in small groups of 6 - no bigger!!
group [work] really good - especially from people not worked with [before] from differing perspectives
opportunity for Jo and Jane to contribute to everyone's work not just certain individuals
could benefit from more tutor feedback
helpful including Jo / Jane [tutors]
very helpful
very helpful
really useful session
constructive
As a whole, really positive, helped a lot
great lecture - extremely useful
really helpful tool
very useful
generated more ideas to expand on initial ideas
really got me thinking about other ideas around my chosen subject area, other than those just in my bubble
Feel the session has given me ideas
good way to generate ideas
helpful when generating ideas
sharing ideas prompted more ideas and a clear direction for case study dissertation
helped me to focus on my idea
really encouraged me to explore new avenues
it really helps understand the unknown facts [I was] oblivious to
helps see how you're project could be structured - themes and topics for inclusion
I managed to clarify my ideas.
also helped to clarify how with one topic develop into final one As I had an idea, but this observation (even can call it a focus group) helped to set mind towards goal
enables you to home in on an idea and strengthen it
provides clarity
helped expand ideas
as well as getting clarity for your idea
helps you to look at areas / develop the idea that you may not have intially thought of
develop ideas further
re-inforce initial idea
useful to generate and expand initial ideas
fantastic feedback for my work and I'm very happy
[found it useful to know] that my ideas were worthy for the case study - confidence
good way of gaining opinions on your ideas even if only initial thoughts
good to see other people's views and ideas on my topic
I found it really useful, getting ideas from other people
useful to get ideas from others with a fresh view, as sometimes working on one idea it's easy to forget other points or miss limitations or opportunities
student included a diagram to illustrate the development of ideas from her own, adding the input of others to a new set of ideas incorporating contribution
The open discussion about chosen work gave sort of an access for observations from different people.
one idea from a person has lead me onto another ideas
good to see other people's views and ideas
group [work] really good - especially from people not worked with [before] from differing perspectives

given negatives / constructive feedback which always helps
opportunity to collaborate ideas
positive, provided valuable support and feedback
and see what other people think are the most important aspects of the idea
Good to share ideas
get perspective from non-placement students too
very useful in collaborating and sharing ideas
enjoyed talking to others about their idea
feel like helping others with their project
and bounce off each other
interesting to see what other people are doing for their projects
getting to look at other people's ideas was also good
[a] chance to see what everybody else is doing
good to see other's ideas
found it useful to know what other people were doing
it's nice to hear everyone's thoughts and nice to discuss everyone's ideas and topics
Share experiences
[opportunity to] exchange resources and contacts [student added a tick to this point for emphasis]
share placement contacts
people may be reluctant to criticise
some people already have a very set idea
Gets everyone involved
given me the motivation to begin my project
gives confidence that your idea is interesting and worthwhile
ideas from people have boosted my confidence in my idea
gives you confidence in the depth of the topic
a very positive learning approach
Personally found it difficult to present my idea to the team, probably didn't get out as much as I'd have liked because of this
should have broadened my idea in readiness for the second part [voting] when everybody moved around the room
seeing others work, if similar to your ideas can be off-putting, as [it] makes me want to change my idea
when you've focused on an idea you like and then lots of other ideas are thrown in it can cause confusion
It's really good because it's triggered topics and question points and questions that I now want to ask while interviewing the buyers for Baukjen

Appendix 12 - Student feedback - 10 December 2013

Student (second action set) feedback on post-it note - 10th December 2013 session - Story tell - Brainstorm - Voting - Feedback & Capture
Difficult to read some of the ideas
Too much written as the initial idea, not very clear
Working with new people has given me even more examples to build on
Great detail and really useful
Allowed exploration of a new idea for dissertation / final major [project]
In helping and discussing with others, sharing knowledge,
Improved confidence
This session has given me a lot of confidence that this is a topic worth pursuing
helps create understanding which could be used in future. Interviews etc.
How to evolve and use the information to aid projects
As we are taking away masses of ideas but how do we then grasp and really report on all / some of it in depth? Another workshop?
Even though I didn't get as many post-its as last time I do feel the session was more focussed

Appendix 13 – Final Questionnaire – Action Set 2 – Blank

Questionnaire – February 2014

Introduction

These questions are designed to help the researcher develop a greater understanding of the impact of undertaking design thinking techniques in the development of your work.
Data collected will be used for research purposes and comments themes generated may be published
Your individual responses will remain anonymous.

Please reflect upon your experiences of using design thinking techniques during your final year of the course, in the development of your case study, dissertation and major project.

Firstly about you

Please tick (✓) as appropriate
I am a final year undergraduate student on the BA (Hons) Fashion & Textile Buying / Management / Retailing pathway ☐
I have progressed directly from year 2 to final year ☐
I have undertaken a placement year ☐
I have undertaken a year out (not placement) ☐

Reflecting on the workshops / exercises

Question 1 aims to find out the students' perception of which piece of work, if any, is most 'helped' by using design thinking techniques

Question 1

We used design thinking techniques in the workshops to support the development of your final year work, please give feedback on your experience of each.
If you didn't participate in particular activities please indicate this in the right hand column.

	Very helpful	***Helpful***	***Neutral***	***Not very helpful***	***Unhelpful***	***Didn't participate***
Case Study	☐	☐	☐	☐	☐	☐
Dissertation	☐	☐	☐	☐	☐	☐
Major Project	☐	☐	☐	☐	☐	☐

Question 2 aims to find out the students' perception of which, if any, technique they found most helpful

Question 2

We used the following techniques in the workshops please give feedback on your experience of each.
If you didn't participate in particular activities please indicate this in the 'your comments' section.

	Very helpful	*Helpful*	*Neutral*	*Not very helpful*	*Unhelpful*
'Story tell' Where you wrote on the large post-it note what the key question / focus of your work was. Describing your subject to the group in 2 minutes.	☐	☐	☐	☐	☐

Your comments on the 'story tell':

Brainstorm Where your group contributed ideas, observations, comments and questions to your study.	☐	☐	☐	☐	☐

Your comments on the brainstorm:

Voting Where you and your group 'voted' for any of the notes / observations / comments that had been made that they felt had value.	☐	☐	☐	☐	☐

Your comments on voting:

Feedback & Capture Where you used the brainstorm ideas and voting to develop an analysis of the information gathered. Using a sheet divided into • Notable / **positive** points(+) • **Constructive criticism** (**Δ**) • **Questions** that were raised (?) • **Ideas** that have emerged ( )	☐	☐	☐	☐	☐

Your comments on the Feedback & Capture:

Question 3 aims to find out the students' perception of the way in which design thinking techniques may have benefitted their work and the way that they work

Question 3

Listed below are stages of development which are normally common to projects, please indicate the impact that the design thinking techniques you used had on your work and the way you have worked:

Generation of ideas

Impact on the **quantity** of ideas generated	Positive □	Helpful □	No impact □	Not helpful □	Negative □
Impact on the **quality** of ideas generated	Positive □	Helpful □	No impact □	Not helpful □	Negative □
Impact on the **speed** of generating ideas	Positive □	Helpful □	No impact □	Not helpful □	Negative □
Comments:					
Information					
Impact on **expanding** sources of information	Positive □	Helpful □	No impact □	Not helpful □	Negative □
Impact on **quality** of information gathered	Positive □	Helpful □	No impact □	Not helpful □	Negative □
Impact on **organising / managing** your information	Positive □	Helpful □	No impact □	Not helpful □	Negative □
Comments:					

Development of ideas					
Impact on **expanding** your original ideas	Positive □	Helpful □	No impact □	Not helpful □	Negative □
Impact on the **speed** of development of your ideas	Positive □	Helpful □	No impact □	Not helpful □	Negative □
Impact on **organising** your ideas	Positive □	Helpful □	No impact □	Not helpful □	Negative □
Impact on your **confidence** in your idea	Positive □	Helpful □	No impact □	Not helpful □	Negative □
Comments:					
Development of focus					
Impact on the development of **focus** to your idea	Positive □	Helpful □	No impact □	Not helpful □	Negative □
Comments:					

Motivation					
Impact on your motivation to develop your work	Positive □	Helpful □	No impact □	Not helpful □	Negative □
Comments:					
Identifying strengths and weaknesses					
Impact on your ability to identify the **strengths** to your work	Positive □	Helpful □	No impact □	Not helpful □	Negative □
Impact on your ability to identify any **weaknesses** to your work	Positive □	Helpful □	No impact □	Not helpful □	Negative □
Comments:					
Anticipation of limitations to your idea					
Impact on anticipating any limitations to your idea	Positive □	Helpful □	No impact □	Not helpful □	Negative □
Impact on solving research problems	Positive □	Helpful □	No impact □	Not helpful □	Negative □

Question 4 aims to find out the students' perception of what they will 'take away' from the experience that they perceive may be beneficial to them

Question 4

Do you do things differently as a result of the experience of using the design thinking techniques?

Have you learned anything about yourself and the way that your work as a result of the experience of using the design thinking techniques?

How do you feel about the experience of collaborating with others on your work?

Question 5

Is there anything else you wish to add regarding your thoughts on using design thinking techniques (please state below)?

……

……

……

……

……

……

……

Thank you for completing this questionnaire

Appendix 14 - Final Questionnaire - Action Set 2 - Results

Questionnaire – February 2014

Introduction

These questions are designed to help the researcher develop a greater understanding of the impact of undertaking design thinking techniques in the development of your work.
Data collected will be used for research purposes and comments themes generated may be published
Your individual responses will remain anonymous.

Please reflect upon your experiences of using design thinking techniques during your final year of the course, in the development of your case study, dissertation and major project.

Firstly about you

Please tick (✓) as appropriate

I am a final year undergraduate student on the BA (Hons) Fashion & Textile Buying / Management / Retailing pathway ☐ **16 students completed the survey**

I have progressed directly from year 2 to final year ☐ **= 3**
I have undertaken a placement year ☐ **= 11**
I have undertaken a year out (not placement) ☐
[2 did not confirm placement of direct progression]

Reflecting on the workshops / exercises

Question 1 aims to find out the students' perception of which piece of work, if any, is most 'helped' by using design thinking techniques

Question 1

We used design thinking techniques in the workshops to support the development of your final year work, please give feedback on your experience of each.
If you didn't participate in particular activities please indicate this in the right hand column.

	Very helpful	***Helpful***	***Neutral***	***Not very helpful***	***Unhelpful***	***Didn't participate***
Case Study	**8** 50%	**4** 25%	**1** 6.25%	**0** **0%**	**1*** 6.25%	**2** 12.5%
*** "because I changed my idea"**						
Dissertation	**6** 37.5%	**6** 37.5%	**3** 18.75%	**0** 0%	**0** 0%	**1** 6.25%

Major Project	**10** 62.5%	**6** 37.5%	**0** 0%	**0** 0%	**0** 0%	**0** 0%

Question 2 aims to find out the students' perception of which, if any, technique they found most helpful

Question 2

We used the following techniques in the workshops please give feedback on your experience of each.
If you didn't participate in particular activities please indicate this in the 'your comments' section.

	Very helpful	*Helpful*	*Neutral*	*Not very helpful*	*Unhelpful*
'Story tell' Where you wrote on the large post-it note what the key question / focus of your work was. Describing your subject to the group in 2 minutes.	**7** 43.75%	**8** 50%	**0** 0%	**1** 6.25%	**0** 0%

Your comments on the 'story tell':

- It was helpful to have other peoples' ideas

- Helps to structure the idea in your head by explaining it aloud

- Help explain idea and research done

- Enabled you to express and engage fully with group so they understand point of view etc.

- Helps to clarify ideas though can be restrictive if the idea is more refined / described.

	Very helpful	*Helpful*	*Neutral*	*Not very helpful*	*Unhelpful*
Brainstorm Where your group contributed ideas, observations, comments and questions to your study.	**13** 81.25%	**3** 18.75%	**0** 0%	**0** 0%	**0** 0%

Your comments on the brainstorm:

- Gathers different opinions and perspectives previously not thought.
- Gains new ideas and angles from other people who aren't aware of your idea before.
- Bounce ideas and help reinforce / clear thoughts
- Give differing opinions and ideas. Reassurance from like-minded people. Sometimes hard to think of ideas though.

	Very helpful	*Helpful*	*Neutral*	*Not very helpful*	*Unhelpful*
Voting Where you and your group 'voted' for any of the notes / observations / comments that had been made that they felt had value.	**2** 12.5%	**11** 68.75%	**3** 18.75%	**0** 0%	**0** 0%

Your comments on voting:

- Sometimes it's hard to understand other people's projects from just reading off their title
- A little more difficult for others to understand the full idea / concept when did not first hear the 'story tell'
- Would be good if you / everyone had put at least one new idea on everyone else's rather than just ticking
- Some people repeat the same positives
- Voting **x** comments. Better if the initial idea is written out to explain idea move instead of one or two words. Get more of an understanding to input additional ideas.
- Sometimes ideas aren't always clear from just reading the sheets - hard to make comments / criticisms.

	Very helpful	*Helpful*	*Neutral*	*Not very helpful*	*Unhelpful*
Feedback & Capture Where you used the brainstorm ideas and voting to develop an analysis of the information gathered. Using a sheet divided into • Notable / **positive** points(+) • **Constructive criticism (Δ)** • **Questions** that were raised (?) • **Ideas** that have emerged ( )	**3** 18.75%	**12** 75%	**0** 0%	**1** 6.25%	**0** 0%

Your comments on the Feedback & Capture:

- I feel it is helpful to organise into areas of related points not into + **Δ ?**
- See common themes and areas that need further development
- Develop triangulation.

Question 3 aims to find out the students' perception of the way in which design thinking techniques may have benefitted their work and the way that they work

Question 3

Listed below are stages of development which are normally common to projects, please indicate the impact that the design thinking techniques you used had on your work and the way you have worked:

Generation of ideas					
Impact on the **quantity** of ideas generated	**Positive** **8** 50%	**Helpful** **8** 50%	**No impact** **0** 0%	**Not helpful** **0** 0%	**Negative** **0** 0%
Impact on the **quality** of ideas generated	**Positive** **9** 56.25%	**Helpful** **7** 43.75%	**No impact** **0** 0%	**Not helpful** **0** 0%	**Negative** **0** 0%
Impact on the **speed** of generating ideas	**Positive** **10** 62.5%	**Helpful** **5** 31.25%	**No impact** **1** 6.25%	**Not helpful** **0** 0%	**Negative** **0** 0%
Comments: - Always interesting to see the quality of other people's ideas, very helpful - Very helpful in generating a lot of initial ideas as well as problems - Help see that I have researched right areas - More helpful for major project					
Information					
Impact on **expanding** sources of information	**Positive** **7** 43.75%	**Helpful** **9** 56.25%	**No impact** **0** 0%	**Not helpful** **0** 0%	**Negative** **0** 0%
Impact on **quality** of	**Positive**	**Helpful**	**No impact**	**Not**	**Negative**

information gathered	**5** 31.25%	**8** 50%	**3** 18.75%	**helpful** **0** 0%	**0** 0%
Impact on **organising / managing** your information	**Positive** **7** 43.75%	**Helpful** **8** 50%	**No impact** **1** 6.25%	**Not helpful** **0** 0%	**Negative** **0** 0%
Comments: - Makes you think about things you haven't thought about, expands your mind! - Ideas from other peoples experiences - We go and source information so I wouldn't say the task impacts very much re quality					
Development of ideas					
Impact on **expanding** your original ideas	**Positive** **14** 87.5%	**Helpful** **2** 12.5%	**No impact** **0** 0%	**Not helpful** **0** 0%	**Negative** **0** 0%
Impact on the **speed** of development of your ideas	**Positive** **11** 68.75%	**Helpful** **3** 18.75%	**No impact** **2** 12.5%	**Not helpful** **0** 0%	**Negative** **0** 0%
Impact on **organising** your ideas	**Positive** **8** 50%	**Helpful** **8** 50%	**No impact** **0** 0%	**Not helpful** **0** 0%	**Negative** **0** 0%
Impact on your **confidence** in your idea	**Positive** **10**	**Helpful** **5**	**No impact** **1**	**Not helpful**	**Negative** **0**

	62.5%	31.25%	6.25%	**0** 0%	0%

Comments:

- Enabled me to think more clearer with an outside perception
- Others were able to offer alternative for the idea if it wasn't feasible.
- Clear ideas and develop thoughts
- Reassurance, dismissal

Development of focus					
Impact on the development of **focus** to your idea	**Positive** **8** 50%	**Helpful** **8** 50%	**No impact** **0** 0%	**Not helpful** **0** 0%	**Negative** **0** 0%

Comments:

- I was already focused but it helps to remain focused and clear.
- With dissertation I found it slightly confusing and overwhelming having so much input
- Enabled wider thoughts
- Gives more focus to idea

Motivation					
Impact on your motivation to develop your work	**Positive** **13** 81.25%	**Helpful** **3** 18.75%	**No impact** **0** 0%	**Not helpful** **0** 0%	**Negative** **0** 0%

Comments:

- I've got loads of ideas now and excited to start researching more
- It has given me confidence in its commercial value
- Made me want to start, gave me motivation
- Positive thoughts help keep motivation
- Excites you when people engage and are positive about your ideas

Identifying strengths and weaknesses

Impact on your ability to identify the **strengths** to your work	**Positive** **9** 56.25%	**Helpful** **7** 43.75%	**No impact** **0** 0%	**Not helpful** **0** 0%	**Negative** **0** 0%
Impact on your ability to identify any **weaknesses** to your work	**Positive** **11** 68.75%	**Helpful** **4** 25%	**No impact** **0** 0%	**Not helpful** **1*** 6.25%	**Negative** **0** 0%
Comments: - I can really see the weaknesses and where I need to improve my idea - Other people's thoughts help to give another perspective - Didn't get any feedback on weak areas of my ideas only strengths * - Areas that need development - Refine and enable to choose if you have more than one idea					
Anticipation of limitations to your idea					
Impact on anticipating any limitations to your idea	**Positive** **7** 43.75%	**Helpful** **9** 56.25%	**No impact** **0** 0%	**Not helpful** **0** 0%	**Negative** **0** 0%
Impact on solving research problems	**Positive** **6** 37.5%	**Helpful** **9** 56.25%	**No impact** **1** 6.25%	**Not helpful** **0** 0%	**Negative** **0** 0%

Question 4 aims to find out the students' perception of what they will 'take away' from the experience that they perceive may be beneficial to them

Question 4

Do you do things differently as a result of the experience of using the design thinking techniques?

- Yes
- Yes
- Yes
- Found that I am open to new ideas, whereas before I was dead set on one specific topic
- Yes

- I feel more organized after the sessions, it gets you off to a good start
- Think more about limitations / issues
- It's much more organised - I do more planning

Have you learned anything about yourself and the way that your work as a result of the experience of using the design thinking techniques?

- Unsure
- Take too much on initially - need to be more specific
- Yes
- Enabled me to think more critically
- Not really
- I realise I handle criticism well, I appreciate the opinions of others to improve my work,

How do you feel about the experience of collaborating with others on your work?

- The first one I didn't want to do it as people may 'steal' ideas but now I understand it's a positive
- Very good, helpful, confidence boosting, interesting to hear other's ideas - very good!
- Builds teamwork
- Very helpful and positive - gives a confidence boost
- Good to collaborate, many minds generate many more ideas and clarify thoughts
- Very helpful, sharing ideas, generating more to come to a clear idea.
- Good, I find it useful to find out people's views about my ideas and enjoy hearing other people's ideas.
- It is good if I am stuck on an idea - feedback / collaboration helps connect my ideas.
- I think it's great! Highly recommend, it makes you think about things you haven't thought about. I bounce well off people's ideas.

General comments in this section:

- Organised ideas into sections, clear research before experience helps improve ideas
- Expands ideas further
- I like getting others ideas to help me with my research
- I have learnt there is more of a breadth of research I can look into after being prompted by others suggestions.
- Initially sharing your idea is daunting however once discussed it gives you confidence in your idea and makes you want to do it again for the next project.
- It's worrying sometimes because you are being judged on your ideas but at the same time it's nice to hear people's feedback.
- I like to gain the opinions of others on my ideas - usually gain a variety of views on the subject (pros and cons).

Question 5

Is there anything else you wish to add regarding your thoughts on using design thinking techniques (please state below)?

- Collaborating with different courses would be a good idea. The case study was great because we hadn't done this before but now we have done this three times people's ideas are starting to get the same - new people would be useful.
- More discussion time would be preferred over looking at everyone else's ideas, to stick with my group - ideas were flowing but had to stop because of fitting in the final activity.
- This should be used in team projects as an effective way for everyone's ideas to be heard.
- Think it is a good idea to work with different people for the workshops for, case study, dissertation and major project as you get different feedback and ideas.
- Very helpful exercise!! Should definitely continue.
- Maybe a structure could be developed for what to put on the big post-it note in order for the voting section to be clear, when you haven't heard the full story.
- Helpful when groups are six (around six) people as more to bounce ideas.
- Placement students have more effective ideas and suggestions.
- Unnecessary to receive instructions each time, one set was sufficient.