Theatre of the Imagination: Blueprint Exchange

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Abstract

'Blueprint Exchange' is the catalyst for a nascent network of children and teachers who are interested in sharing stories and artefacts, concerning the UN global goals, in order to foster critical thinking, creative skills and compassion.

My research brings together Participatory Action Research and Constructivist Learning Design to help build personal agency and metacognitive skills. Learning methods transferred from art and design education are applied in primary schools through a series of practical workshops. The toolkit is adapted to whole-class practice by gifted primary school teachers in the UK and India. Children are encouraged to share lived experiences by articulating tacit knowledge through modelmaking and video production across geographic space.

Transition Design provides a framework for social transformation by encouraging children to construct a vision of what might be possible in the future. 'Blueprint Exchange' workshops have produced compelling insights that suggest art and design in mainstream primary education has the potential to impact upon cognitive acceleration. Translocated Practice with India and Mexico sets out to build a creative toolkit for teachers and children across continents.

KEYWORDS: primary education; personal agency; metacognition; creative toolkit; transition design; constructivism; participatory action research, translocated practice; global citizenship

1.0 Introduction

'Theatre of the Imagination' (Pulley, 2019) is the title of my PhD thesis, completed in February 2019. Professor Ashley Hall and Dr Esther Burkitt were my supervisors and are joint-authors of this paper. Our work illustrates how creative practice can nurture personal agency and global citizenship in primary education. 'Blueprint Exchange' sets out to carry this new knowledge forward by:

- continuing to develop metacognitive skills through design and making
- continuing to foster critical thinking through the UN global goals framework
- continuing to nurture compassion, across geographic space, locally and globally

My research journey involves primary school children and their teachers in workshops related to the contested concept of 'global citizenship'. Qualitative evidence, collected by researchers in India and the UK, illustrates how design and making can be applied to enhance creative and critical thinking. My research colleagues in Mumbai, Professor Ravi Poovaiah and Dr Ajanta Sen, are also the creators of the international conference on learning through play for which this paper has been written. Our creative collaboration produced its first outcomes 22 years ago.

1.1 Motivation

'Blueprint Exchange' calls upon the work of Malaguzzi's 'Reggio Emilia' primary school movement (Katz, 1993). Malaguzzi believed that learning and play are not separate activities and that children can form an understanding of their place in the world through interaction with others (**Figure 1**).
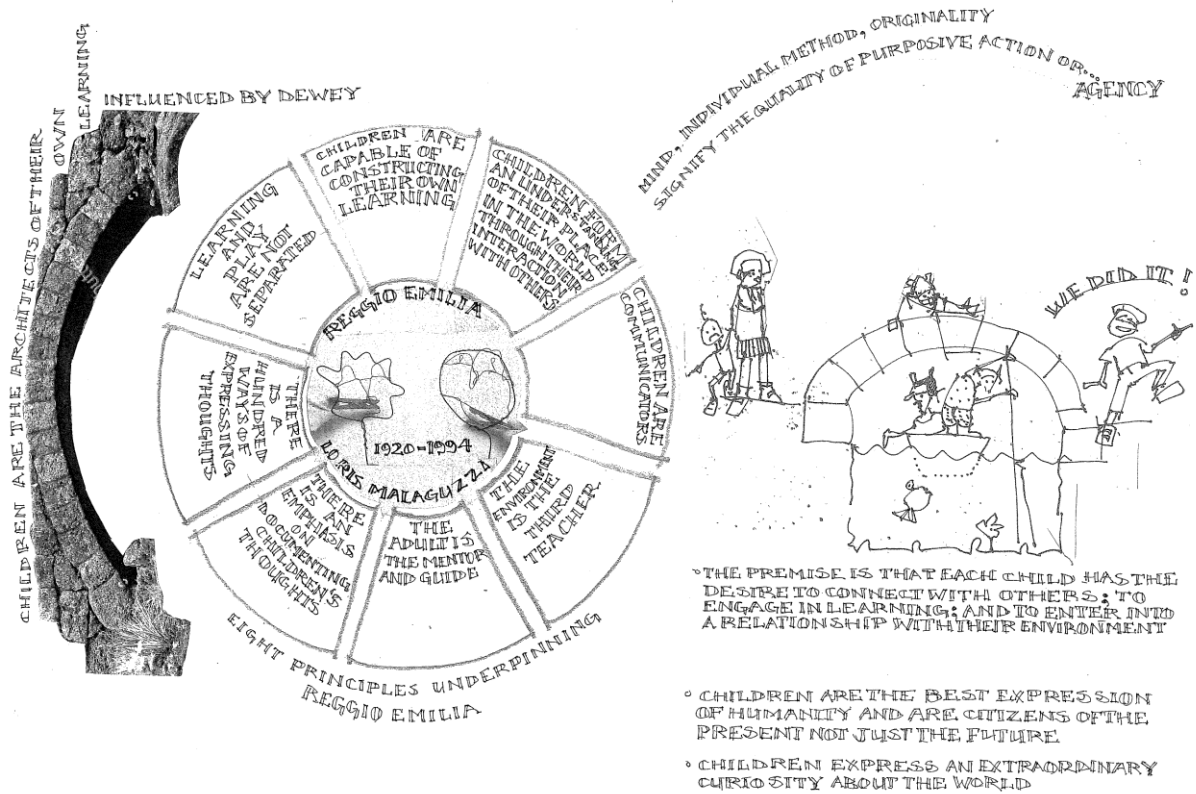

Figure 1: Reggio Emilia approach to primary education

Collaboration and co-operation, on art and design interventions, with primary schools in the UK, India and Mexico includes projects with IDC Mumbai (**Figure 2**) and with the Xilitla Foundation in Mexico. Collaborationt with fellow researchers at IITB, from 1997-2000, was pioneering in the context of Computer Mediated Design and Communication. During this early example of translocated practice (Hall, 2015), we were able to address a lack of cultural and ethnic diversity in Cornish primary education, as noted by OFSTED. In 2017 we tested the effectiveness of the nascent 'Blueprint Exchange' toolkit as a framework for critical and creative thinking in global learning.

Figure 2: Blueprint Exchange at IDC,IITB (2017)

1.2 The value of interpretivism

Alexander (2017) suggests that individual autonomy is undermined when learners are subjected to knowledge transmitted in one direction, from the 'expert' to the learner. The interpretivist approach is designed to help establish new practices, co-created with participants, to reflect upon 'ways of being'. Interpretivism proffers that people's behaviour and life chances are not determined solely by their social background and emphasises the role of the active individual and interactions between people in shaping personal identity and, in turn, wider society (Given, 2008).

Parental consent was obtained for the use of photography in my work, and includes the use of photographs in conference papers and associated websites. The images are selected to provide evidence of engagement.

1.3 The UN global goals

The UN global goals framework (**Figure 3**) was distributed to primary schools in the UK by local education authorities in 2015. This timely intervention provided a ready-made framework for exploring critical thinking related to social and environmental issues through creative practice. Hunt et al. (2015) found that global goals at primary level are linked to higher awareness of diversity and to developing learners as socially aware, responsible citizens.

Figure 3: Selected UN Global Goals used in 'Theatre of the Imagination'

Students were encouraged to become agentive and to articulate personal ideas concerning complex environmental and social issues (Bruner, 1996, p.93) and to act in their local environment, at school and at home. My purpose in combining the creative toolkit and global learning goals was to encourage mutual respect and care for others (Tunstall, 2011; Rogers and Bremner, 2017), through creative practice across geographic space.

1.4 A constructivist process for generating data

Models, puppets and videos helped teachers, practitioners and researchers to undertake visual narrative inquiry (Connelly and Clandinin, 2006, p.375) related to children's ways of thinking. According to Connelly and Clandinin, narrative inquiry is a method of understanding and inquiring into experience through 'collaboration between researcher and participants, over time, in a place or series of places, and in social interaction with milieus…'.

Embodiment of this nature may be achieved through experiential learning (Kolb, 1984) when children move from having an experience in the world to abstract conceptualisation. What learners make of these stages will determine what they learn from the experience. Metacognition encourages children to engage in a second-think time, and to think about thinking. Dialogue with peers generates dissonance which often provokes reflection and new thinking. As concepts collide, they are transformed, informed by earlier thoughts, and take on a new slant. Chow and Jonas (2010) refer to this as case transfer, a kind of abductive thinking, and 'Blueprint Exchange' emphasises the contribution creative thinking can make to such abstract conceptualisation. Constructivist Learning Design (**Figure 4**) provided a robust structure for 'Blueprint Exchange'. The theme for each workshop referenced a particular global goal and the CLD model (Gagnon and Collay, 2006) helped to structure the key stages in each workshop.
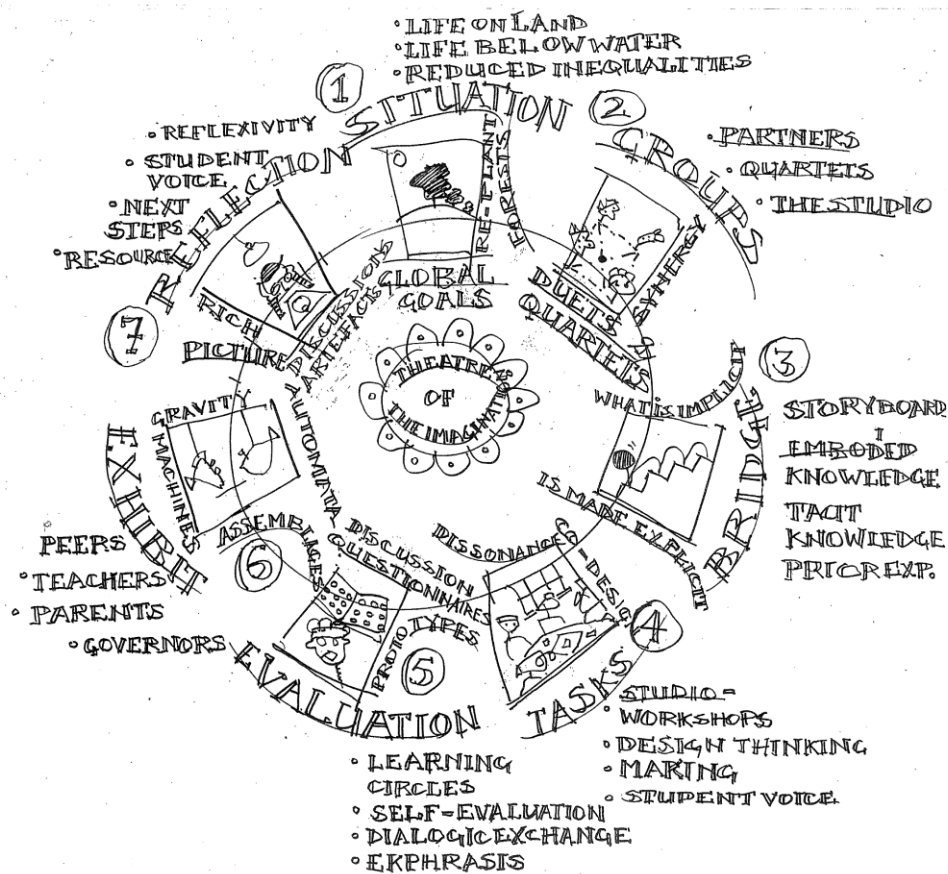

Figure 4: The Constructivist Learning Design method (Gagnon and Collay, 2006)

1.5 A 'mosaic' approach to data analysis

The sturdy CLD structure allowed each workshop to navigate a unique path, reflecting local circumstances and events. I discussed and recorded outcomes with participants and teachers during workshops, in front of displays of work, and in small seminar groups (**Figure 5**). The themes of the enquiry helped organise data using a mosaic approach (Clark and Moss, 2011). This enabled children and teachers to share data and analyse work through 'studio critiques'.

Figure 5: Learning Circle Discussions in front of my reflective diary (2018)

Data collection began with a pre-workshop self-evaluation (**Figure 6**). The questions focused on aspects of agency, metacognition and the UN global goals. Outcomes helped to highlight the difference between children's feelings and skills before and after each workshop. Feedback was also collected through one to one, and one to small group question and answer sessions.

Figure 6: Self-evaluation questionnaires at Halstow School (2016)

1.6 The composition and function of Learning Circles

Piaget (1955) suggested that to understand is to invent. Learning Circles (Collay et al., 1998) provided a platform for shared meaning-making and understanding. These groups were predicated upon co-operation, equity and mutual respect, with a focus upon reciprocity, which proved difficult when skills in self-regulation and self-efficacy were weak.

1.7 Visual narrative inquiry

Thematic and visual narrative approaches to analysis (Wang et al., 2019)) lend themselves to the constructivist paradigm and support the process of interpretation through reflection by participants. My field notes and rich pictures were part of the process of collecting feedback from participants and reflecting through drawing and writing. Video and audio recordings also helped to capture the thoughts of children and members of the learning circles.

Visual data including drawings, 3D models, photographs and animation was used to elicit stories from participants. Visual narrative inquiry has the benefit of allowing the examination of agency evolving from interaction between the individual and social context over time. Sairanen and Kumpulainen (2014) suggest we lack research on how different activity settings and their socio-cultural resources mediate the sense of agency in children. The activity setting of interest in this study is 'the studio' and by this I mean the combination of people, materials, tools, and spaces for creating and making in schools.

The visual narration of an individual's sense of agency and identity integrates their reconstructed past, perceived present, and imagined future. To establish underlying meaning, and to uncover what is not explicit, I initiated informal discussions during and after each workshop. The themes of 'Blueprint Exchange' workshops were implicit in the self-assessment questionnaires. The process of clustering visual narrative information and other data, into cohesive groupings, was akin to constructing visual 'affinity diagrams' (Kawakita, 1960s, n.d.), with emphasis upon sorting information collaboratively.

A participant in Plymouth described the process as being "...like Dumbledore's pensieve..." (Rowling, 2014, p. 490). According to Sherrington (2019) we build upon the schemata in our long term memory when conceptual information enters into our working memory and is then processed by connecting it to knowledge we already possess.

1.8 Creative thinking in the curriculum

When primary school teacher Isabel asked Key Stage 2 student Matteo, in what way the creative workshop 'Make Yours Move' (Pulley, 2017) was different to the way he would normally learn in school his response was compelling:

> It's kind of like bringing together DT, art and literacy. In school we don't normally bring those subjects together – in literacy you normally have an aim decided by the teacher, but this was more 'free' and more for us to decide. We had to decide on the story and on what our characters looked like. It made me feel kind of like a master. I dunno... in charge.

Manzini (2015) explains that diffuse design is performed by everybody and expert design is performed by those who have been trained as designers (**Figure 7**). Working together in teams may help foster meaningful social changes within local communities. Cosmopolitan localism is founded upon social justice and responsible stewardship, values and meanings which echo those made

explicit through the United Nations global goals. The ethical threads that connect 'Blueprint Exchange' and social innovation also promote transition design and as Irwin (2015) suggests:

> Fundamental change at every level of society is needed to address the issues confronting us in the 21st century. Climate change, loss of biodiversity, depletion of natural resources and the widening gap between rich and poor are just a few of the wicked problems that require new approaches to problem solving.

'Blueprint Exchange' is designed to address the urgent need to improve communication across geographic 'boundaries'. Creative practice provides an effective toolkit for transdisciplinary and trans-cultural thinking, and may help the next generation of researchers and practitioners to harness technology in order to help build a more compassionate global village.
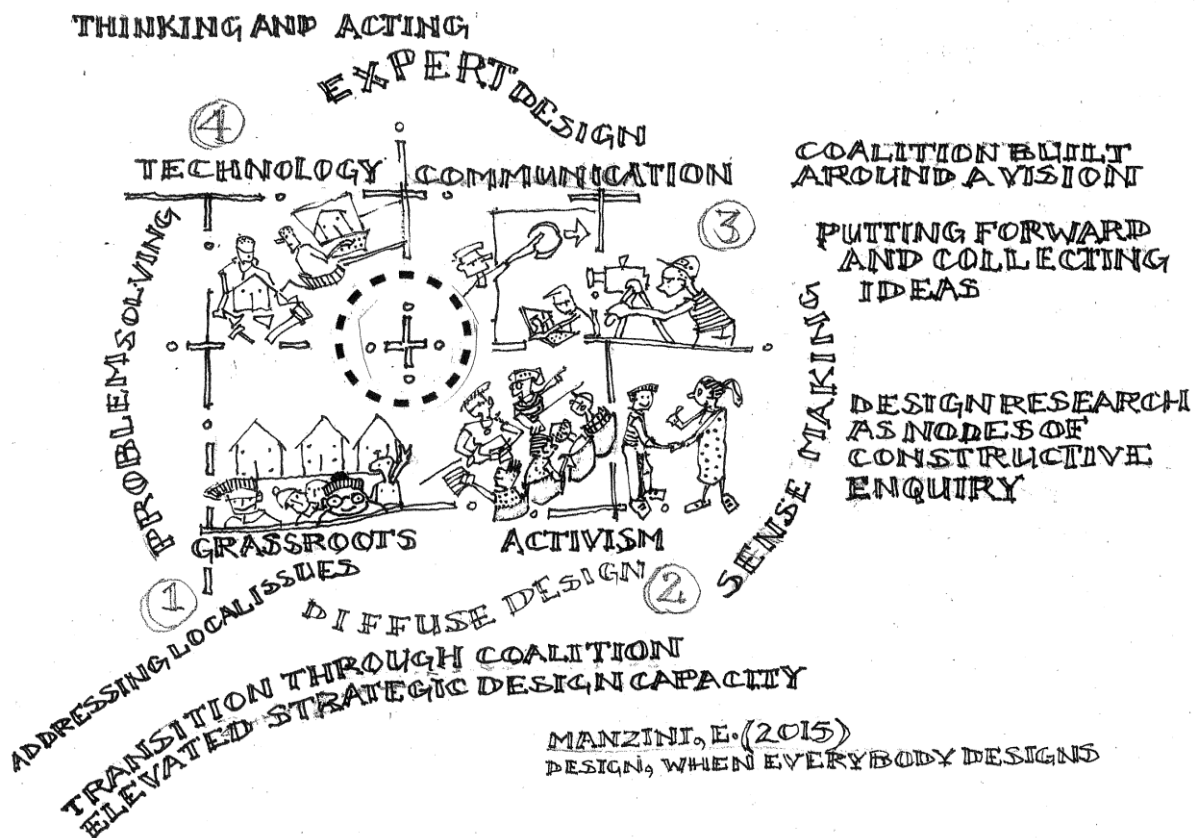

Figure 7: Diffuse Design (Manzini, 2015)

2.0 Plymouth School of the Creative Arts

Creative workshops held at PSCA in 2016 and 2017, related to Global Goal 14: 'Life Below Water', set out to foster personal agency through creative practice and to explore how design in primary schools can help generate knowledge and change attitudes towards the environment. The 'Life Below Water' workshop was conducted in collaboration with 'Kodama', a partnership of design graduates from the Royal College of Art (2016). Collaboration between a fledgling commercial enterprise, children at PSCA, and me as a design researcher at the RCA, generated ideas aimed at connecting analogue and digital animation through blended learning (**Figure 8**) .
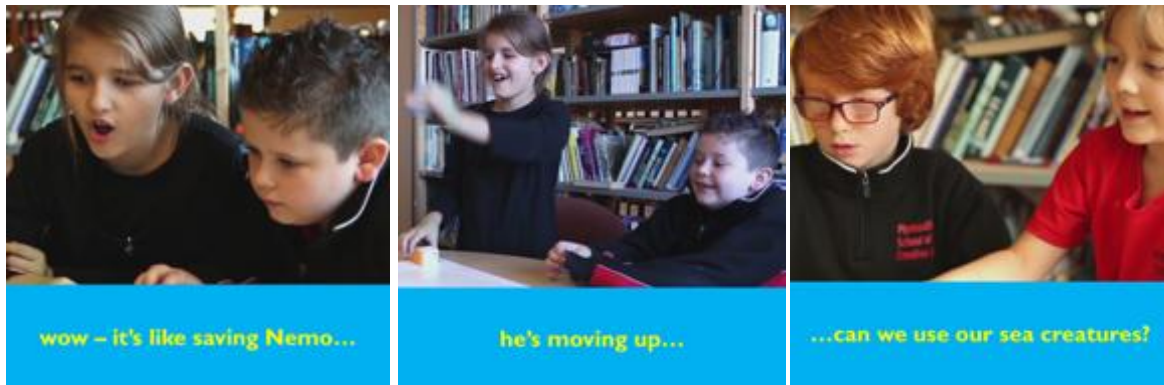

Figure 8: Lower KS2 children testing the Kodama digital animation prototype

An education in global citizenship includes opportunities for young people to develop their skills as agents of change and to reflect critically on this role (Oxfam, 2015). Transition Design provides a portfolio of methods for changing attitudes and behaviour. 'Life Below Water' focussed on the impact of pollution in our seas, what this signifies for a world where seas, oceans and people are connected, and what we can do to help (**Figure 9**). One of the UN targets is to prevent and significantly reduce marine pollution of all kinds, from land-based activities, including marine debris and nutrient pollution by 2025 (UN Global Goals, 2015).

Rachel Carson (1991, preface, p.xiii) noted:

> It is a curious situation that the sea, from which life first arose, should now be threatened by the activities of one form of that life. But the sea, though changed in a sinister way, will continue to exist, the threat is to life itself.

Figure 9: Global Goal 14: 'Life Below Water' (2015)

The pilot workshop was designed to encourage individual participants to work in duets and as part of a team. Macauley proclaimed; '…we are all members of the design studio today.' Eight lower KS2 students, a link tutor and I worked together to explore the problem in the studio. Participants, often with different levels of knowledge, discussed their thoughts on the causes of debris in the ocean and considered how changes might be made. These discussions linked a global goal to a local issue that participants had experience of in their day-to-day lives.
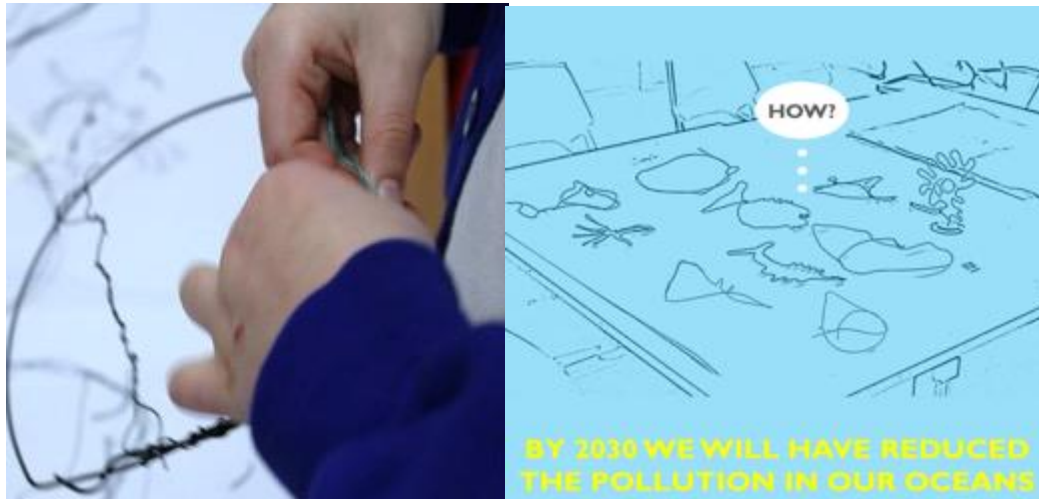

Figure 10: Magic sea creatures made by children at PSCA

Designs for magic sea creatures were drawn and drawn again. As these ideas developed, so the stories of new adventures were enthusiastically shared with partners and teachers. The wire sculptures were transformed into 'Bags of Fishy Stories', a series of critical artefacts designed to support storytelling and video-making across the evolving network (**Figures 10 and 11**). Through abductive thinking and case transfer, participants shared early concepts in the form of drawings and appeared to be striving to improve the potential of the whole team (Knight and Littleton, 2015).

The wire drawings were exhibited as 'an aquarium of magic sea creatures' which became a vehicle for visual narrative inquiry, to collect the thoughts and reflections of participants. These rhetorical devices also helped learning circle evaluation. Copies of 'Bags of Fishy Stories' were requested by colleagues from the Helen Hamlyn Centre® for a research project with children with special educational needs (2017). Copies were also requested by schools in the UK, Germany and Spain.

2.1 Self-evaluation and triangulation
Participants completed the 'pre-' and 'post-' workshop questionnaires; took part in discussions during the workshops; and took part in a critical review of the process and artefacts. Non-participant teachers, students and parents were invited to comment and give feedback during the 'show and tell' exhibition at the end of the workshop. David, an experienced art teacher at PSCA, suggested that collaboration, through the 'Bags of Fishy Stories' workshop (**Figure 11**), with non-specialist teachers might help to build confidence in using 'art practice' to develop thinking skills.
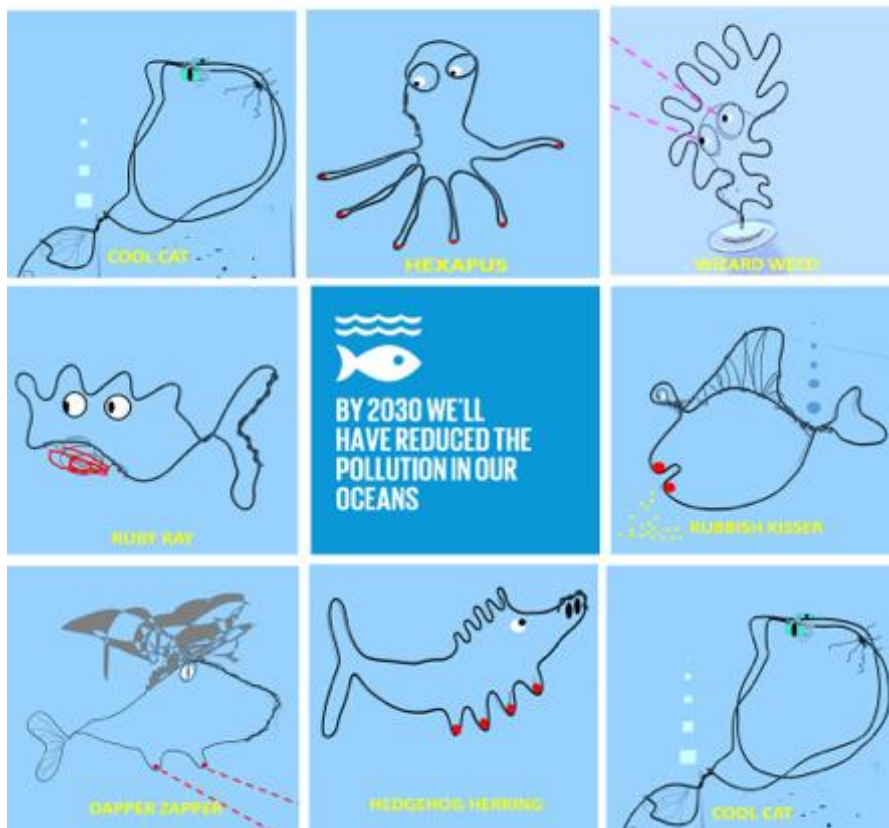
Figure 11: Bags of Fishy Stories (2017)

2.2 Analysis and findings

Students and teachers responded positively to the design of the questionnaire and the use of fun stickers to complete the 'pre-' and 'post-' self-evaluation exercises. I explained the meaning of each question and checked for understanding. While it remains doubtful that all students understood all questions, reviewing selected responses provided useful insights.

2.2.1 How effective are you in a team?

The change in perception across the pilot group was significant (**Figure 12**). The emphasis on working as teams in the 'design studio' may account in part for this positive outcome. Shreeve (2010) suggests that the studio is at the heart of education in art and design and students learn through engaging in activities which reflect those undertaken by practitioners in the field. It is possible to help children take part in a collaborative task and, at the same time, reassure each individual of their ability to express personal, embodied knowledge through thinking and making. Scaffolded learning (Vygotsky,1986) can be highly developmental when the learner is fully engaged in making things while collaborating with and supporting partners.

LIFE BELOW WATER: workshop 1	pre to post workshop scores
HOW EFFECTIVE ARE YOU IN A TEAM?	+7
HOW IMPORTANT ARE THE GLOBAL GOALS?	+22
HOW OFTEN DO YOU HELP OTHERS?	+1
HOW MUCH DO YOU LIKE COMPUTERS?	+5
HOW MUCH DO YOU LIKE MATERIALS?	+7
HOW ABOUT MATERIALS AND COMPUTERS?	+1
HOW MUCH DO YOU REFLECT UPON YOUR WORK?	+6
HOW GOOD ARE YOU AT IMPROVING YOUR WORK?	+6
HOW GOOD ARE YOU AT IMAGINING NEW IDEAS?	+2
HOW CONFIDENT ARE YOU ABOUT DRAWING IDEAS?	+1
DO YOU KNOW MUCH ABOUT ANIMATION?	+7
HOW WOULD YOU RATE YOUR MAKING SKILLS?	+7

Figure 12: pre and post 'Bags of Fishy Stories' self-evaluation

2.2.2 How often do you reflect upon your work?

The concept of reflection was the focus for student discussion based upon personal examples of what this meant in relationship to improving ideas. The outcome indicates a significant shift in perception. For example, Jude felt that remaking drawings and models during the process of designing, 'means you want to make it better'. Macauley felt that drawing 'helps you see if it's right, ... if it matches your ideas'. Summer believed that visualising ideas for sea creatures eased discussion, 'Sometimes you see how the magic power is supposed to work - but if you are not sure then you can ask'.

2.2.3 How good are you at improving your work?

Pre-workshop scores were medium to high and the post-workshop scores showed variance across the group. Summer said she found the idea of magic sea creatures funny but when it came to making the wire sea creatures she found it difficult, 'I bent this bit by mistake and thought, okay that can be its magic power ... like a Dyson for the water'. Serendipity in this case gave Summer impetus to continue making a successful model. Olivia's playful attitude translated into a shoal of small wire models of magic sea creatures, each three-dimensional sketch informing the next in quick succession. The iterative process led to her pièce de résistance, 'Rubbish Kisser'.

2.2.4 How good are you at imagining new ideas?

The perception of Macauley and Summer, that design and making helped them to imagine new ideas, provided a reliable guide to how students who show fluency in creative thinking are able to use drawing, designing and making to express innovation. Feedback from teachers and parents suggested that all children in the workshop found the link between making, thinking and storytelling inspiring. Macauley suggested, 'Designing means you can think nonsense, and then think "why not?"'

2.2.5 How would you rate your making skills?

It is possible, from the response of teachers, that the skills and confidence of children may be nurtured by encouraging design thinking and making to support a sense of agency. The deputy headteacher's observation concerning the link between making, global learning, and storytelling indicated that 'Bags of Fishy Stories' created value related to effective communication and teamworking in children and teachers. The learning circle agreed that the 'Talking Pegs' videos were a valuable method of fostering 'student voice through visual narrative'. I suggest that it also illustrates how small interventions using hand skills have the capacity to provoke big ideas. Organising skills development exercises in drawing and making can help participants to overcome an engrained feeling that they lack skills. Children as young as five repeat the phrase 'I can't draw'.

2.2.6 How about physical materials and computers?

Most participants remained engaged throughout the two half-day workshops as a climate of creativity and growing confidence flourished. The nature and range of the tasks encouraged both independent and collaborative working and students appeared to navigate changes, from one workshop to the other, without hesitation or difficulty. The two workshops, running side by side, encouraged the transfer of ideas, from one domain to another. The proposal to merge the two approaches into a blended, analogue–digital method of animation struck a chord with students, teachers and practitioners. This presented a compelling example of what Peirce (1965) described as serendipitous abduction of a surprising observation.

2.2.7 How confident are you about drawing ideas?

The transfer from drawing on paper to 'drawing' using wire was introduced through a short technical demonstration aimed at developing skills and there was a sense that the creatures were being 'brought to life', according to Macauley. This feeling reflected feedback from Noah at West Dean, who described his portraits as 'becoming like a new friend'.

One reason for using wire for drawing was to 'transport' participants into the realm of three-dimensional space and to raise questions about why and how we go about the practice of drawing or 'dithering' (Speed, 1913). The confidence and thought invested in the drawings grew as participants began the process of making and making again.

Summer began by marking herself high in confidence at the pre-workshop stage and placed her fish sticker in the 'ummm...' circle at the post-workshop stage. When asked about her self-evaluation, she said, 'I thought I knew all about drawing but now ... it's like a new thing'. Year teacher Huw said that he could see the connection between drawing and thinking. He continued to explain that

this meant he could see the relationship between the mind, imagination, and the physical world. As time progressed, the 'studio climate' became more experimental and it was rewarding to see students drawing and redrawing ideas without being anxious about the judgement of peers.

2.2.8 How much do you know about animation?

Learning circle discussion following 'Life below Water' focussed upon the potential for real-time animation, offering users the opportunity to select or make physical characters as a visual communication tool. Participants felt this might be helpful for children who speak different languages, teachers and students with special educational needs, scientists, artists and communicating with culturally diverse communities across geographic space. One member of the learning circle suggested that real-time animation could be a useful communication tool for doctors and young patients, to improve diagnostic insights. By making videos, using the magic sea creatures as puppets, children brought critical and creative thinking together.

2.2.8 How important are the global goals?

The level of change in the post-workshop assessment constituted a huge shift in understanding, and had by far the greatest impact across the entire questionnaire as participants discussed the effect plastic debris has on animals and the environment.

Imagining and making sea creatures with magic powers over the two half-day workshops was designed to reinforce the connections children made between local and global environments and to nurture creative thinking about how their interventions might improve things. The degree of change in participant awareness suggested that exploring a problem through critical and creative thinking encourages reflection in children. Thinking, and thinking again, while planning an effective approach to problem exploration is at the heart of metacognition. 'Making' made critical thinking tangible, as Matteo at Halstow School explained (Pulley, 2017), '…it's like holdable proof.'

I raised arguments for and against the contested global goals framework and encouraged participants to develop counterarguments in their teams and with partners. Tom suggested that as the UN target dates are way into the future this gives offenders licence to continue offending: "How do you get someone to stop doing what they already know is wrong?" Other participants felt that 'the rules' needed to be changed.

2.3 Second-order thinking and iteration

The second workshop at PSCA began by testing if the 'Bags of Fishy Stories' could be used to provoke new narratives and elicit opinions about future changes in our 'ways of being'. Glanville (2004, p. 1382) describes second-order cybernetic conversations thus:

> …communication that takes place between entities that build understandings out of their interpretations of what they sense their conversational partner (or partners) offer them. This understanding is fed back to their partner(s) in new offerings that the partner(s) in turn interpret and compare to their original intention.

The second morning session was spent making experimental video clips using iPads, which students were already adept at using. The children and I relocated to a corridor space to develop an effective co-design team in what became an ad-hoc studio space for making videos (**Figure13**).
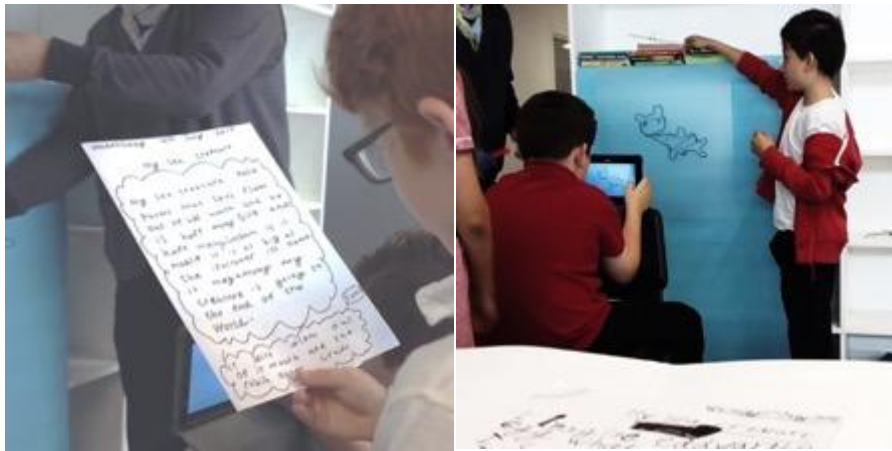

Figure 13: 'Talking Pegs' videos (July 2017)

Barbetti (2012, p.81) quotes from an interview with art critic Roberta Smith:

> Art accumulates meaning through an extended collaborative act. ... you put into words something that everyone has seen. That click from language back into the memory bank of experience is so exquisite. It is like having your vision sparked.

Participants were excited to discover that their sea creatures reflected a research project by scientists at the University of California, San Diego (Lott-Lavigna, 2015), who are reported to have engineered 'microbots' that move through and clean sea water, removing carbon dioxide. Although the design brief was framed as developing sea creatures with magic powers, the discovery of this university-based research project generated surprise and delight (**Figure 14**).
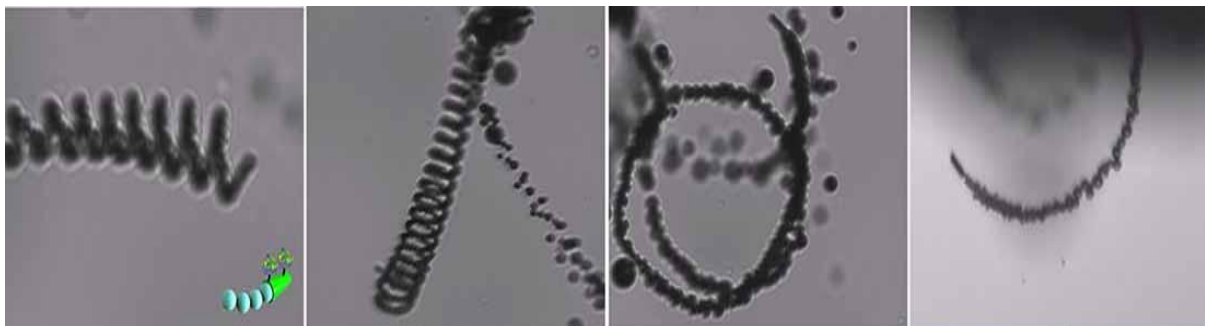

Figure 14: Movement of a micromotor in sea water at UC San Diego (2015)

Children in Plymouth expressed a wish to share their story to inspire participants from other primary schools to generate ideas related to global issues at the local level. Tom and Macauley mused: 'I wonder what children in another country would do?' My research aim is to help children exchange ideas across continents in collaboration with research colleagues in the UK, at IITB and the UN.

Children's puppeteering went through a process of 'toing and froing' between the material domain and abstract conceptualisation. Models were in a continuous process of flux, and there was always

the potential for further discovery. Prototypes were ideas in transition as children shared stories and made video animations in the studio (**Figure 15**).

Figure 15: Storytelling experiments with talking pegs and magical sea creatures (2016)

2.4 Learning circle discussion

Discussions about the project with teachers and senior members at PSCA gave rise to valuable perspectives and insights. For example, associate headteacher Andy explained: '…it's great to see how they are combining making with innovation and storytelling. I think this way of working would also lend itself to science – and particularly to physics. It reflects the ethos of our school…'. A lower key stage 2 co-ordinator said: 'I can see how this connects children's kinaesthetic skills to literacy and numeracy and the benefit this may have...'. A newly qualified teacher suggested: 'The process and outcomes are engaging. My research interest is in learning styles and I can see how kinaesthetic learners are telling stories about life in our seas and how they are 'owning' the issues you have been discussing with them...'. A design and technology teacher reported: 'Focussing upon the process has great benefits for learning through reflection and revising your ideas. The problem is that it can seem intangible and so difficult to assess – there is no finished 'thing' that summarises what has been achieved to 'tick the box…'. I pointed to the completed self-evaluations and explained that children also recorded their process of development on video. The children's mantra became, '...we are a design team'.

2.5 Visual narrative findings

Olivia synthesised declarative knowledge concerning a specific global goal with drawing and making as process:

> **Olivia:** I like tropical fish, their 'roundy' bodies and big eyes…and their lips move like they're kissing something in the water.
>
> **Me:** Can you remember how you came up with this idea?...
>
> **Olivia:** Yeah…my mum kisses me when I fall over and stuff…that's like magic, right?
>
> **Me:** …do you think Rubbish Kisser works like that?
>
> **Olivia:** Ummm…I don't know, there's no such thing as magic really, is there? (looking toward the Kodama table)…perhaps I can learn how to make magic things because they learned how to make that computer game…and I could not make this (Rubbish Kisser) until now.

Olivia's account indicated that she understood it is possible to do new things tomorrow because she remembers that she had not tried making 3D wire models yesterday. This indicated a sense of agency and a conception of what is possible in the future.

In the same workshop, Macauley explained how a combination of making physical models using wire and playing with the Kodama digital animation software made him think about developments that might be possible in the future. He explained, 'I like my model more than their figures and thought - if I could use my idea instead then it would be more - from me…'. Macauley realised he had licence to add his thoughts to the process of designing and he sensed the possibility of a new invention was within his grasp.

It is worth noting that Summer's baby brother's name is Eddy:

> **Summer:** Eddy-turtle is a magic creature… he (Eddy-turtle) eats waste plastic and then poos seaweed to catch sunlight and make food for other animals. Eddy-turtle wants to build homes for his friends.
>
> **Me:** …how long do you think that would take?
>
> **Summer:** Not long because he poos a lot.

3.0 New insights

The children's heightened level of engagement and concentration was noted by several respondents involved in the feedback session and was underlined by the number of non-participant children who expressed a wish to take part. The transferability of the learning approach was commented upon by a senior teacher at PSCA and the potential for professional development of non-specialist teachers emerged through observation and discussion. Feedback on the workshops supports the proposition that participants and teachers feel design and making is an effective tool for fostering metacognitive thinking in primary aged children. And we know metacognition accelerates cognition.

Evidence collected from the workshops indicates that 'Blueprint Exchange' nurtures the development of creative skills and critical thinking skills. Working in 'the studio' in duets and quartets encourages dissonant opinions to be heard. Evidence also suggests that exploring the global goals builds declarative knowledge and the process of Constructivist Learning Design scaffolds procedural knowledge. Participatory Action Research and Visual Narrative Inquiry help to make meaning out of discussions with children, teachers and members of learning circles. Thinking, reflecting and thinking again exemplify second-order cybernetics in the studio.

Working as a design studio and encouraging open-ended creative thinking in mainstream primary education can be messy, uncertain and challenging. The challenge is worthwhile because primary children are able to develop metacognitive skills and, during this process, reflect upon their stance in relationship to the global goals.

Reassuring participants of their ability to express imaginative ideas as personal, embodied knowledge helps to foster a culture in which caring for partners and learning through making supports self-efficacy. Personal agency helps balance 'symmetrical reciprocity' between facilitators

and children as activities play out. The workshop structure allows 'creative turns' and unexpected opportunities to take hold in response to the ideas of children.

Ideas generated and tested included 'Translocated Practice' with international colleagues as a first step towards building a network, across continents, for transition design and making. The research team at IITB developed a series of creative workshops in response to reciprocal exchanges. Teachers in the UK feel it would be possible to develop empathy in children across geographic space through 'Blueprint Exchange'. Valuing diversity and nurturing 'care-full' stewardship of the planet and its people, at a time of political fragmentation, is a critical issue for the next generation.

Adding the creative toolkit to a growing body of work aimed at broadening and enriching the primary curriculum while driving independent learning, may help to engage more teachers in design and more designers in teaching. Children assessed as average using the current schema or judged not performing at the average level for their age, often displayed advanced creative ability. Some students with a higher level of mastery in numeracy and literacy were more tentative and less confident when generating imaginative ideas through making and abductive reasoning.

The creative toolkit may help to off-set the paucity of creative practice in teacher-training programmes. Many experienced commentators believe that the primary curriculum is not fit for purpose and 'smart technologies' have impacted negatively on the development of haptic skills and peer-to-peer co-operation. Blueprint Exchange helps provide an antidote.

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