The Elusive Keys of Imagination and Play: unlocking creativity and innovation in design and technology education DATA International Research Conference: UK Keynote

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Abstract

In the John Eggleston Memorial Keynote in 2002, Richard Kimbell identified the specific problem caused by a mismatch between "qualities at the heart of innovation" and current assessment criteria. At the core of this he identified two particularly problematic qualities: "the terrible two - the intractable two - the tantalising two ... the ability to be playful in restructuring the world and the ability to spark ideas". (Kimbell 2002: 25)

This paper will take these "terrible two" as a starting point and explore in greater depth the relationship between these qualities and the concepts of imagination, play, fantasy and reality. It will identify the significance of these concepts for creativity and innovation and the potential they provide as a foundation for the development of creativity and innovation in humans. The paper will then tackle the knotty problem of utilising these concepts in levering open the historic problems of the "gridlocked" design and technology (D&T) curriculum, by drawing on evidence and insights gained from research from within and beyond D&T, including illustrations of how a current research project Assessing Innovation* is exploring ways in which play and imagination can be promoted such that they spark, enkindle and sustain creative responses within D&T experience.

Key Words

creativity, innovation, play, playfulness, fantasy, imagination.

Introduction

From Marx to Bronowski, literature on the development of humankind abounds in examples of creativity and innovation as capacities that set humans apart from other species: our ability to vision the future as being different from the present and then to control our surroundings and resources to make the vision a reality. As a society, we see education as a way of developing human capacity, and D&T education has terrific potential to make a major contribution in the development of creative and innovative capacities.

Throughout the development of D&T education glimmers of achieving this potential have been witnessed. However, a range of historic issues has curtailed the fulfilment of this potential in a wholesale way. Rehearsing these issues becomes like listening to a gramophone with its needle stuck. The arguments for and against teaching and learning "process" and "content"; the imperatives of educational or instrumental aims; the problems imposed by assessment are all made and debated. The process of doing so highlights the extent to which the D&T curriculum has become "gridlocked" in ritual, convention and constructed realities of what is and isn't possible. This problem has been identified by those across the education spectrum, including DfES, QCA, Engineering Council UK and the Design Council.

While the problems are dissected and analysed, there is the ongoing search for the Holy Grail, the magical ingredients that will make D&T teaching a feast which nourishes creativity and innovation: new techniques, strategies, schemes of work and resources.

In the Professor John Eggleston Memorial Lecture in 2002 Richard Kimbell identified the specific problem caused by a mismatch between "qualities at the heart of innovation" and current assessment criteria. At the core of this he identified two particularly problematic qualities:

> the terrible two - the intractable two - the tantalising two ... the ability to be playful in restructuring the world and the ability to spark ideas.
> (Kimbell 2002: 25)

Both Professor Kimbell's Keynote of 2002 and this paper are set in the context of the gridlock. This gridlock has a number of features, the first of which is the debate that has festered for many years, about whether the priority for the subject of D&T should be to develop a learner's procedural ability or to develop the skills necessary to make products. Linked closely to this has been the ongoing debate of whether the subject is in the curriculum for purely educational reasons (to make the young learner a more capable person in terms of their ability to engage with all aspects of their life), or whether it is in the curriculum to help the learner get a job and to support the economic needs of the country. Add to this the problems of assessing both D&T and, in particular, of

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assessing creativity, the reasons for the gridlock become clearer. In reference to the value of play, I believe another aspect of the gridlock is the ingrained "Protestant work ethic", which suggests that play and exploration are something that there is just not time for, that we should get on with the job in hand. A further aspect of the gridlock is the "Audit Culture" that we have experienced in recent years, in both the UK and elsewhere: linked to league tables, National Curriculum requirements, requirements for students training to be teachers, Ofsted requirements... the list goes on and on. Finally, and cumulatively, is the perception of what is and isn't possible. What are teachers allowed to do? How might a change in approach to learning and teaching impact on the examination results of the pupils in their care? What is and isn't acceptable by exam boards, Ofsted, parents? It is a difficult problem for the teacher to address what they see as fundamentally important in D&T education, and what they perceive as "expected" by their "clients" and their "masters".

Humans, creativity, imaging, perception and imagination

I would like first to step completely aside from schools and D&T in the curriculum to consider the development of human beings and how this relates to the development of creativity and the linked area of imagination. As stated earlier, the literature on the development of human beings provides ample examples of the relationship between creativity and humans as one of the things that sets humans apart from other species. Critical within this is our ability to envisage how different the future might be to our present reality and at the same time our desire to shape and control the world to create the future we have envisioned. For Csikzentmihahalyi, creativity is at the centre of our ability to do this and he links into this a whole range of features that make human beings what they are, from language, to values, to technology:

> Creativity is a central source of meaning in our lives for several reasons. ... First, most of the things that are interesting, important and human are the results of creativity. We share 98% of our makeup with chimpanzees. What makes us different - our language, values, artistic expression, scientific understanding, and technology - is the result of individual ingenuity that was recognised, rewarded and transmitted through learning. Without creativity, it would be difficult indeed to distinguish humans from apes.
> (Csikszentmihalyi, 1996: 2)

Linking together such things as language, values and artistic expression is important in seeing how humans operate in a creative way; but what is particularly critical is the way in which human beings have the ability to create images in their mind both of what they have seen and experienced, and also what they have not seen and experienced. This "imaging" of the future, "seeing in the mind's eye", is pivotal to creativity as it allows us to draw together our experience, our values, our understandings and project these in a creative way. Eisner makes a clear point about the recalled images that we have of our experience and the way in which we transform them into future imagined possibilities:

> There is a difference between recalled images and their imaginative transformation. Were we limited to the recall of the images we had once experienced, cultural development would be in trouble. Imagination gives us the images of the possible that provide a platform for seeing the actual, and by seeing the actual freshly, we can do something about creating what lies beyond it. Imagination, fed by the sensory features of experience, is expressed in the arts through the image. The image, the central term of imagination, is qualitative in character. We do indeed see in our mind's eye.
> (Eisner 2002: 4)

It is important to distinguish here what is meant by the word "seeing", because in fact, our ability to create and project images is based on all our senses, not just our sense of sight. We can "image" with all our senses. We can image taste, sound, touch and smell. We can also image with our emotions and feelings. Again, Eisner draws our attention to this:

> Our conceptual life operates in each of the sensory modalities and in their combination. We not only can generate in the mind's eye a visual image; we can see that image even while hearing music

> "around" it. We can taste a banana without actually tasting it. We can envision an opera without actually seeing or hearing it."
> (Eisner 2002: 22)

While it is evident that humans have the ability to do this, the fact remains that the quality of our "imaging" is directly related to the richness of experiences we have had and the way in which we have been encouraged to explore the images in order to use them in a creative fashion. Put simply, in the words of Yvonne Outerside, "we cannot begin to imagine what might be if we have no perception of what is". (Outerside 1993: 43)

So, let us look a little more deeply at how we develop the building blocks that we can draw on in our imagination. At the core is perception. If we consider tiny babies and think about the way in which they perceive the world before they are in a position to make sense of what they perceive, their perception is through their senses; using the terms used by Bandler and Grinder (1976) through the child's visual, auditory, kinesthetic, olfactory and gustatory senses. As babies start to experience a range of things through their senses, they start to pull together what they perceive as they begin to make sense of their world by developing concepts. The example is used of the way in which a small child might develop the concept of "grandmother", drawing on early experiences a child might have of their grandmother, perceived through their senses. This could include the memory of the grandmother's kitchen, perceived visually; the smell of her baking bread, perceived in an olfactory way; the sense of security of being with her, perceived kinesthetically, all contribute to the child building a concept of "grandmother" that relates specifically to their own grandmother. As their world enlarges and they start to realise that other people also have grandmothers, they develop a more generic concept of "grandmother" that allows for differences and similarities within the child's understanding of what grandmothers are. Our concepts, and our experience are the building blocks that we draw on when we are using our imagination. A child with a well developed concept of "grandmother" could imagine a grandmother that they have never met, and that doesn't even exist. The richer the child's understanding of the concept, the greater the facility they have in being creative with it, the more imaginative they can be in conjuring up the new grandmother. The imagination needs feeding and a rich diet of experience is what is needed.

Singer and Singer (1990) draw our attention to the importance within this of fantasy; of the ability to fly into the realms of fantasy to be really creative in our imaginings.

> ...the concept of "what might be" - being able to move in perception and thought away from the concrete given or "what is" to "what was, what could have been what one could try for, what might happen" and ultimately, to the purest realms of fantasy - is a touchstone of that miracle of human experience, the imagination.
> (Singer and Singer 1990: 19)

Fantasy has not been seen by all as an entirely positive aspect of imagination and creativity and critical in this has been a concern for the ability of a child (or for that matter an adult) to distinguish between fantasy and reality, such that fantasy can be genuinely used to explore the unknown and to think the unthinkable and that the resulting thoughts and ideas can be drawn back into reality. (Stables, 1992)

This concern with the balance and positive tension between fantasy and reality, and children's ability to distinguish between the two, is one that has exercised a number of researchers over the years. However, research has shown that encouraging children to engage in fantasy and make-believe helps children distinguish, rather than unhinging them from reality (e.g. Singer and Singer, 1990; Tucker, 1975). The Longman Concise English Dictionary tells us that fantasy is "unrestricted creative imagination" - employing the fantastical element of one's imagination is an important thing to encourage learners to do. However, looking at the use of fantasy in a learning context, it is important to see that it is used in a constructive, positive environment if it is to aid creativity. As Jones (1970) points out, imagination + loneliness + helplessness = anxiety, whereas imagination + community + mastery (as one could have in a well structured learning situation) = creative learning.

The use of fantasy is not restricted to children; professional designers are equally likely to engage in fantasy. Indeed, in his book on Design Methods, Chris Jones (1970) identifies engaging in fantasy as an explicit ploy of designers in being creative. Taking just a few examples from his text illustrates the point he is making very well.

> To wish for, or to imagine, things as they are known not to be, e.g. what we really want is a little slave to dial the telephone for us; we need a road that disappears except where the wheels touch the ground.
> (Jones 1970: 279)

But to return to small children, let me draw from the case study research of Outerside (1993) to illustrate how perception, the development of concepts and the use of fantasy all support the child's ability to be creative. Outerside conducted a longitudinal case study of the young child "Joe". The following example, taken from a point at which Joe is four years old, has Joe playing with a toy man, moving it in the air. Joe states that:

> "The man is flying in the big balloon, but he does not have enough fire to get down."
> He was asked, "So what does he do? Can he get down?"
> Joe said, "No, because he isn't heavy enough to come down."
> Joe was then asked if the man would have to wait until he drifted down.
> "No," replied Joe, "he will eat his dinner, then he will grow bigger and then he can come down".
> (Outerside 1993: 45)

Outerside explains Joe's sequence of thought in the following way:

> Joe has visualised processes, that of the man eating and growing bigger and heavier, and the resulting heaviness causing the balloon to come down. His knowledge and experience of life processes and forces has enabled him to apply this understanding logically in the context of play.
> (Op. Cit)

In this example Joe has applied creative thought to the situation to provide a solution that may be in the realms of fantasy, but which is mediated through his perception of reality. He has unwittingly applied "lateral thinking" to the situation, basically by being prepared to be cavalier with the way in which he has applied his concepts of eating, weight and gravity. He has not been bound by preconceptions but has suspended them in his search for a resolution of the situation. His ability and willingness to suspend reality is critical to him being able to respond as creatively as he does, and illustrates the potential fantasy has in developing creative solutions.

Through the above examples and references, it can be seen how important experience and conceptual development is in supporting the use of imagination and creativity. The richness of experience and the way concept development is supported, are very much things that can be enhanced through well structured learning situations. None of this is contentious. However, what we can see from the latter example with Joe, is the importance of play as he is learning through physically engaging in play and is also by exploring ideas in the context of play. And where play is concerned, there as many negative connotations as there are positive.

Play, wit, humour and playfulness

In order to explore the value of play in developing creativity and innovation, I will start by looking more generally at the value of play in learning. As a starting point it is generally helpful to look at definitions and in this instance I have chosen the definition provided by Pronin Fromberg as it provides a clear set of criteria that illustrates the breadth and depth of the potential of play and almost by definition that play is something to be taken seriously in the development and learning of children. She defines play as:

- Symbolic, in that it represents reality with an "as if" or "what if" attitude.
- Meaningful, in that it connects or relates to experiences.
- Active, in that children are doing things.
- Pleasurable. even when children are engaged seriously in activity.
- Voluntary and intrinsically motivated, whether the motive is curiosity, mastery, affiliation, or something else.
- Rule-governed, whether implicitly or explicitly expressed.

- Episodic, characterized by emerging and shifting goals that children develop spontaneously and flexibly.
  (Pronin Fromberg, 1999: 28)

But looking into the literature on play it is quite clear that there is a contrast between the positive framing of play as a concept that is important to development and where play is seen as a secondary activity or as a support to something more important. Play is seen by some as a time for practising skills, for growing, for exploring ideas or as a way of discharging energy, sending children "out to play" so that they can burn up excess energy or as a way to recharge energy, to step away from serious thinking time and take a breather. It can be seen as something that the children are allowed to do when the "serious" work is done, linked to frivolity, which is sending mixed messages about the value.

In a major study reported in 1949, Huizinga undertook an extremely serious study of play and through his work identified play as a fundamental characteristic of humans and as the driving force of culture in society. He speaks of play as pre-dating culture, identifying play as a characteristic of a whole host of animals, not just humans. But in his view play is absolutely fundamental to the way in which human society and culture have developed. He gives as an example of this the way we play with language and it is in playing with language that we are exercising the creativity that results in the development and use of metaphor:

> The great archetypal activities of human society are all permeated with play from the start. Take language, for instance - that first and supreme instrument which man shapes in order to communicate, to teach, to command. Language allows him to distinguish, to establish, to state things; in short, to name them and by naming them to raise them into a domain of the spirit. In the making of speech and language the spirit is continually "sparking" between matter and mind, as it were, playing with this wondrous nominative faculty. Behind every abstract expression there lies the boldest of metaphors, and every metaphor is a play on words.
> (Huizinga 1949: 4)

He also identifies play as being fundamental to the mental attitude of the Renaissance and believed that that to not support the play element in culture is to threaten culture.

> We can scarcely conceive of minds more serious than Leonardo and Michelangelo. And yet the whole mental attitude of the Renaissance was one of play. This striving, at once sophisticated and spontaneous, for beauty and nobility of form is an instance of culture at play.
> (Huizinga, 1949: 180)

In the context of learning, play has a great history of strong advocates. One only has to look at the beliefs and writings of educators such as Rousseau, Pestalozzi, Froebel, Dewey, Bruner and Eisner to see what a long culture and history there is in the belief in the importance of play. And yet play has had its critics. During recent years, as we have experienced a more policy driven curriculum, the more negative connotations of play have been apparent. Angela Anning (1994) draws our attention to the way in which these connotations have been promoted both at policy and "grass roots" levels. She comments on the effect of the policy makers and also the potential and possibly unintended actions of teachers themselves in promoting this more negative and dismissive attitude to play:

> The value system of the dominant political power group of the past decade - mostly men, mostly educated within the independent sector, mostly deeply uncertain about women - have determined the policies for which they have legislated under the terms of the Educational Reform Act. For them, play is a frivolous and low-status activity associated with the long hair, beads and the hedonism of the Sixties Generation or with women and children in church halls. Acceptable play may take place only in competitive team games or on the golf course.
> (Anning 1994: 68)

She gives examples of comments from these legislators:

> Michael Fallon ... criticizing the use of project work said: "At worst this kind of practice turns the primary school into playgroups where there is much happiness and painting, but very little learning". (Anning 1994: 68)

She also comments on the schism which can be perpetuated in the classroom:

> Every time infant teachers make a clear distinction between the "important" aspects of learning (the "real work" of learning the basics of literacy and numeracy) and the low status of practical activities (the "play" or "choosing time" activities) they are beginning the process of focusing on a narrow range of intelligences of the children for whom they are responsible. They are negating, by their actions, their claim to want to educate the whole child and beginning to shut down the potential areas of growth. They are laying the foundations of the apartheid separating the academic from the practical.
> (Anning, 1994: 72)

Here I would like to look back at a study countering this more negative attitude to play and certainly pre-dating much of the policy driven curriculum that is currently the experience in schools. This research, which took place in the 1970s by J. Nina Lieberman, characterises play in a very specific way as involving joy, spontaneity and humour and her research related these qualities to divergent thinking in young children. She developed a playfulness quotient and a divergent thinking quotient and through her research found a significant link between those with a high playfulness quotient and those seen by their teachers as divergent thinkers. She took a particularly benign and positive view in her characterisation of play, for example seeing humour as "gentle humour" and wit as "friendly wit". Through her research she focused on playfulness as the quality that we have as humans which we develop through playing as children and retain as we move beyond childhood:

> My own studies suggest that playfulness is made up of spontaneity, manifest joy and a sense of humour. My theoretical speculations and those of others, as well as evidence from my studies and those of other investigators, points to playfulness becoming a personality trait of the individual and a possible clue to cognitive style. ... If we assume that there exists a core of traits that constitute playfulness and if we assume that there is a developmental continuity of playfulness as behavior, then we may posit that playfulness survives play and becomes a personality trait of the individual.
> (Lieberman 1977: 6)

Looking back at the earlier sections of this paper that focus on the importance of imagination and the examples such as that of Joe who is being playful with ideas, I would suggest that by thinking of playfulness as the important aspect to be focused on in supporting the development of creativity and innovation in D&T is a more useful and positive approach than taking play as a more general concept.

Play, playfulness and designing

Whilst a case could be made from the above to support the importance of play in development, learning and creativity, to gain some perspective on how play relates to unlocking the gridlock in the D&T curriculum, it's important to explore the relationship between play and design and between designing and playfulness.

Looking back at Pronin Fromberg's definition, a critical feature for D&T is play that has the "what if? attitude", suggesting simultaneously questioning and projecting into the future. The literature on play also identifies a number of functions and types of play. Of the latter, one which I believe has particular significance in supporting the development of D&T capability is that which Tina Bruce labelled as "free flow play". In drawing a distinction around this particular type of play, Bruce is referring to the type of play that can be engaged in purely for its own sake: that is directionless, with no explicit purposes or intentions and which is valuable because of the range of learning experiences that it enables. She describes a play activity where the "player" literally

"wallows" in the experience and in this wallowing develops a range of skills and understandings:

> As we experience, so we struggle, manipulate, explore, discover and practise in order to wallow fully and become proficient. ... If we can use first hand experience as a means towards wallowing in experiences, and being proficient we have a sense of control over our lives. ... This sense of control impinges on self-esteem, self confidence, autonomy, intrinsic motivation, the desire to have a go, to take risks and to solve problems, and the ability to make decisions and to choose.
> (Bruce 1991: 82-83)

Of particular significance for D&T, is the way in which free flow play allows a forum for uninhibited development of manipulative skills, problem solving skills, confidence and so on. This can best be illustrated by an example taken from research undertaken in TERU in the early 1990s (the ESRC funded Understanding Technological Approaches project, Kimbell et al 1994) in which we observed children, on a minute-by-minute basis, engaged in D&T activities. It was during observation of a group of Year 1 children (five and six year olds) that I witnessed the power of free flow play within the D&T activity of one small boy. This five year old, along with his school mates, was designing a house for a spider and his particular house featured an exterior slide, running from the roof to the ground. He observed that his spider couldn't get on to the roof in order to go down the slide, and needed a ladder. Having explored with him the way he felt he could make a ladder, I taught him how to measure, mark and cut tiny pieces of dowel that he could then glue together to make his ladder. Once he began to cut and join the wood, I believe he temporarily lost sight of the aim of his activity as he completely wallowed in the experience of cutting and sticking the wood. Once he had seven rungs on his ladder it was quite adequate for his purposes, but I watched as he measured, cut and stuck until he had fifteen rungs - and he would have carried on, had I not drawn him back to the task in hand. In wallowing in this experience he became so expert in the new skill and so confident in deploying it, that he showed the older children in the class how to use the saw, bench hook and glue gun, when they wanted to cut and stick wood. As is indicated by the quote above, this small boy had fully wallowed in the experience and as a result developed a great deal of skill and confidence.

There is a similarity here in what Eisner refers to as a permissive feature of the arts generally:

> ...permission to pursue qualitative experience in a particularly focused way and to engage in the constructive exploration of what the imaginative process may engender ... permission is provided to explore, indeed to surrender to the impulsions the work sends to the maker, as well as those sent from the maker to the work
> (Eisner 2002: 4)

and one that young children engage in through play:

> We see this perhaps most vividly when we watch preschoolers engaged in play. It is during this period that children take special pleasure in the sheer exploration of the sensory potential of the materials they use. It is at this time that their imaginative abilities, uninhibited by the constraints of culture, make it possible for them to convert a stick of wood into a plane they can fly, a sock into a doll they can cuddle, or an array of lines drawn so they stand for daddy. For young children the sensory world is a source of satisfaction, and imagination a source of exploratory delight.
> (Eisner 2002: 4-5)

What is being described above has a clear relevance for designing, but there is a step beyond this to relate play more directly to designing and this has been to focus of a range of writing by Ken Baynes through which he has drawn attention to what he terms "designerly play", play activity that has clear direction and intention: to explore and create the world in which the children are playing. The difference between exploratory play and designerly play is highlighted when he draws attention to what (from the point of view of design) is missing from the approach of the early advocates of play and learning (referring explicitly to the work of Rachel and Margaret MacMillan).

> The children encountered the world of objects, they played with and drew and modelled natural things, they handled clay, sand and water (and sometimes even fire), but they were not asked to use their experience to make a world of their own. (Baynes 1989: 77)

So, play can be seen to provide a context for designing, a place for exploring ideas, for asking "what if?", an opportunity for developing a range of skills useful to the designer, and, in the case of designerly play, a way in which these variously are drawn together as the player is actively creating new futures. But how often is this rich context permitted in D&T lessons, particularly with older learners in secondary schools?

Whilst I would contend that providing the space for play for older learners is valuable and will pay dividends if well structured, it is perhaps difficult for teachers to make the connections between the way a young child plays and what goes on in a D&T lesson. Playfulness, however, is a different story. I recall from my own experience as a young teacher undertaking the ubiquitous "bag" project with a group of twelve year olds, starting the project with a brainstorm on as many different types of bags as possible, that it wasn't until the infamously "creative" boy in the class started to throw in suggestions such as "tea bag" and "rat bag"** that the project took off. These interjections prompted the class to become playful with the concept of "bag" and the ideas began to flow. Playfulness is an attitude that the designer can adopt and is very much linked to wit and humour. Lieberman has pointed to the potential for playfulness to become a personality trait that is developed through play experiences in young children and that the quality is retained into adulthood. She also draws attention to the importance of wit and humour in playfulness and returns us to the importance of suspending reality and allowing fantasy to be the vehicle to explore this:

> ...holding reality in abeyance and allowing the fantasy elements to reign on a temporary basis seems to be a major ingredient in appreciating and perhaps also comprehending humour. (Lieberman 1977: 66)

She also indicates an interesting link to the tension between the child and the adult in play and playfulness and to the role that, through history, society has given to certain individuals as adults to take this role as jesters, troubadours and fools:

> The fool, in general, has permission to lighten dark, brooding moments and thus present the comic counterpart to the unfolding tragedy. He is the artist-philosopher and, at the same time, is given a child's licence. (Lieberman 1977: 10)

As teachers we will all recognise the self appointed jester in our classes - how often do we give the "child's licence" - the permission to be playful?

Wit and humour are part of the more emotional side of designing that professional designers are becoming increasingly explicit about deploying in their work. Richard Seymour (1999), in talking about the relationship between good design and what he terms emotional ergonomics, draws attention to the reality that good design is not exclusively in the realms of technical function.

> Is an Alessi Bottle Opener (you know, the one that looks like a little devil) good design or bad design? Well, it works just as well as any other bottle-opener I've ever used, but it also makes me smile every time I open a bottle. It gives me a little wink when I'm at my most frazzled in the evening. Yup. It passes the test. (Seymour 1999: 12)

This is not to say that meeting the emotional needs is the priority. Still speaking of the bottle opener, Seymour continues:

> It's effective and it engages my emotions. But what if it had still got that little bit of humour but it actually worked worse than its less amusing brethren? You'd feel that you had been taken for a ride, and you'd be right. (Seymour 1999: 12)

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Beginning to unlock the gridlock

The playfulness that can be seen in the design of the Alessi bottle opener can also be seen in a whole host of products currently stocking the shelves of department stores. Linked closely to playfulness is the space and the elbow room to be playful: time to play, time to wonder, time to speculate, to think "what if?" - in fact time to "let go" temporarily of the preconceptions and constraints of the situation. In standard descriptions of design processes, this would be seen as the time given to divergent thinking and indeed Lieberman's work showed a strong link between playfulness and divergent thinkers. Providing learners with this space is an important aspect of unlocking the gridlock using the key of play and supporting the learner to be creative.

Enabling the students to let go, to go beyond their pre-conceptions, to explore the unknown, to think the unthinkable, is something that we aim to do at Goldsmiths with students training to be come D&T teachers. Our aim is to give them models of design that are different and that challenge those that they have experienced elsewhere, to allow them the opportunity to be genuinely innovative. This has meant the students being brave, risky and prepared to place faith in their tutors as they have been encouraged to abandon a sequential designing process and embark on a project without knowing where it is going to take them. This can be illustrated through the example of the project a final year student who, in considering the ways in which we deal domestically with fires, spent 24 hours living with a fire extinguisher, taking it on the bus, to college, to bed, having it with him at all times. Through this experience, he produced a range of products - a child's teddy bear and the football with fire blankets hidden on their insides, a fire resistant umbrella. The designs were both technically functional in terms of curtailing small domestic fires and also included the sense of humour and emotional ergonomics described by Richard Seymour. One of the keys to "letting go" was allowing both tutors and students to be "freed up" from the tyranny of the linear, sequential design process as presented to us through the literature over the past 30 years. It was through the initial research in TERU - the APU D&T project, that we first broke the mould in our thinking about design processes, seeing them as iterative, responsive and dependent on the integration of action and reflection, rather than sequential, prescriptive and managerial.

This sequential process has also been challenged over the years by the professional design community and the way in which we have been encouraging our students to work is echoed in the words of Bill Moggeridge and Tim Brown (1999), referring to the innovative design practice IDEO:

> The challenge of designing experiences and behaviours for complex technological systems needs to be met with new ideas about design process: ideas which build on the traditional strengths of design (conceptualisation and visualisation) and enrich them with new human - and technology - focused approaches. At IDEO we have steadily moved away from a sequential idea of design process towards a set of values which contribute to a rich design and innovation culture. These values provide a framework within which chaos, risk, experimentation, innovation and vision can thrive.
> (Moggeridge and Brown 1999: 91)

For teachers, "letting go" is also a risky business as it means shifting the priority away from what might be seen as the task in hand of getting through the syllabus, preparing for exams, making sure that the learners have produced all the necessary documentation to get good grades in their examinations. It requires brave moves and nerves of steel for a teacher to shift their paradigm of the process of designing to a framework of chaos, risk and experimentation. In 2002 we evaluated an In Service Training initiative that linked professional designers with D&T teachers, provided by London's Design Museum (Kimbell et al 2002). Both the pressures teachers felt, through things like the examination systems and the need to provide the space, or what one of the designers referred to as "getting some fresh air" into the school curriculum, were very apparent in the findings of the evaluation. Designers were of the view that the approach teachers were taking in school was not experimental enough - and put a major emphasis on modelling ideas in their workshops with the teachers as a way of giving very direct personal experience

of being experimental and countering the damaging effect on creativity and innovation of the domination of the "final product". In the words of a designer from the Dyson Company:

> We try to inspire a more experimental hand-on approach - testing - curiosity - adventure - making things work - then making them work better. The teachers say they have to have beautifully made final pieces - even if they are not well designed. That seems daft. (Kimbell et al 2002: 4)

The emphasis on modelling had a major impact on the teachers and there was a distinct shift in the teachers' confidence in developing creative responses in learners as a result. But, while the teachers had new understandings and skills in this area to take back into schools, there was still a feeling that the assessment regime in schools didn't "allow" modelling - and that for the teachers it remained a risky strategy.

In the APU project we were tasked with assessing D&T capability and our exploration with the processes of designing that resulted so explicitly in us breaking away from the linear, sequential and managerial view of designing allowed us to begin to see how by getting assessment processes lined up with designing processes the way in which assessment can act as a constraint on creativity and innovation can be broken down. However, the reality over the last dozen years or so, certainly in the context of the English National Curriculum, is that assessment still acts as a stranglehold and this was identified by Richard Kimbell in his 2002 Keynote. Happily, our interest in assessment and creativity at Goldsmiths has been matched by the recent interest in Government circles and so our current research project is focusing entirely on ways of developing assessment approaches that promote creativity rather than stifle it. This project, *Assessing Innovation**, is still underway. It has drawn on our previous research and has also been developed closely with both teachers and examination awarding bodies and aims to establish approaches to providing both activities and assessment structures that promote creativity in D&T. Interestingly, in light of the view of the value of modelling that emerged from the Design Museum initiative, referred to above, when we asked teachers to run an intensive (two day) D&T activity, focusing on developing creative responses in learners and without concerning themselves how it would be assessed, teachers all structured activities that explicitly "gave permission" to modelling in 3D as a way of developing ideas. As the project has developed, incorporating opportunities to model in 3D (with the developments being captured digitally for assessment purposes) has become a major feature and one that has enabled a more playful, experimental approach to developing ideas. This approach has been welcomed by teachers and learners alike, provoking comments such as "I liked letting my imagination go wild", "using your own ideas; making models instead of drawing - they work better" (from learners) and "the whole process is "pacey" and nothing becomes overworked or laboured", "pupils felt a range of emotions during the project – apprehension, edgy, risky, exciting, familiar but also a sense of achievement and pride" (teachers).

This project, due to be completed later this year, has had at its heart the challenge of the "terrible two" of "being playful in re-structuring the world" and "sparking ideas", has developed activity contexts and structures designed to provide opportunities to promote these qualities and is developing an assessment framework that seeks out and gives credit to them. From the teachers involved to date, the response has been extremely encouraging in the total effect it is having.

> This trial has had an real affect on my teaching. It has reinforced things I do, reminded me of thinks that I have done, and prodded me to think of things I have never done. My PGCE student is completely "gob smacked" with the method of working and is implementing many of the principles in the trial in his teaching. His lessons are showing real pace and focus. (Teacher/Examiner from Assessing Innovation project, June 2004)

But if this project, and other initiatives with similar aims are going to succeed, then teachers and learners alike need to be given the time, space and permission to play, to be playful, to be creative and innovative, to reflect on and embed their experience in their practice.

Notes

* Assessing Innovation is a research project, funded by the DfES, currently being undertaken in TERU at Goldsmiths is directed by Richard Kimbell. It is due to be completed in December 2004.

** "rat bag" is an English term of endearment for someone who has annoyed you.

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