ADAPTIVE ENVIRONMENTS AS CREATIVE SPACES: THEORETICAL DEVELOPMENTS AND EDUCATIONAL APPLICATIONS

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ABSTRACT

Three years ago the authors worked collaboratively on a paper that integrated theoretical perspectives and practical insights in a conceptualisation of adaptive educational environments as creative spaces for fostering intellectual abilities associated with transference and synthesis in cross-disciplinary situations (Loi & Dillon, 2006). Since 2006, they have worked independently, developing and refining the notion of adaptive educational environments as creative spaces in different educational and industrial settings. The present paper offers a new synthesis and reflects on how their thinking has changed in the light of continuing work at both theoretical and practical levels.

ADAPTIVE EDUCATIONAL ENVIRONMENTS AS CREATIVE SPACES

The original conceptualisation of adaptive educational environments (Loi & Dillon 2006) arose from a critique of the intellectual abilities that Sternberg and Lubart (1999) identified with creativity. Much of the analytical, synthetic and practical work arising within educational systems is structured around formal curricula and is thus based in subjects or disciplines. Whereas discipline-based work may be creative, we were interested in how educational environments may be structured to facilitate intellectual creativity in a broader sense. Our view was that educational environments that claim to foster creativity must incorporate potential for analysis and, especially, transference and synthesis between and across disciplines as well as within disciplines.

All educational environments are *adaptive* in that they accommodate changing relationships between people and resources. By modelling the processes through which educational environments are maintained and developed, it is possible to design *interventions* that favour particular outcomes. Interventions are an important part of the model, especially technologically and pedagogically mediated interventions to educational environments that facilitate synthesis and transference. The modified environments arising from these 'designed interventions' may be regarded as 'creative spaces'.

Creative spaces, and the learning activities that occur within them, can be modelled systemically through ecological theory. An ecosystem is a self-contained community in its complete environment. In an ecological view of learning, any part of the environment, human or physical, may be regarded as a resource. Tools (in the broadest sense) mediate between people and resources. Interventions may be designed to promote the generation of intellectual and creative *niches* through the transactions and connections that people make with each other and the ways in which they utilise resources, tools, and information. In this sense, creative spaces are educational environments that are adapted to accommodate the fluidity of collaborative, integrated work, where ideas are analysed, synthesised and applied.

Drawing on the work of Beach (1999), the intellectual outcomes of interventions that lead to synthesis and transference in creative spaces may be thought of as 'consequential transitions'. A consequential transition involves a developmental change in relation between an individual and one or more social or professional activities and the continuation and/or the transformation of knowledge, skill and identity (Beach 1999).

THEORETICAL DEVELOPMENTS AND EDUCATIONAL APPLICATIONS

Dillon's work has moved in two interconnected directions since the first paper on adaptive education environments: (i) a pedagogy of connection for working across and between disciplines (Dillon 2006; 2008a; 2008b), and (ii) a cultural ecological lens on educational environments generally (e.g. Dillon 2008c).

Loi's work has moved into further explorations of designed interventions by: (i) identifying a number of implications associated with designing interventions (Loi 2007a; 2007b), and (ii) designing, deploying and reflecting on the possible roles of designed interventions within educational and industrial settings (Burrows & Loi 2006; Loi 2009; Loi & Prabhala 2008).

Theoretical developments

Cultural ecology is broadly based in systems theory. It deals with reciprocal relationships between people and their environments which it sees as complex and adaptive. This view of cultural ecology incorporates three important elements (Dillon 2008c):

- *Niche formation* – where people and environments are in mutually transformative relationships.
- *Cultural dialogues* – the interactions between beliefs, ideas and behaviours, and the arena in which interactions take place between the people who hold or practice them.
- *Coming into presence* – a mechanism that accommodates the emergence and endurance of cultural patterns at varying scales and in varying timeframes.

Niches are formed through mutually transformative interactions between people and their environments (Odling-Smee et al. 2003). Environments are more than just physical surroundings. They encompass the social and psychological as well as the physical. This means that, in a given environment, niches are configurations of knowledge, skills, ideas, beliefs, emotions etc. relative to and co-constituted with social dynamics and physical characteristics.

Niches are maintained through cultural dialogues, that is, the interplay between human behaviour and the environment. Cultural dialogues involve interactions between information and processes associated with artefacts, tools, practices (e.g. any form of creative work), modes of communication (e.g. symbols, language), lifestyles and combinations of these (e.g. any profession as a combination of tools, processes and lifestyle). Cultural dialogues adapt to opportunities and are an expression of norms, values and local conditions where they give rise to *cultural patterns*.

In addition to their regular, local expressions, cultural patterns have also novel characteristics that transcend the properties of their constituent parts and cannot be predicted from the behaviour of the constituents. Dillon and Howe (2007) and Osberg and Biesta (2007) call this *coming into presence.* Coming into presence is an expression of the notion of 'incoming of the other'. What emerges both transcends (in that it is more than what came before) and subsumes (in that it includes what came before) the prior configurations. Coming into presence reveals something not unexpected, but of unpredictable configuration, like in a kaleidoscope.

Designed interventions are based on notions of anomalous objects and odd experiences. By playing with these notions it is possible to dramatically expand creative engagement between people, providing platforms where diverse interpretations can be generated (Loi, Burrows & Coburn 2002; Loi & Burrows 2004; Burrows & Loi 2004; Loi & Burrows 2006). Using these notions as conceptual background, a number of tools have been developed and tested, namely reflective probes, playful triggers, and primitive probes (Loi 2007a).

Reflective Probes (Loi 2004; 2007a) create the conditions for reflective practice (Schon 1983) to prosper through activities that take the form of creative, ambiguous and inspiring artefacts. Playful Triggers (Loi 2005) rekindle the possibility for people to play, wonder, and learn – and to discover (or rediscover) the pleasures and benefits of such experiences. Reflective engagement, fruitful communication, and improved collaboration are major outcomes related to such experiences. A number of issues emerge when these tools are deployed in practice in relation to: their context (where should they be deployed?); time (when?); audience (who are the most appropriate recipients?); producer (who should design/deploy them?); content (what type of 'data' can they

provide?); soul (are they rational or ambiguous?); purpose (what is their function?) and form (how should they be designed?).

Through practically adopting these tools in a number of ethnographically informed and industrially based projects, a number of core understandings have emerged (Loi 2007a):

- a 'one size fits all' approach does not work – context is key;
- when a tool should be used is strictly related to where/why it will be used;
- these are not magic toys: sometimes they simply will not work, or better – they do not work as anticipated;
- the quality of a tool is strictly related to the capacity of its producer to design its content and form;
- these tools produce warm information which can be highly valuable or completely unrepresentative of objective data – their value is related to one's view of what research is, should be and represents;
- tools can enrich data when used alongside other ethnographic methods;
- these tools should be about engaging with knowledge creation and how it may be challenged through creative endeavour; and
- they should be carefully and purposefully designed.

Moreover, the tools demonstrate a number of benefits, as they:

- appear to assist researchers and participants through their transformative agency;
- help researchers to 'break the ice' and 'bridge gaps' within culturally sensitive contexts, fostering and supporting a participatory and unthreatening tone within focus groups and in-home interviews;
- assist researchers when asking and supporting participants when answering complex or potentially sensitive questions;
- help individuals to better understand their customers and collaborating partners and stakeholders to better understand the value of design research;
- successfully complement qualitative research activities, facilitating, after and during, focused yet open-ended ethnographic interviews, a comfortable increase in the level of specificity of feedback;
- prove to be easy to adapt and modify on site, providing on-the-go visualisations/responses and concrete, tangible and easy-to-access insights.

Educational applications

Dillon has explored some practicalities of a cultural ecological approach to education through the Arts Council of England's Creative Partnership Scheme. Loi has continued her work with designed interventions through two Australian Research Council funded projects focusing on primary and secondary teachers' use and understanding of Learning-by-Design.

This project in the Arts Council of England's Creative Partnership Scheme was a collaborative venture involving landscape designers (Colour Udl, Newcastle-upon-Tyne) and researchers Anna Craft (University of Exeter and The Open University) Penelope Best (Roehampton University) and Patrick Dillon working in co-participant action research with staff, pupils, parents and governors in Peases West Primary School. The project was concerned with how transforming the grounds (the outside environment) in a primary school altered the way teaching and learning took place, both inside the school and outside.

Peases West is a primary school for c.125 pupils in a rural location in a former mining region of Weardale, County Durham, UK. The school is accommodated in a modern, one-storey building which incorporates a nursery unit. The interior is semi-open plan with four main teaching areas, shared areas for practical work, and quiet areas between rooms. The main hall is multi-purpose, being used for dining, physical education, assemblies and performances. There is an information and communication technology suite. The central part of the school is built around an open-air quadrangle with split levels, flower beds, a fish pond and seating. The school grounds comprise two playgrounds, extensive areas of grassland and numerous trees. There are extensive views of the north Pennine landscape to the south and more locally to the surrounding village giving a strong sense of place.

Creative interventions were an important dimension in the creative partnership. The landscape designers undertook interventions that involved (i) on-site activities concerned with favourite and least-favourite places, imagined uses of space, building temporary structures, and designing and managing space for specific purposes, and (ii) off-site visits for staff to see outdoor education initiatives elsewhere. The interventions were designed to build articulacy with the external environment, engage the students and staff cumulatively in exploring the potential of spaces within the school grounds for learning and teaching, and in particular to encourage involvement through thinking, feeling, doing, and to prepare for some permanent changes. The researchers and landscape designers first established a *baseline* and then the researchers collected information in parallel with the interventions of the landscape designers. Research was undertaken in a broadly interpretative frame, i.e. seeking to understand rather than to explain, and involved ethnographic and inductive-deductive approaches. A range of methods was employed, including direct observation, participant observation, interviewing, and gathering evidence through structured records kept by teachers and pupils. A report of the research is in Dillon, Craft and Best (2007) where the results are given in full. What follows is summary of the significant outcomes.

Baseline information was collected from pupils, teachers, parents, and governors. In summary, it revealed that:

- *Pupils* had need of varied and diversified indoor and outdoor environments that accommodated the developmental needs of different ages with material elements, social spaces and spaces that offered opportunities for different forms of learning.
- *Teachers'* focused on learning, and thus primarily with the inside of the school. But they recognised the importance of the wider school environment to the general wellbeing of the pupils and thus liked to see it well designed, well managed and physically and aesthetically pleasing. They were aware of the potential of the outside for learning activities.
- *Parents* valued places for dedicated activities favoured by their children and places with personal memory associations.
- *Governors* were concerned primarily with the school fabric and ensuring the best for the staff and pupils. They recognised that the school environment plays an important role in the way the school is represented.

Having established a baseline against which change could be reviewed, the research team documented the creative partnership through the *stories* of the main participants. Of these, the learning and teaching stories, i.e. those of the pupils and teachers, are given prominence.

The teachers' story

The approach with the teachers' research was largely ethnographic and aimed to build a cumulative account of the teachers' story 'from the inside' by progressively focusing and encouraging emergent issues. Things happened through the project (actualities), and possibilities and challenges were identified.

In terms of actualities, the project encouraged more opportunities for concrete and experiential learning, for generating questions outside, greater sensitivity to the educational potential of the outside, and more flexible use of the environment. These are evidenced in: more co-planning between teachers, pupils and others; more connections between the thinking, feeling, doing and playing aspects of learning; different forms of organisation and management of space; and changing relationships between the cognitive and affective aspects of learning. A better understanding emerged of the relationship between creativity and what makes learning experiences special: e.g. beyond enjoyment, excitement and happiness, fantasy and reality, and possession, 'being part of it'. Research tools, developed by the researchers and introduced to the teachers in workshops, helped teachers with both recording and curriculum development.

Possibilities and challenges included: reducing the extent to which fixed equipment restricts the potential use of space; recognising the possibilities for planning work outside and the rules for using different spaces; finding applications in subjects that do not lend themselves to work outside; how to build on the contribution of pupils and the expertise they developed as pupil researchers, and how to build on their own expertise as researchers.

The pupils' story

The approach with the pupils' research was largely based around deductive and inductive analysis of criterion-referenced questions which enabled the production of numerous thematic findings which could be referenced back to the information sources and from which generalisations could be derived. The research revealed that through the project:

- pupils' showed greater sensitivity to the management of space and were more discriminating about space, e.g. spaces for thinking, spaces for doing, and spaces for just being;
- pupils' vocabulary changed;
- pupils' thinking matured;
- initially learning was linked to curriculum and taught subjects; the best places for learning were not too cluttered and were physically comfortable;
- pupils enjoyed planning and doing activities more than hearing about them;
- planning became significantly less important and hearing about the activity even less so; the enjoyment was in 'doing' and seeing the outcomes;
- enjoyment, excitement and happiness were recurring expressions of doing. For older pupils enjoyment was connected with involvement, cooperation and increased confidence. The transferable nature of learning skills was recognised, but pupils found it difficult to deconstruct how they learnt;
- there was increased collaborative opportunities through team work;
- working with others gave a sense of fun, enjoyment, confidence and pride;
- pupils experienced a greater blending of inside and outside;
- identity was reflected in the things that were created. This generates memories pupils will take with them.

The research revealed a developmental sequence associated with learning, play and socialising. For the youngest children (age 4-5) physical/cognitive aspects of learning were particularly emphasised and then the emotional aspects of learning came into focus. As they got older relational elements were prioritised, with an emphasis on pupils' proximity to others during learning. Later still, social elements were emphasised more, with high value placed on partnership, volunteering, sharing and collective ownership of ideas. By age 11, there was an emphasis on achieving a balance between individual and social work.

Throughout the project, places where pupils felt happiest were seen to be 'favourite' places and these were increasingly outdoors, although the differentiation was less pronounced with the younger pupils. Special restricted places, available to certain year groups, were deemed important. For older pupils in particular, there was a sense of ownership and legacy. For some pupils opportunities to be messy are associated with happiness but school spaces were viewed by pupils throughout the project as tidy and clean. Over the course of the project even the younger pupils recognised the significance of, and opportunities to develop, their creativity and imagination.

In 2005 and 2006 Loi worked on two Australian Research Council funded projects focused on primary and secondary teachers' use and understanding of Learning-by-Design (Burrows & Loi 2005; Cope et al. 2005), a pedagogical theory that assumes that:

- teaching takes place in the context of a digitalised/globalised environment;
- issues of student diversity and inclusion have to be taken into consideration;
- there is a need to be mindful of the grammars involved in constructing and de-constructing multimodal texts;
- teachers need to deliberatively choose between a range of context-appropriate pedagogies.

The first project (*Learning-by-Design: creating pedagogical frameworks for knowledge building in the 21st century*) investigated the ways in which 'middle-years' teachers design, record and enact their curriculum and the relationships between pedagogical choices and learner outcomes. The second (*Pedagogies for elearning: a critical analysis of strategies for effective use of ICT for teaching and learning*) investigated the needs of learners in a communication environment where digital and multimodal texts are adopted. A particular focus in both projects was on the development of a methodology that would enable researchers to collect rich and meaningful data while avoiding classroom disruption. A participative inquiry approach was developed, and approximately fifty teachers from four different jurisdictions in Australia (metropolitan and rural Queensland, Victoria and the Australian Capital Territory) were engaged in the projects.

Participative inquiry is 'a participative process, about research with people rather than research on people' as 'a means by which people engage together to explore some significant aspect of their lives, to understand it better and to transform their action so as to meet their purposes more fully' (Reason 1994, p. 1). This mode of inquiry is characterised by a focus on the practical – the capacity for the research to speak to a wider audience, and to prompt reflective practice. When engaging in participative inquiry people cycle iteratively through four interdependent forms of knowing to 'enrich their congruence and deepen their complementarity' (Reason 1998: p. 429)

- propositional knowing – when questions, concepts and related methodology are explored and developed together;
- practical knowing – when methodologies are applied in the world of practice individually or together, and lead to demonstrating skills and competencies;

- experiential knowing – where direct face-to-face encounters, prompted by the methodologies, lead to new understandings;
- presentational knowing – where the significant patterns identified via these shared experiences are represented through expressive multimodal forms of imagery and lead to a renewed understanding of the originating questions.

The participative approach to both projects integrated ideas of teachers and students as co-researchers (Loughran et al. 2002; Phelps et al. 2004) and designers (Brown & Edelson 2003). The research also adopted an innovative rhizomic approach to professional development where teachers learn to become mentors and collaborating researchers. This builds on research practices that involve the 'networking of practitioners' using 'a system which affords classroom-based enquiry, the sharing of ideas, and reflection on practice and learning' (Kennewell 2003).

To enlist teachers as reflective co-researchers and to elicit their insights about their practices, a range of tools and methods was adopted: interviews and recorded conversations; classroom observations and impact stories; background and contextual data; reflective prompts and artefacts (Reflective Probes); student artefact collections; and workshop-based interventions. Ethnographically informed and multimodal ways of capturing and representing data were encouraged at all levels and a range of knowledge sharing sessions enabled teachers throughout the projects to share ideas and learn how to adopt ethnographically informed and multimodal tools as part of their teaching and co-researching practices.

The rationale behind the use of the methods and tools was that engagement with these types of artefacts can provide a richer, more vibrant, and potentially more informative experience than would be possible with empirical methods. Moreover, 'teachers are not all the same. They have different beliefs about how children learn and how best to help them. Their classroom experience draws on, and reshapes, these beliefs' (Reimann & Goodyear 2004, p. 4). The challenge therefore is to capture the potentially subtle pedagogical beliefs and choices represented in and through teachers' practices. The methodology that was adopted for the two projects addressed this challenge.

In analysing what happens when teachers become co-researchers and when they adopt research tools and techniques, a number of observations can be made. The approach adopted in the two projects described here enabled a paradigm shift on competencies as well as a shift of agency, where researchers had more often the role of synthesising teachers' research, observations and insights instead of conducting direct classroom research and observations (see Table 1).

Tools	**Data type**	**Teachers/mentors role**	**Researchers role**
Interviews and recorded conversations	Notes; audio or video recordings	Interviewers/interviewee /analysers/synthesisers	Interviewers (maybe) /analysers/synthesisers
Classroom observations and impact stories	Notes; audio or video recordings; photographic	Self & peer observers/ observed/recorders/ analysers/synthesisers	Observers (maybe)/ recorders/analysers/ synthesisers

Background and contextual data	Hand-written, printed, photographic, existing documents…	Responders/analysers /synthesisers	Collectors/analysers/ synthesisers
Reflective prompts and artefacts	Hand-written or drawn, printed, photographic, audio, video…	Responders/analysers /synthesisers	Creators/analysers/ synthesisers
Student artefact collection	Hand-written or drawn, printed, photographic, audio, video…	Collectors/analysers /synthesisers	Prompters/analysers/ synthesisers
Workshops/interventions	Hand-written or drawn, printed, photographic, audio, video…	Participants/analysers /synthesisers	Creators/facilitators collectors/analysers/ synthesisers

Table 1. Research design: tools, types of data, actor roles

It is interesting to note that the research showed in several instances that many of the teachers involved in the project had a tendency to describe their practices in minimalist and foreshortened ways and to take for granted what they do and how they have arrived at what they do. The design of the methodology, and the ways in which the methodology has been enacted throughout the two projects, has been crucial in eliciting insights from teachers.

Another interesting benefit that arose from the adopted technique was its professional development potential for teachers. As a consequence of enlisting them as co-researchers, teachers were given the opportunity to expand their knowledge and capabilities beyond teaching practice and towards a deeper appreciation of research methods and endeavours. Moreover, the adoption of ethnographically informed and multimodal techniques to gather data greatly influenced their teaching practice. Consequently, as the two projects evolved, teachers expanded their skill repertoire and teaching practices – many of them have since enrolled in Masters and PhD courses, most of them modified their own teaching to embrace multimodality, reflective practice and ethnographically informed techniques, and some are now in mentorship roles to assist new teachers who decided to join the projects.

In 2006 a yearly forum was established by the researcher team to provide teachers with a space in which to present and share their insights as co-researchers. Through the forum teachers have and continue to demonstrate the transformative power of the research methodology and tools they adopted during the projects. Presentations not only provide an insight into their evolved and evolving practice, but also the richness and diversity that has been generated as a consequence of their involvement in the projects.

REFLECTION AND SYNTHESIS

The set of common understandings on which the original paper was based were generated in 2005. Since then, the authors have shared some ideas through email at a general level, but have otherwise worked independently of each other. In this section we reflect on the research reported above and comment on matters on which there has been further consolidation and matters which present further challenges.

CONSOLIDATION

The cultural ecological/systemic approaches were premised on the notion that routine interventions that happen in educational situations maintain the status quo through negative feedback, that is, they produce largely predictable, objective-responsive behavioural outcomes. Designed interventions associated with creative spaces have the potential to generate more radical outcomes, but they do so by de-stabilising the status quo, a process called *positive feedback.* In the terminology of systems analysis, positive feedback means systemic change. It is thus distinct from but related to the more common usage of the term as a 'form of affirmative response'.

Systemic change resulting from positive feedback is evident in the Creative Partnership, for example in:

- The ways in which learning was gradually seen, particularly by pupils, to seep into the outside as well as the indoors. At the outset of the project, pupils identified inside as a significant place for 'learning', and by the end they were identifying outside spaces as where learning might take place too.
- Pupils' capacity for leadership. Older pupils were able to consider ways of engaging younger ones in co-analysis and questioning through evolving their own strategies. Remarkable was their ability to consider their environment for research or teaching, the need for behaviour management and clarity in their introduction of work. Older pupils positioned themselves as both teacher and researcher for younger pupils.
- An implicit adoption of *possibility thinking* (Burnard et al*.* 2006; Cremin et al*.* 2006) – in other words moving from what is to what might be. In particular, where pupils pose questions, play with ideas, and immerse themselves in activities designed to foster imagination, innovation and to a degree, self-determination.

Systemic change resulting from positive feedback is evident in the Learning-by-Design projects, for example in:

- How teachers extended their competency – from teachers to researchers as a result of engaging as research partners in the project. By the end of the project several teachers had enrolled in Masters and then PhDs.
- How teachers transformed their teaching practice as a consequence of the multimodal research methodology they were asked to gradually unfold and apply. At the start of the project most tended to adopt more conventional tools in their teaching practice. After a few months of working as research partners, they started to notice and articulate how multimodal tools could be applied. By the end of the project, most teachers radically transformed their practice to incorporate multimodality as a core competency.
- Pupils' capacity to articulate complex matters and ideas through multimodality. A competency transfer gently yet visibly occurred during the project – pupils not only benefited from their teacher's new multimodal methods, but learned through role-modelling how to adopt multimodality themselves. As a consequence pupils' ways of exploring new concepts and of articulating themselves visibly benefited, as they increasingly developed their own ways of using multimodality in the classroom and beyond.

Positive feedback also generates energy and momentum. In the Peases West Creative Partnership, the project lives on in that it informs (i) a re-design of the school grounds including the construction of some new permanent features, and (ii) ongoing creative work in teaching and learning, including designing a broad and balanced curriculum derived from the needs and abilities of the pupils, the expertise and interests of the staff, the particularities of the environment, and ethos at the school.

Similarly, although the Learning-by-Design project is still in progress, a number of elements already demonstrate how it has radically impacted on teachers and surrounding communities: (i) a network of Learning-by-Design practitioners has been established and is providing ongoing support where teachers can actively share their practices through a number of online tools; (ii) a conference was established and annually offers a forum for Learning-by-Design practitioners, teachers and researchers to share with peers and the community examples of and reflections on their practices and investigations; and (iii) a Learning-by-Design online tool and network is enabling teachers to articulate and share their teaching modules across the country.

CHALLENGES

In the original formulation of adaptive educational environments as creative spaces we placed great emphasis on contexts. To some extent the importance of context has been confirmed, especially with respect to some of the tools used in the Learning-by-Design projects. However, it is also evident that emergent and unpredictable outcomes, i.e. those not pre-specified through objectives, and typically associated with positive feedback, also challenge established notions of context.

For one of us (PD), this was a particularly striking outcome in professional development work undertaken in Mongolia. As if often the case, working in a different cultural situation throws up questions about contextual matters that are otherwise taken for granted (see Dillon, Bayliss, Stolpe & Bayliss 2008). In brief, the argument is this: In Western educational settings, structures and contexts are substantially pre-defined, and we talk about things as ‘context-dependent’, since context is something that can be defined as the backdrop to behaviour. This is a *relational* view of context: situations and activities are understood relative to each other and relative to other situations and activities. In Mongolia occasions were observed when both meaning *and* context emerged from people’s interactions with their environments and *subsequently* could be described. These contexts, like their Western counterparts, are relational in that once they have emerged they can be understood relative to other situations. But they also have an ‘in the moment’ unpredictability about them, a ‘context’ emerges that could not have been anticipated. Because these emergent contexts are dependent on the peculiarities of a particular time, place and set of circumstances, we called them *co-constitutional.* Relational and co-constitutional interpretations are different, not oppositional or mutually exclusive. What we see in the Creative Partnership and the Learning-by-Design projects is both relational and co-constitutional manifestations of context, with the co-constitutional particularly evident in emergent outcomes.

This is essentially an ecological explanation that recognises the capacity of adaptive environments to reflect both stasis and change simultaneously. Thus a relational characterisation of the Peases West context would be that the school, the curriculum, pedagogies and teaching methods provide structured places and ‘spaces’ through which children learn, develop and socialise. A co-constitutional characterisation would be that pupils inhabit

space by continuously constructing places, both imaginary and real. Within these places, pupils' interactions with others, and with the environment, determine the possibilities and qualities of learning. An ecological characterisation, arising from the interaction of the relational and the co-constitutional, would be that space is given shape and identity by the relationships created within it. Learning is situated, adapted, localised, and connected through continual 'dialogues' between the pupils, adults and their environment.

Another interesting challenge permeated the initial stages of the Learning-by-Design project: the innovative and experimental nature of the method generated a number of obstacles and sceptical responses. For some teachers the method required a massive engagement, grander than their already complex daily routines. The method was novel, it was designed by researchers and not teachers, it was perceived by some teachers and administrators to be risky and potentially not worth the effort as there was no evidence that it would work. Moreover, some administrators and, more interestingly, some members of the research team who were involved in the less operational aspects of the project, were sceptical about the research design as its novel nature represented a potential risk of failure, something to be avoided as the project was government funded. In both cases, first the perseverance of the research team, and later the enthusiasm of the teachers involved overcame the doubts. Once the first set of results arrived, data clearly evidenced the transformative power of the methodology and indeed showed benefits that reached well beyond what the researchers initially planned and hoped for. This challenge demonstrates that novel design interventions involve taking creative risks, not dissimilar to the creative risks involved in dealing with 'in the moment' co-constitutional experiences.

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REFERENCES

Beach, K. (1999) Consequential transitions. A sociocultural expedition beyond transfer in education, *Review of Research in Education*, 24, 101-139.

Brown, M. & Edelson, D.C. (2003) *Teaching as design*. Detroit, The Center for Learning Technologies in Urban Schools.

Burnard, P., Craft, A. & Grainger, T. (2006) Possibility thinking*, International Journal of Early Years Education,* 14 (3), 243-262.

Burrows, P. & D. Loi (2004) A Surrealist Encounter: using eccentric objects and odd experiences to foster reflective and collaborative learning, *OBTC 2004 - 30th Annual Organizational Behaviour Teaching Conference, A Tradition of Teaching*, University of Redlands, CA, June 22-26, accessed 30.09.08 at: http://obtsweb.pitzer.edu/gconference/redlands2004/

Burrows, P. & D. Loi (2006) Learning-by-Design: combining a pedagogical framework and epublishing medium to create, plan and share teaching practice, *The International Journal of Learning, 13*, accessed 30.09.08 at: http://theuniversitypressjournals.cgpublisher.com/product/pub.30/prod.805

Cope, B. & M. Kalantzis (2005) *Learning-by-design*. Altona, Australia, Common Ground Publishing.

Cremin, T., Burnard, P., Craft, A. (2006) Pedagogy and possibility thinking in the early years, *International Journal of Thinking Skills and Creativity,* 1 (2), 108-119.

Dillon, P. (2006) Creativity, integrativism and a pedagogy of connection, *International Journal of Thinking Skills and Creativity,* 1 (2), 69-83.

Dillon, P. (2008a) A Pedagogy of connection and boundary crossings. Methodological and epistemological transactions in working across and between disciplines, *Innovations in Teaching and Education International,* 45 (3), 255-262.

Dillon, P. (2008b) A pedagogy of connection for active learning and citizenship, pp.59-70 in M. McManus & G. Taylor (Eds), *Active Learning, Active Citizenship,* London, CSAP.

Dillon, P. (2008c) Creativity, wisdom and trusteeship – niches of cultural production, pp.105-118 in A. Craft, H. Gardner & G. Claxton (Eds). *Creativity and Wisdom in Education.* Thousand Oaks, CA, Corwin Press.

Dillon, P., Bayliss, P., Stolpe, I. & Bayliss, L. (2008) What constitutes 'context' in sociocultural research? Paper presented at Cultures in Transit Conference, Liverpool, accessed 30.09.08 at: http://www.hope.ac.uk/ah/cultures-in-transit-conference.html

Dillon, P., Craft, A. & Best, P. (2007) *Turning Peases West Inside Out: flexible educational environments for developing pedagogies and possibilities.* Arts Council, England, accessed 30.09.08 at: http://cp-static.co.uk/static/PDFs/Turning_Peases.pdf

Dillon, P. & Howe, T. (2007) An epistemology of presence and reconceptualisation in design education, *Interchange*, 38 (1), 69-88.

Kennewell, S. (2003) Developing research models for ICT-based pedagogy, *IFIP conference: ICT and the teacher of the future*, St. Hilda's College, The University of Melbourne.

Loi, D. (2004) Document/Reflect/Create - Cultural Probes in Teaching and Learning environments, pp. 123-126 in A. Bond, A. Clement, F. de Cindio, D. Schuler & P. van der Besselar (Eds), Vol. 2, CPSR - Computer Professionals for Social Responsibility, Toronto, Canada.

Loi, D. (2005) Lavoretti per bimbi: Playful triggers as keys to foster collaborative practices and workspaces where people learn, wonder and play, PhD thesis, RMIT University, Melbourne, Australia.

Loi, D. (2007a) Reflective probes, primitive probes and playful triggers, *EPIC07 – Ethnographic Praxis in Industry Conference*, Keystone CO, October 3-6, accessed 30.09.08 at: http://www.anthrosource.net/doi/abs/10.1525/epic.2007.2007.1.232

Loi, D. (2007b) Of suitcases, playful triggers and other stories – enabling Collaborative and creative practices in post-disciplinary worlds, Presentation at *SIOP 2007 - Enabling Innovation in Organizations: The leading edge*, Kansas City, MO, October 26-27, accessed 30.09.08 at: http://www.siop.org/lec/2007/loi_abstract.aspx

Loi, D. (2008) Of participation in industry: a hybridized possibility? Participatory Design Conference – Experiences and Challenges, Bloomington, IN, October 1-4, accessed 30.09.08 at: http://www.pdc2008.org

Loi, D (2009) Leading through design enabling: practical use of design at Intel, *Design Connexity – 8th International Conference of the European Academy of Design*, Aberdeen, Scotland, April 1-3, will be available through: http://www.designconnexity.org

Loi, D. & P. Burrows (2004) A table, a box, friends and conversation: stimulating collaborative reflection, *3rd Carfax International Conference on Reflective Practice - Reflection as a catalyst for change*, Gloucester, England, June 23-25.

Loi, D. & P. Burrows (2006) Magritte and the pea: anomalous artefacts and the contexts they create, *Working papers in art and design - The role of the context in the interpretation of artefacts and visual semantics in art and design research*, vol. 4, accessed 30.09.08 at: http://sitem.herts.ac.uk/artdes_research/papers/wpades/vol4/dlabs.html

Loi, D. & Dillon, P. (2006) Adaptive educational environments as creative spaces, *Cambridge Journal of Education*, 36 (3), 363-381.

Loi, D. and S. Prabhala (2008) The Rise of Middle and Upper Middle Class in Emerging Markets: Product and Service Opportunities, *OzCHI 2008 – Design for Habitus and Habitat*, Cairns, Australia, 8-12 December, will be available through http://www.ozchi.org/mediawiki/index.php/OZCHI_2008

Loi, D., Burrows, P. & Coburn, M. (2002) The Pea Project - Design Stimulus, pp. 415-417 in T. Binder, J. Gregory & I. Wagner (Eds), *PDC02 - Participatory Design Conference 2002*, CPSR, Malmö, Sweden.

Loughran, J., Mitchell, I. & Mitchell, J. (2002) *Learning from teacher research*. St Leonards, N.S.W. Allen & Unwin.

Odling-Smee, F. J., K. Laland, & M. W. Feldman. (2003) *Niche construction: The neglected process in evolution.* Princeton, NJ: Princeton University Press.

Osberg, D. & Biesta, G.J.J. (2007) Complexity, knowledge and the incalculable: the epistemological implications of 'strong' emergence, *Interchange,* 38 (1), 35-51.

Phelps, R., Graham, A. & Kerr, B. (2004) Teachers and ICT: Exploring a metacognitive approach to professional development, *Australasian Journal of Educational Technology,* 20, 49-68.

Reason, P. (1994) *Participation in human inquiry*. Thousand Oaks, CA, Sage Publications.

Reason, P. (1998) Co-operative inquiry as a discipline of professional practice, *Journal of Interprofessional Care*, 12 (4), 419-436.

Schon, D. A. (1983) *The reflective practitioner how professionals think in action*. Temple Smith, London.

Reimann, P. & Goodyear, P. (2004) *ICT and pedagogy stimulus, Ministerial Council for Education, Employment, Training and Youth Affairs (MCEETYA), Task Force – Review of National Goals: "Australia's Common and Agreed Goals for Schooling in the Twenty-first century",* Sydney.

Sternberg, R.J. & Lubart, T.I. (1999) The concept of creativity: prospects and paradigms, pp. 3-15 in R.J. Sternberg (Ed) *Handbook of creativity*. Cambridge, Cambridge University Press.

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