# 'Little c' Creativity and 'Big I' Innovation Within the Context of Design and Technology Education

Gill Hope, Canterbury Christ Church University College, England

## Introduction

The title of this paper is based on Craft's (2001) distinction between everyday 'little c' creativity and the 'big C' creativity of Picasso or Einstein. Craft's 'little c' creativity is close to Boden's (1994) P(ersonal)-creativity, and, perhaps, is even related to Kuhn's (1962) 'normal science.' Boden's H(istoric)-creativity is more likely to be associated with the occurrence of Kuhn's 'paradigm shift' which, for the purposes of this paper, is called 'Big I' innovation.

As a generalization, creativity research splits in to two forms: process research and product research. Isaak & Just (1996) claim that the traditional emphasis on generative processes and consequent neglect of analytical process has led to a confusion between insight and invention. Mumford et al. (1994:3) wisely begin with the words 'creativity is reflected in' rather than 'creativity is':

'Creativity is reflected in the generation of novel, socially valued products.'

There are multiple views on what creativity is, with definitions proffered from such standpoints of psychodynamics, humanism, cognitivism, social constructivism and more. Away from the debate of an inner quality, ethereal (perhaps ephemeral?), designing technology equates to producing something tangible, viewable, open to comment and appraisal. Design and technology (D&T) educators are interested in the process (how can we foster it) but also look to the product: what will they produce (by end of the course).

## The research context of the paper

The ideas explored in this paper are grounded in the author's doctoral research into young children's design capabilities, in which one Year 2 class received teaching input on modelling design ideas through drawing (the 'focus class') through a 15-month programme (Appendix 1), whereas the children in a parallel class (the 'comparison class') did not. The focus class input was based on the author's model of design drawing as both container (products) and journey (process), shown in Figure 1, which was used to explain the purpose of using drawing to support the development of design ideas (Hope, 2000). Thus the aim of the programme was to impart understanding of the role of drawing for designing to the focus class rather than the teaching of specific techniques.

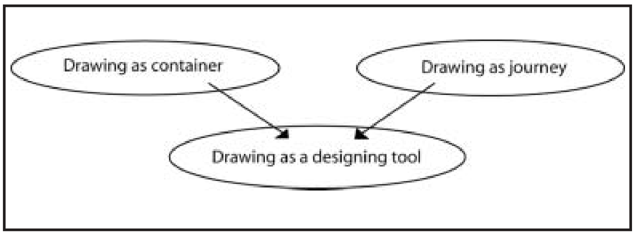



**Figure 1**

Assessment tasks were conducted with both classes at intervals throughout the programme. These were stand-alone D&T lessons from which the drawings and products were analysed.

Figure 2 shows the instrument used for analysing data from these assessment tasks: a 'dimensions wheel' with aspects of design drawing capability as the spokes radiating from the central hub of understanding the purpose of the design drawing, based on the dimensions of design capability of Kimbell et al. (1991) and Pascal & Bertram's (1991) child-centred framework for defining and assessing quality in early childhood education (Hope, 2003a & 2003b).

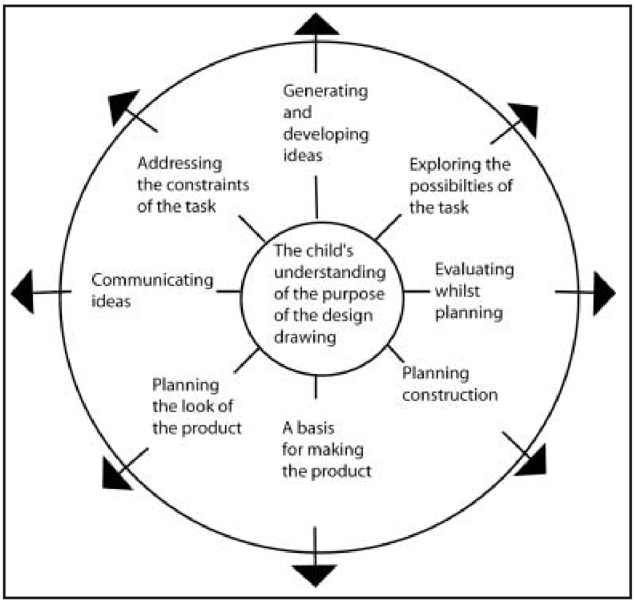



**Figure 2**

As the radial plots in Figure 2 show, the comparison class found addressing the task more challenging than did the focus class. The product design task, designing an Easter Egg holder, occurred near the beginning of the programme. Each child was given a section of cardboard tubing that was much wider than the hard-boiled egg that was to be used for sizing. The criteria were made clear: the egg had to be held securely, it must not fall out, the holder must be attractive and interesting. The focus class took the task restraints on board and designed bunnies and chicks, using smaller tubing or cups inside the big tube to hold the egg. The comparison class looked for other ways to solve the problem. Some children discarded the large tube altogether. Some made pyramids with ever smaller tubes and the egg perched on top. One girl (Zara) designed a shoulder bag with the egg sitting in a hole in the top. Were these responses creative, divergent or just plain off-task? At this stage of the research project, I was unsure.

The problem scenario task for which the data is shown in Appendix 2 came at the end of the programme and involved making a model of the Knossos maze for Theseus to escape the Minotaur. By this stage the focus class were adept at using drawing as a discussion document to support design thinking. 'What I'm going to do is, look,...' and 'what you could do is, look,...' conversations flowed as they drew. They were sparking ideas off each other and also quashing each other's more unrealistic flights of fancy.

In her discussion of 'exploratory creativity', Boden (2001) remarks that mental spaces are easier to change or adapt than physical ones. It would appear that their greater facility with design drawing had provided the focus class with a means of scaffolding their thinking, so that their own thoughts had become visible to themselves and others and thus available for review and discussion. This enabled a greater creativity of response through playing with ideas that, whilst still in the mind's eye, could be adapted and changed through reference to the drawing. The focus class were beginning to use the drawing as a modelling tool, whereas the comparison class tended to wait until they were handling the materials before making the real decisions about the product they were going to make.

This was the key difference between the two classes' working methods. The focus class talked as they drew, the comparison class elected to draw in silence and then began sharing ideas once they were engaged in making the maze. However, at this point they lost the plot. Instead of making a model maze to help Theseus escape, they were now designing snake pits and trap doors. Zara (who made the shoulder bag egg-holder) made a simple box 'maze' and then made a river outside the castle walls with a crocodile in it and a boat to help Theseus escape from the crocodile. I was beginning to refine my thoughts about what counts as creativity within design and technology and its relationship to addressing task constraints.

**Playing with the design game**

Design problems generally perceived as being indeterminate, open-ended and are answered by good/better rather than right/wrong answers, 'wicked problems' (Rittel & Webber, 1969) for which 'a number of problem representations will be activated.' (Mumford et al., 1994: 13)

'But how will you look for something when you don't in the least know what it is? How on earth are you going to set up something you don't know as the object of your search? To put it another way, even if you come right up against it, how will you know that what you have found is the thing you didn't know?'
Plato (c.500 B.C.)

Wittgenstein (1969) referred to the construction of meanings within separate domains of human endeavour as 'language games,' each with their own rules and internal logic from which phenomena are 'seen as'. Liddament (1991) applied Wittgenstein's concept of language games to designing. In design terms, Wittgenstein's 'seeing as' is the ability to juggle conflicts inherent in the problem-space and find a creative solution that satisfies both user and situational constraints. Successful problem-solving depends on the ability to set up, reason and imagine within a clearly defined mind-space. It is the ability to image fantasy onto reality, what might be onto what is, and to accept and reason within the fantasy / reality interface inherent in the design task. It has a family resemblance to a game of football in which players with flair can exploit the game potential whilst remaining within the constraints of the game's rules. The focus class' greater design success was, I believe, to do with their greater ability to reason within the rules of the design game. Zara, for example, was not playing my game; she was playing one parallel to mine.

Near the root of the problem seemed to be whether creativity (along with other cognitive functions) is a domain-general skill (something we apply to every new situation) or whether it is domain-specific (in educational terms, subject specific). Did Zara have problems answering the question in other subjects too, or was it just in design and technology? Was 'thinking outside the box' a character trait that I could identify in Zara and that should be encouraged, rather than penalising her for not answering the question? If the creativity she was displaying was (perhaps) inappropriate to design and technology, would it have been relished by her Art teacher and applauded as a new take on the tale in English? I was beginning to ask questions about the nature of creativity in designing technological innovations.

Mumford et al. (1994) portray a ‘satisficing strategy’ as a screening process used to match mental representations to the ill-defined problem. This would suggest that an analytical selection process is at work within the mind of the creative designer, acting as a brake on the free-flowing, free-wheeling originality of ideation fluency, since in real-life design situations what is required is not a long list of ideas that no one else has ever thought of, but a few good, workable suggestions that have a ring of viability about them.

‘Products that are valuable as well as novel, however, can arise only if the generated ideas are evaluated effectively. Successful invention, therefore, requires both generative and analytical facilities.’ Isaak & Just (1996: 297).

This accords with Donaldson’s (1991) requirement of perception of salience for effective problem-solving, with Wittgenstein’s ‘seeing as’ and with the idea of reasoning within a bounded search and construction space seeking a satisficing zone

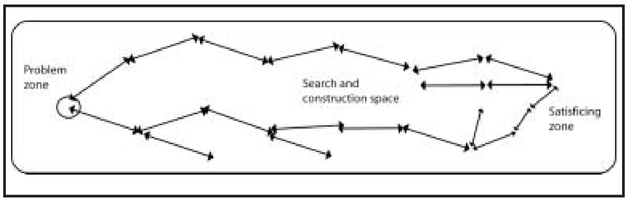



**Figure 3: from Middleton, 2001**

Isaak & Just (1996:307) argue that:

‘successful invention depends on imposing constraints on the nature of the invention during design space limitation and design analysis and on releasing or reformulating constraints during design generation…Whereas knowledge or experience may provide subjects with the means to attack a problem, only the integration of ideas or experiences can lead to inventive solutions.’

Rogers & Clare (1994) placed reflection at the centre of design capability (Figure 4):

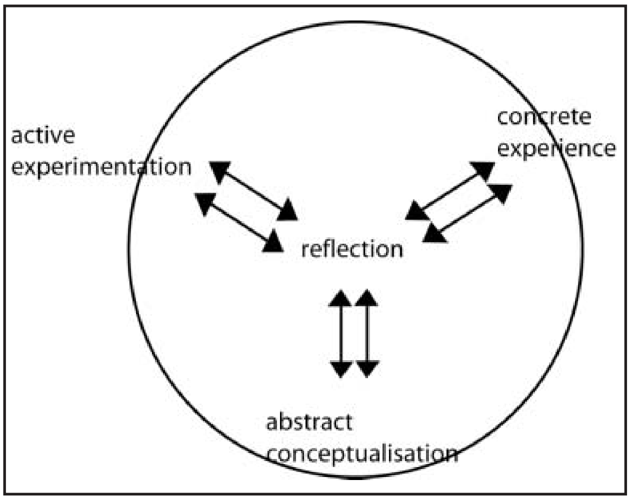



**Figure 4**

Creatively playing the design game involves constant self-monitoring and peer review (plus the occasional intervention of a referee). Appendix 1 indicates that the focus class in the research that underpins this paper were also more capable than the comparison class in evaluating whilst drawing. The combination of the ‘but what you could do’s’ and the ‘but it’s got to be able to’s’ in the discussions across the drawings ensured that the flow of bright ideas did not slide beyond the remit of the task.

**Educating Zara**

Zara was a bright, inquisitive girl from a home that encouraged experimental playing. When she was five, she made a hot air balloon from paper, but holding it above the radiator did not provide enough up-draught and her seven year-old brother nearly set their house alight trying a cigarette lighter instead. Yet Zara found difficulty answering problems set by others, even those for which her rich practical experience and knowledge would suit her best.

If part of our aim in design and technology education is to produce the innovators of the future, ‘big I’ and not just ‘little c’, then knowing how to foster such talents is vital. Perkins’ (1981: 101) claim that ‘discovery depends not on special processes but on special purposes’ leads to an ‘everyone can do it’ viewpoint:

‘In this view, the psychological processes of James Joyce writing Finnegan’s Wake do not differ fundamentally from those of an electrician deciding how best to wire a redecorated room.’
(Kneller, 1965: 11)

This is encouraging for educators. Psychological tests to determine the creatives among our students are unnecessary. All students are creative and teachers just have to foster it. How, is, of course, another matter. Bruner (1986: 127) coined the phrase ‘stance marking’:

'Some stance markings are invitations to the use of thought, reflection, elaboration, fantasy... If the teacher wishes to close down the process of wondering by flat declarations of factuality, he or she can do so. The teacher can also open wide a topic of locution to speculation and negotiation.'

Questions with invitational stem: 'in what ways might...? or 'how might...' invite an open or wide-ranging searching for many, varied and novel options. However, the school curriculum often focuses on 'answer finding' rather than 'problem finding' and the mechanistic view of education, dominated by input-output models, in which 'discovering where the child is' is interpreted as 'which ability group to place the child in' and slotting them into ready-prepared places (Wells, 1986), (c.f. Blue Peter's 'here's one I prepared earlier') inevitably militates against the fostering of the child's own interests and talents and stifles creativity.

For Bruner (1986:126) it was important that the child becomes an 'agent of knowledge making as well as a recipient of knowledge transmission'. Well's book is entitled The Meaning Makers and although it focuses on language and learning, it has important messages for design and technology too. Making meaning, for oneself and others, saying something new, whether through language or through producing creative artefacts is only possible in a climate in which it is safe to do so.

**'Little c' or 'Big I'**

Without creativity and innovation, society stagnates, yet other possible converses to creativity (often associated with 'Big I' innovations) are anarchy and destruction. The beginnings of truly innovative movements are frequently highly anarchic within themselves, if not destructive of what has gone before. Are we brave enough to foster this kind of ground-breaking talent?

Despite the statement in *All Our Futures* (1999:28) that

'In our view, all people are capable of creative achievement in some area of activity, provided the conditions are right and they have acquired the relevant knowledge and skills. Moreover, a democratic society should provide opportunities for everyone to succeed according to their own strengths and abilities.'

The fostering that appears to be on offer is of 'little c creativity', making products that are 'useful', rather than to turn the status quo up-side-down. The relationship between the three terms in Howe, A., et al.'s (2001) subtitle Creativity, Culture and Citizenship need further unpicking if we are to accommodate the truly 'Big I' innovators.

This paper began from a dilemma about categorising children's responses in a research task related to using drawing for designing, in which Zara, of all the children, exemplified that dilemma. What are the chances of a grown-up Zara, a think-outside-the-box person, getting to a position from which she could challenge the paradigm? How many conformist hoops would she have to clamber through in order to be sufficiently high up the ladder for her voice to be heard, her ideas to be appreciated, or her reformulation of the Theseus' Maze problem to be recognised as a totally new way of 'seeing the world as'. And what contribution would I, as her teacher, as an adult in education who knew her well for four years, have made to that? Far less, I fear, than that which she has contributed to me and to my thinking about creativity within design and technology education.

**References**

Boden, M. (1994), 'What is Creativity?' in Boden.M.A. *Dimensions in Creativity*; MIT Press, Cambridge, MA.

Bruner (1986), *Actual Minds, Possible Worlds*, MIT Press, Cambridge, MA.

Craft, A. (2001), 'Little c creativity' in Craft, A., Jeffrey, B. & Leibling, M. *Creativity in Education*, Continuum, London.

Donaldson (1992), *Human Minds*, Penguin Books, Harmondsworth.

Hope, G. (2000), Beyond 'Draw One and Make it': *Developing Better Strategies for the Use of Drawing for Design at Key Stages 1 & 2*; Design and Technology International Millennium Conference 2000, DATA, Wellesbourne.

Hope, G. (2003a), *A Holistic View of Assessing Young Children's Designing;* The Third International Primary Design and Technology Conference (CRIPT); Birmingham

Hope, G. (2003b), *Taking Ideas on a Journey : a model to support young children's thinking processes*; British Educational Research Association (BERA) Conference; Exeter.

Howe, A., Davies, D. & Ritchie, R. (2001), *Primary Design and Technology for the Future: Creativity, Culture & Citizenship*; David Fulton Publishers

Isaak, M.I. & Just, M.A. (1996), 'Constraints on Thinking in Insight and Invention' in Sternberg, R.J. & Davidson, J.E. *The Nature of Insight*, MIT Press, Cambridge, MA.

Kimbell, R., Stables, K, Wheeler, T, Wosniak, A & Kelly, V. (1991), *The Assessment of Performance in Design and Technology;* Schools Examinations and Assessment Council, London.

Kneller, G.F. (1965), *The Art and Science of Creativity*; Holt, Reinhart & Winston, Inc, New York.

Kuhn,T.S. (1962), *The Structure of Scientific Revolutions*, Chicago University Press, Chicago.

Liddament, T. (1991), 'Design Talk' in *Design and Technology Teaching* 23, 2; Trentham Books.

Middleton, H. 'Design and Technology: what is the problem?' in *Conference Proceedings*, DATA Millennium International Research Conference; DATA, Wellesbourne.

Mumford, R. & Runco, M. (1994), *Problem Finding, Problem Solving and Creativity*, Ablex Publishing, New Jersey.

National Advisory Committee on Creative and Cultural Education (1999), *All Our Futures: Creativity, Culture and Education*, Department for Education and Employment, Suffolk.

Perkins, D.N. (1981), *The Mind's Best Work;* Harvard University Press, Cambridge MA.

Plato (W.K.C. Guthrie trans. 1956), *The memo*; Penguin, London.

Rittel, H. & Webber, M.M. (1969), 'Wicked Problems'; in Cross, N., Elliott, D. & Roy, R. Man-*Made Futures,* Open University Press, Milton Keynes.

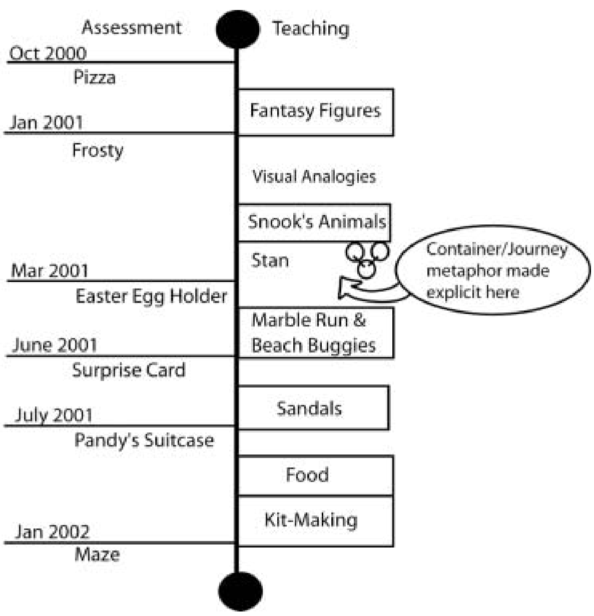
Rogers & Clare (1994), 'The Process Diary: developing capability within National Curriculum Design & Technology - some initial findings'; in *Conference Proceedings of International Design and Technology Educational Research (IDATER94*); Loughborough University, Loughborough.

Wells, G. (1986), *The Meaning Makers*, Hodder & Stoughton, London.

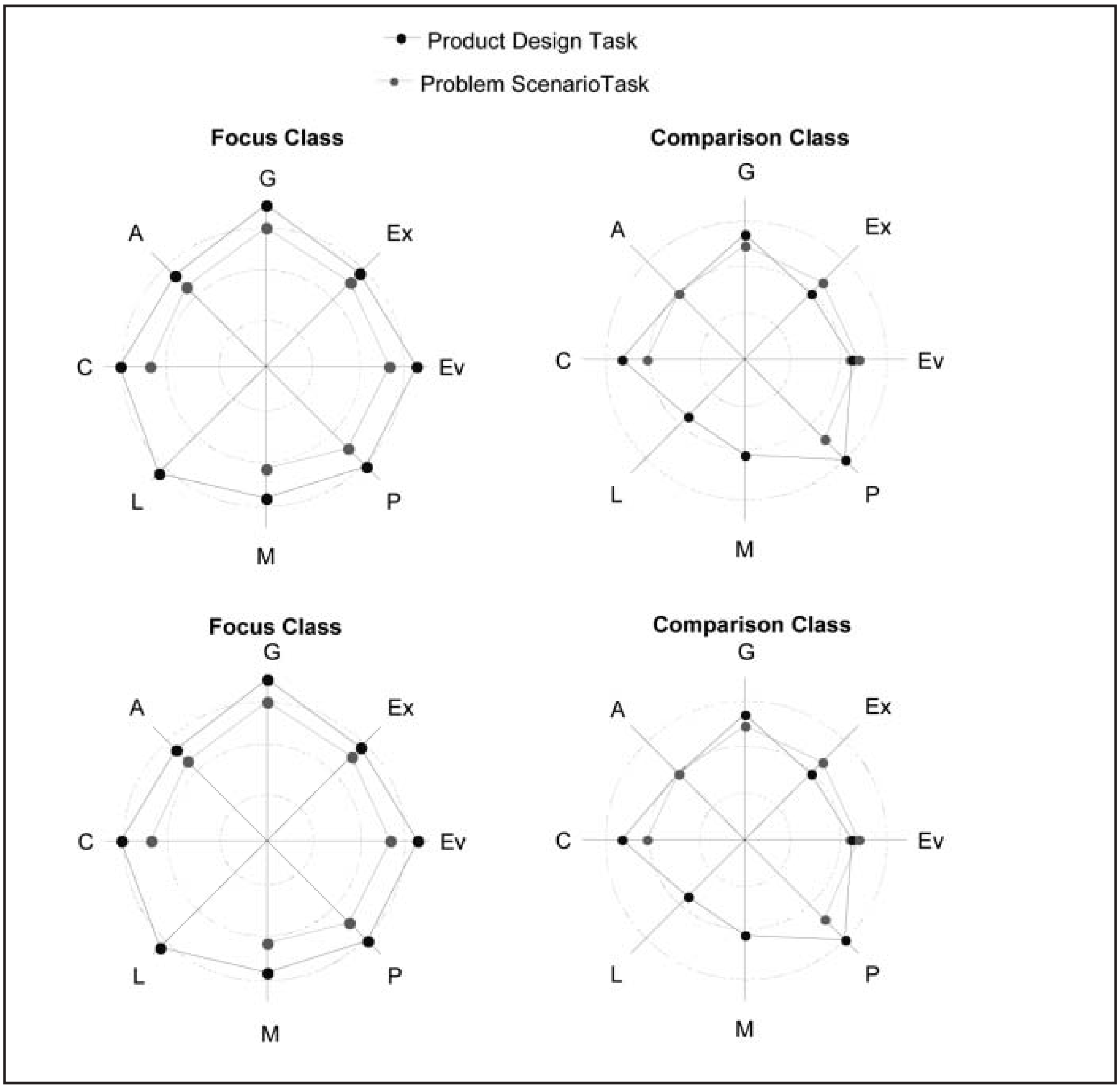
Wittgenstein, L. (1969), *Philosophical Investigations; the Blue Book; The Brown Book*; Basil Blackford, Oxford.

| Term | Project | Skills | Techniques |
|---|---|---|---|
| Autumn 2000 | Fantasy figures | To make what they have drawn<br>Making a pattern before engaging with materials<br>Evaluation at planning stage through discussion with partner<br>Develop ideas collaboratively | labelled diagram<br>design sheets/grids<br>story-boarding |
| Spring 2001 | Visual analogies | Using what they see to stimulate ideas<br>Develop understanding of and facility with visual analogies | transfer by tracing |
| | Ideas on a Journey | Understanding what constitutes clear design communication<br>Introduction of container/journey metaphor<br>Use drawing to support design journey | clarity of diagrams<br>recording materials |
| Summer 2001 | Modelling in other media | Evaluate each other's ideas and create a joint product<br>Use media other than drawing forplanning<br>use drawing part-way thorugh design and make process | paper folding for runs<br>bead-making<br>flat-pack box |
| | Extended project | begin design activity from product analysis<br>Carry through ideas across severalsessions | observational drawing<br>pattern development |
| | Team working | Use drawing to communicate ideas within a group<br>Work as part of a team<br>Develop meta-cognitive awareness of design processes | design development<br>graphic communication |
| Autumn 2001 | Designing for others | Generate and critically review each other's ideas<br>Address needs of a client<br>Communicate and refine ideas<br>Prototype a product | |

**Appendix 1a: Teaching Input to Focus Class**




**Appendix 1b: Programme Structure, indicating timing of Assessment Tasks**




**Appendix 1c: Comparative data from two assessment tasks**

The abbreviations on the plots represent the dimensions analysed in the research (see Figure1) as follows:

G = Generating and Developing Ideas
Ex = Exploring the Possibilities of the Task
A = Addressing Tasks Constraints
L = Planning the Look of the Product
C = Communicating Ideas
P = Planning Construction
Ev = Evaluating Whilst Planning
M = Basis for Making the Product