Life Below Water: How Can Creative Practice Nurture Personal Agency and Global Citizenship in Primary Education?

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Abstract

'Life Below Water' aims to establish how creative practice can provide an effective way to nurture self-efficacy and self-regulation in primary education. A constructionist approach was developed to help children explore UN Global Goal 14, through drawing, prototyping and storytelling as collaborative activities. Working in duets and quartets, a group of eight Key Stage 2 children were set the task of 'inventing' sea creatures with magical healing powers. The children evaluated their progress through pre and post-workshop questionnaires, and through discussions with their peers, teachers and parents. Workshop outcomes illustrate how nurturing skills in making can help foster creative agency and metacognition. Co-operating as a design team encouraged symmetrical reciprocity, self-regulation and a 'care-full' approach to environmental protection. The study provides guiding knowledge for prospective developments, based upon tentative findings. The time required to assess the impact of 'Life Below Water' is extended to enable future research efforts, by teachers and practitioners, to inform context-specific interpretations through whole-class workshops and international exchanges.

Keywords

constructionism, creative agency, global citizenship, metacognition, primary education

Introduction

Professor Kneebone (2017) suggested that the hand skills of surgical trainees are often not fit for purpose during an informal exchange with me. He reckoned this might be down to a lack of time spent making things at primary school. 'Life Below Water' picks up on the importance of making in primary education by suggesting it can also help children to become responsible citizens and independent thinkers.

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). Hunt & King (2015) found that global goals at primary level are linked to higher awareness of diversity and to developing learners as socially aware, responsible citizens. Researchers at UCL also found that most respondents believe that global learning helps foster community cohesion, school ethos and 'pupil voice'.

There are commentators who subscribe to global citizenship's ability to address global problems and there are those who view the concept as imperialist and a contradiction in terms (Pashby *et al*. 2021). An attempt to address this impasse resulted in the development of the 'United Nations Goals for Sustainable Development' (UN SDGs 2015). Prior to the SDGs initiative, Dori Tunstall (2011) recommended that we stimulate the adoption of a trans-modern value system because cross-cultural exchange can foster compassion. In an attempt to synthesise Tunstall's ideas and the global goals, 'Life Below Water' was conceived.

Those involved in the project were invited to reflect upon qualitative data arising from constructionist 'thinking through making' workshops. I developed and tested these workshops across geographical space by sharing artefacts, created by children and teachers, with research colleagues who helped to generate evidence concerning the impact of making on agency and metacognition. Participants came together in 'Learning Circles' (Collay *et al*. 1998), a key research instrument

TABLE 1 Members of the learning circle

Participants	Titles	Role	Involvement
Pupils 1–8	KS2 pupils aged 7–8	Making & writing	Workshops 1 & 2
Postgraduate 1	Design entrepreneur	Photos & feedback	Workshop 1
Postgraduate 2	Design entrepreneur	Photos & feedback	Workshop 1
Link tutor 1	Student–teacher	Learning circle	Workshop 1
Teacher 1	PGCE student	Learning circle	Workshop 1
Teacher 2	Head of year	Learning circle	Workshops 1 & 2
Teacher 3	Design technology	Learning circle	Workshops 1 & 2
Teacher 4	Art & philosophy	Learning circle	Workshop 1
Administrator 1	School manager	Learning circle	Workshop 1
Administrator 2	Assoc. headteacher	Learning circle	Workshops 1 & 2
Researcher 1	Post-doc tutor	Testing & feedback	Toolkit user

applied in 'Life Below Water', to help evaluate workshop outcomes as part of the process of qualitative analysis (Table 1).

Student responses to some of the pressing issues of our time are introduced under 'Qualitative Evidence'. This is where the creative agency of children is scrutinised alongside their ability to embrace cognitive dissonance (Festinger 1957).

Contextual Framework

Evidence suggests that normative quality assurance procedures in the primary sector (Burkitt & Lowry, 2015) and (Burkitt in conversation, 2016) need to be eased to give teachers in mainstream schools an equal level of control to that of teachers in the independent sector. Under these circumstances, adopting creative practices applied in 'Life Below Water' may help to reset the balance between teaching to tests and developing creative agency and independent thinking in children.

Government-funded research

Alexander (2010) suggests that 'exciting the imagination' through creative skills has a significant potential to nurture self-regulated learning and self-efficacy. A complication arises from research carried out by Winner *et al*. (OECD, 2013, p. 41) which concluded:

> We did not find support for the kinds of claims that we typically hear made about the arts – that infusing the arts in our schools improves academic performance in the form of higher verbal and mathematical test scores. . .and makes children more innovative thinkers. It is here that we have to conclude: not yet proven!

The debate concerning knowledge and skills divides educators. 'Life Below Water' includes the methods of instruction that involve cognitive activity alongside discovery learning, supported by skills development (Thomas *et al*. 2015). The workshops transfer signature creative pedagogies from tertiary education as methods of learning and teaching in primary schools. These pedagogies echo those highlighted by government research published in 'The Education Endowment Foundation Toolkit' (EEF 2015). The toolkit describes feedback, metacognition, peer tutoring, oral language intervention and small-group tuition as methods that generate 'high gain'. The EEF research quotes Winner's report yet promotes a list of the most established art and design learning and teaching methods.

Constructionism

Constructionism (Papert 1993) proposes that mental models are strengthened when people are active in making things in the real world as a process of experiential learning (Kolb 1984). Constructionism focuses on 'learning to learn' and Papert demonstrates how conversations can be mediated through artefacts to help learners construct new knowledge.

Papert builds upon the work of Piaget (1936) by arguing that making ideas tangible and shareable helps children to communicate tacit knowledge through visual artefacts and related narratives. He proposes 'diving into' situations and thus apply empathy to the service of intelligence. Papert was concerned with how people think once their convictions break down and expanding their view of the world

becomes necessary. 'Life Below Water' presents an opportunity for children to 'dive into' global learning through drawing and making.

Creative practice in primary schools

According to Burkitt, creative skills have the potential to nurture agency in mainstream education, a characteristic that fosters confidence and greater equality of opportunity with peers from more economically privileged backgrounds. Burkitt suggests that mainstream primary schools find it difficult to match specialist schools in teaching creative arts practice. This, she argues, is in part due to limited opportunities for professional development in an increasingly marginalised area of the curriculum. 'Life Below Water' sets out to bridge the gap between the skills of children and non-specialist teachers in mainstream schools and those in independent schools.

Thompson & Hall (2016, p. 5) define learning through art and design as: '... the shaping of the learning environment as a whole, in classroom settings, and more widely in the school and community.' Their research explores the differences between learning through the arts and the 'default pedagogy' established in schools by a standards agenda that defines excellence in terms of progress against a limited set of indicators.

Metacognition and creative thinking

Hargrove and Nietfeld (2015, p. 292) reported that there is little indication that deliberate creative thinking strategies are being taught in design at tertiary level, let alone primary level, in the United States and the United Kingdom. They advocate a metacognitive approach to learning and teaching in creative practice to help practitioners think strategically to improve explanation and interpretation, application and perspective, empathy and self-knowledge. Viewed from this position, metacognition supports narrative inquiry (Connelly & Clandinin 2006) by comparing current and future potentialities. In the case of 'Life Below Water', the future is a place we imagine together by thinking through making.

Design is a sequential process of description and redescription, and designs are transformed tween through a visual and mental transaction between the practitioner and the representation. 'Life Below Water' encourages re-representation as a method of thinking about thinking (Flavell 1979; Fisher 1998; Knight & Littleton 2015) and as a way of igniting the imaginations of children and their teachers.

Interpretivism

Alexander (2017) established that individual autonomy is undermined when learners are subjected to knowledge transmitted in one direction, from the 'expert' to the learner, in preparation for tests used to assess numeracy and literacy. The interpretivist approach (Kincheloe & McLaren 2000) suggests new practices, co-created by participants, to challenge 'ways of being'. At a time when actions in the realm of ideology have global effects, it is critically important to give children the opportunity to develop and express an independently constructed opinion.

'Life Below Water' explores the concept of 'symmetrical reciprocity' (Fals Borda, in Reason & Bradbury 2008, p. 30) as a research approach that nurtures mutual respect between participants, and between humans and nature.

Transition design

Irwin *et al.* (2015) believe that transition design takes design for social innovation further by developing new socio-economic and political paradigms. They share Manzini's (2015) commitment to rebalancing freedom and equality through cosmopolitan localism. 'Life Below Water' sets out to introduce children to practices that help raise awareness of issues impacting upon their immediate surroundings and the world as a whole.

Transition design promotes change by fostering 'Living Systems Theory' which explores phenomena in terms of dynamic patterns (Geels 2002). Irwin suggests that niche innovations, such as 'Life Below Water', may be co-constructed and disseminated to influence the wider landscape.

Methodology

'Life Below Water' adopts a constructionist epistemology and explores the ontological concept of freewill in children and their teachers. The question: 'How can creative practice nurture personal agency and global citizenship in primary education?', is supported by the aims of the project.

The first aim was to design a series of creative workshops, based upon selected global goals, as a vehicle for discussion and enquiry into the research question. The

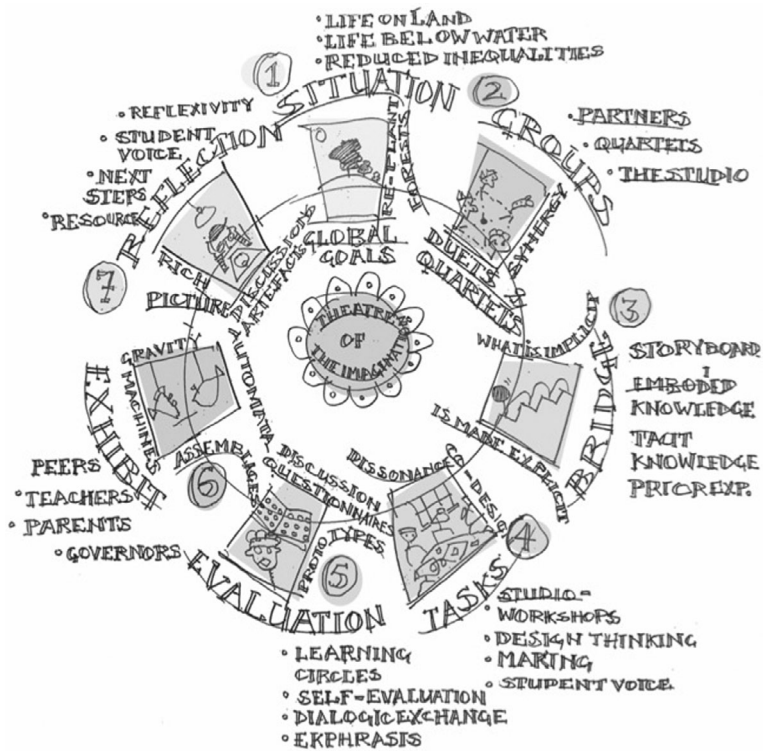

Figure 1
The Constructionist Workshop Process (2018).

second aim was to explore connections between making and metacognition. The third aim was to raise awareness of the UN global goals. The research instruments are described in the Methods section and the Workshop Process.

Methods

Gagnon and Collay's 'Constructivist Learning Design' (CLD, 2006) was adapted to create a 'constructionist' approach to the workshops (Figure 1). The CLD process emphasises six elements: Situation, Groupings, Bridge, Questions, Exhibit and Reflections. A seventh element, Evaluation, was added to the sequence, between 'Tasks' and 'Exhibit', to make qualitative data analysis an explicit stage of the journey. This cyclical process of planning acting, observing and reflecting constitutes classical action research (Revans 1989).

According to Collay *et al*., Learning Circles are small communities who come together intentionally for the purpose of supporting each other in the process of learning through sharing and good discussion (Figure 2). Members of the 'Life Below Water' Learning Circle contributed to the process of evaluation and analysis by reviewing artefacts and videos emerging from the workshops and by triangulating qualitative data.

Two workshops were organised so that each would run for a day and a half, separated by a period of 6 months. Part one and part two were carried out in the same primary school, with an identical group of children. The students were invited to create magical sea creatures and describe their special powers through drawing, model making and video-animation. Participants discussed their creature's attributes in corridors, studios and in critiques during informal 'Exhibitions'. These events, taken as a whole, provided a myriad of opportunities for collecting data and for triangulating interpretations. The artefacts produced by the children, and the proximity of the Learning Circle to the site of production, provoked good discussion and insightful analysis.

According to Adams and Atherton (2018, pp. 4–5):

> Artistic experiences are the creative foundation for life; in the home, in families, with friends, in communities, in early childhood settings, with the people they encounter, and in times spent alone where children may glimpse other worlds through the arts.

Analysing images and models produced by children meant looking for interpretations while reflecting on their visceral impact. Physical outcomes were treated as critical artefacts (Bowen 2009), to help provoke discussion and analysis (Figure 3). The models and videos assisted teachers and children in the process of what Connelly and Clandinin describe as narrative inquiry (Connelly & Clandinin 2006, p. 375). They explain that narrative inquiry is a way 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' (2000, p. 20).

The Learning Circle utilised studio critiques as vehicles for inquiry. It also supported me in the production of my 'Research Journal' (2016), in which I recorded various encounters with participants. This Journal took the form of a portfolio of my drawings, quotes from children and teachers, and Learning Circle reflections, gathered during and after each workshop. Pages from the Journal also helped to inform our discussions.

Figure 2
Members of a Learning Circle evaluating my Research Journal (2018).

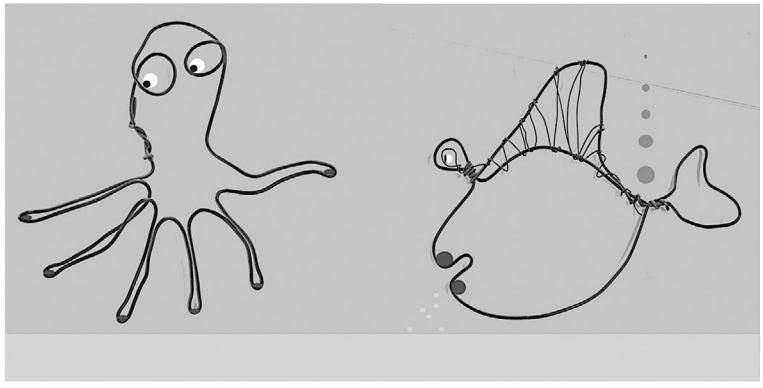

Figure 3
Hexapus and Rubbish Kisser (2018).

The informal 'Exhibitions' called upon a 'Mosaic' approach, organised by children, teachers and researchers to encourage data sharing. There were two stages: in stage one, the children and adults gathered the data; in stage two, the data

were pieced together and 'pinned-up' by adults and children for dialogue, reflection and interpretation (Clark & Moss 2005).

The Workshop Process and Activities

Each step of the constructionist workshop process included good discussions, captured in audio and video recordings and in my Research Journal. Part one concentrated on introducing the global goal framework, imagining and making sea creatures and on subscribing magical powers. Part two focussed upon a review of the outcomes of part one and on the production of a series of video animations of the sea creatures and their magical exploits.

Situation

'Life Below Water' was a topical subject for a school located in an historic sea port. Prior to the first session, children completed the Likert Scale questionnaire which I produced as a small booklet. Once participants had positioned stickers against each of the multiple choice question, we watched a UN video concerning Global Goal 14. One of the targets of 'Life Below Water' is to prevent and significantly reduce marine pollution of all kinds. The 'Situation' stage ran for around 40 min and generated discussions across 'the studio'.

Groups

Part one of the workshop was designed to encourage participants to work in teams. I positioned myself as an orchestrator of the 'studio' to help create a 'zone of proximal development' (Vygotsky 1986). Teachers, administrators and other children drifted in and out over the course of the event. A core group of four boys and four girls, aged between 7 and 8, were organised into duets and quartets to encourage creative responses to the causes of pollution in our oceans.

Bridge

Following the first morning break, children were invited to imagine what a sea creature with magical powers might look like, based upon a game of 'exquisite corpse' (Breton, circa 1930). Abductive thinking helped participants to share ideas with their partners. Creative practice and dialogue fostered 'scaffolding' between children working together and sharing knowledge and skills in the studio. The 'Bridge' stage ran for around 30 min in the part one workshop and melded into the 'Task' stage through iteration and second time thinking (Garton & Renshaw 1988).

Tasks

Magical sea creatures were drawn and drawn again and ideas related to magical powers were shared. Haptic skills were honed as wire was twisted and formed to create 'magical sea creatures'. One-to-one working meant all participants were immersed in the model-making process of 'toing and froing' by the end of the first session of part one.

Garton suggests such dyadic exchange fosters a common understanding. Line drawings in pen and pencil were translated into wire sculptures. A short demonstration on how different thicknesses of wire could be bent, manipulated and joined, was followed by one-to-one support where necessary. Thinking through making and re-

making was encouraged as a metacognitive skill. The 'Task' session ran for 2 h—1 h before lunch and 1 h in the first session following the lunch break.

Evaluation

The pre- and post-workshop questionnaires provoked a series of discussions between children during the part one workshop. These fed into the Learning Circle's review and analysis of creative outcomes. During this critical review, participants had an opportunity to give and receive formative feedback and explanation. Thoughts were collected in collaboration with children, teachers and researchers on site, reflecting the Mosaic approach described by Clark and Moss. Interpretations by the children responsible for creating the work were elicited as part of the 'Exhibition'.

Exhibition

Evaluation took place during informal Exhibitions, mounted at the end of each workshop for approximately 1 h. The wire sculptures produced by children during part one were displayed in the studio which encouraged comments by students and teachers. Many non-participants showed interest in getting involved, and some wanted to try making wire sculptures 'on the spot'. This was facilitated, to some extent, by all participants.

Non-participant teachers, students and parents all gave feedback during the Exhibition of the part one artefacts. The wire drawings were arranged as an 'aquarium of magical sea creatures'. According to Administrator (1), the exhibition '...gave everyone a perfect opportunity to listen to the children's stories and thoughts'.

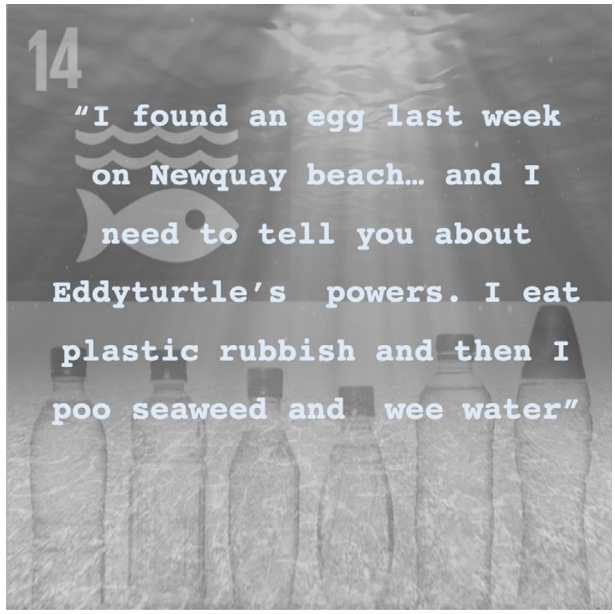

Figure 4
A poster from 'Bags of Magical Stories' (2018).

Reflection and re-making

Outcomes from this reflective exercise generated insightful ideas during and after the workshops. One such idea arose at the end of part one. Students (1) and (2), Teacher (3) agreed that I should produce printed images of the sea creatures as a series of cardboard 'sleeves'. These became known as 'Bags of Magical Stories' and were used to kick-start the 'part two' workshop 6 months later. The sleeves were filled with drawings, descriptions of magical powers and questionnaires (Figure 4).

Qualitative Evidence

While the completed questionnaires from respondents did not provide 'reliable' findings in a quantitative sense, this small sample provided good qualitative feedback and helped triangulate the thoughts of members of the Learning Circle. The questionnaire raised awareness of the aims of the workshop and acted as a reminder of the 'state of play' at the beginning of part two, as part of 'Bags of Magical Stories'. It also provided a 'guiding script' for discussions (Table 2).

Creative agency

Members of the Learning Circle agreed that by nurturing a simple set of making skills, participants were able to express independent, imaginative ideas in new ways. The ephemeral nature of the materials encouraged reusing and remaking. Children began to develop their 'visual vocabulary' while determining what special powers their sea creatures possessed. Allowing things to take an unplanned course encouraged second time thinking through prototyping. Student (8) pondered: 'How do you get someone to stop doing what they already know is wrong?' This

TABLE 2 Summary findings of Likert scale questionnaire

Self-assessment questions for life under water	Total pre- to post-movement
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 working with computers?	+5
How much do you like working with materials?	+7
How about computers and materials?	+1
How often 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 your ideas?	+1
How much do you know about animation	+7
How would you rate your making skills	+7

prompted Link Tutor (1) to suggest that working as a studio team helped foster self-regulation when faced with cognitive dissonance (Festinger 1957).

The informal exhibition in the late afternoon of day 1 provided opportunities for the children to discuss work with friends, parents and teachers. By reflecting on their drawings and models, self-efficacy and self-regulation 'appeared to flourish' (Teacher 1, Research Journal, 2016). Orr and Shreeve suggest 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.

Showing someone how, as opposed to doing things for, provoked a markedly different level of engagement. So it became clear that the teaching approach taken at pivotal moments demanded student-researcher proximity and awareness. The line between nurturing agency and missing the opportunity to show how making enables independent thinking was carefully navigated. Independent learning accelerated when children 'rubbed shoulders' in the studio.

It took time to inculcate this way of working and when scaffolding was effective 'creative ideas and objects flowed effortlessly' (Research Journal, 2016). Teacher (3) felt the ease shown in generating new ideas provided sound evidence of self-efficacy through making and wondered how this might be reliably measured (Learning Circle, 2016). We discussed how the nature of 'making as dialogue' was exemplified through the artefacts. Teacher (3) felt that the sea creatures constituted 'creative interventions as an outcome of research through practice' (Research Journal, 2016).

Teacher confidence and skill is a crucial factor in the classroom as studio. As time progressed, my confidence grew and self-regulation became more evident in students through prolonged periods of concentration and a willingness to 'help me out'. This had a positive impact upon the group and upon me. Teacher (4), a highly experienced art teacher, suggested that collaborative workshops with non-specialist teachers might help to 'change mindsets' concerning the value of creative practice in relationship to self-regulation and self-efficacy.

In the part two workshop, participants spent the first morning session discussing and reflecting upon ideas using the 'Bags of Magical Stories' as critical artefacts. The making of new wire drawings took place in the afternoon session when a continuous stream of non-participants joined the group to try out drawing with wire having seen the outcomes from part one. This provided good evidence in support of using the creative workshops as an effective method of engagement.

The afternoon session of the part two workshop was spent making experimental videos using iPads. The children were adept at using these as a result of prior skills development work with Teacher (3). Combining analogue and digital skills provided evidence of how blended learning can promote creative agency (Figure 5).

Drawing and model making sparked the imagination and provoked visual narrative accounts of things remembered, combined with new ideas. Videomaking and puppeteering went through an intense process of trying and trying again, iterating between the material domain and abstract conceptualisation. Models were in a continuous process of flux, and there was the potential for further discovery at any moment. Participants felt that prototyping was pivotal in generating thinking through re-making (Learning Circle, 2016).

In the part two workshop, children were 'flabbergasted' (Research Journal, 2016) to discover that their sea creatures reflected a project by scientists at the University of California (Lott-Lavigna 2015). During this university-based research project, students in San Diego engineered 'swimming microbots' to help clean sea

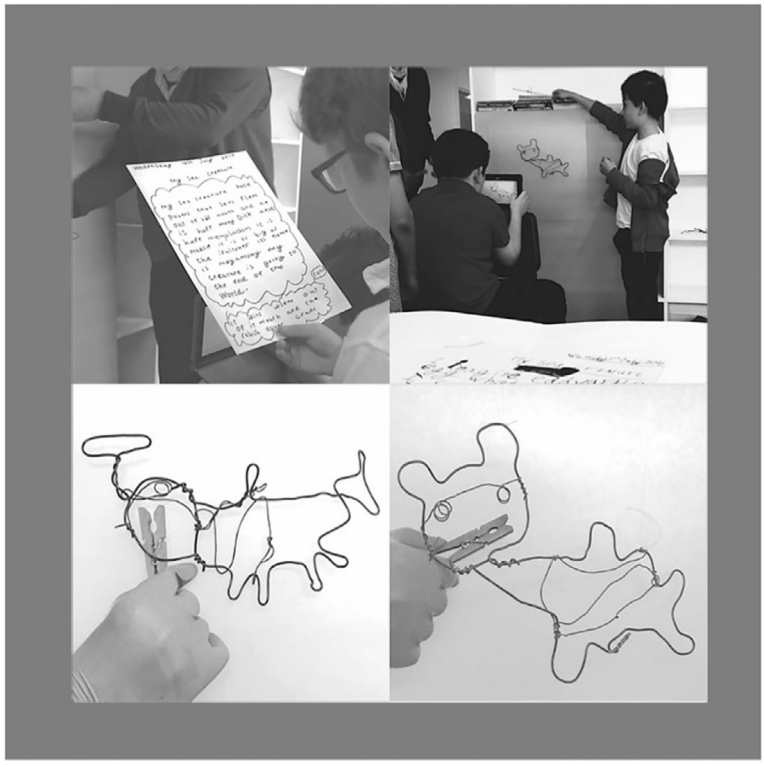

Figure 5
Making 'Life Below Water' videos (2018).

water by removing carbon dioxide. Although the 'Life Below water' brief was framed as developing sea creatures with magic powers, the San Diego research project fostered confidence in participants to 'think the unthinkable' (Administrator 2, 2016).

Student (4) recited a short story 'Eddy-turtle' in her animated video:

> I found a turtle's egg on the beach last week. . .and I need to tell you about my magic powers. My power is that I eat rubbish and then I poo seaweed and ice cubes. This makes food for animals and cools down the water at the same time. Yeahhh. . .

Teacher (2) suggested:

> There is a sense of nurturing, outlined in Student (4)'s story of consuming rubbish and transforming toxic materials into safe and useful things. The eyes, whiskers, and tail show close attention to detail and aesthetic harmony. The sea creature appears 'trustworthy' and goes about problem-solving with the minimum of fuss and distraction. These characteristics illustrate the maker's wish to act upon the world.

Metacognition through making

Government-funded research holds that metacognition has a high impact upon cognitive acceleration but does not recognise the role art and design may play in fostering these skills. The enhancement of making skills, indicated in the questionnaires and as evidenced through the models and videos, was considered fundamental to fostering procedural skills by Teacher (2) and Administrator (2). The 'Learning Circle' agreed that making and re-making was a way of retaining declarative knowledge related to the global goals and a successful way of learning how to perform a specific skill or task.

Procedural knowledge and declarative knowledge are considered to be transferable metacognitive skills. The distinction between declarative ('knowing that') and procedural knowledge ('knowing how') is relevant to teacher performance (Shulman 1987). Linking the global goals to making connected knowing what, knowing why and knowing how.

During the iterative process of making wire models, there was a sense that the creatures were being 'brought to life', according to Student (3). His feedback reflected many similar comments by participants (Research Journal, 2016). One reason for using wire for drawing was to 'transport' students into the realm of three-dimensional space and to raise questions about why drawing as 'dithering' is valuable (Speed 1913). Dithering provokes second time thinking, a key component of metacognition and personal agency (Figure 6).

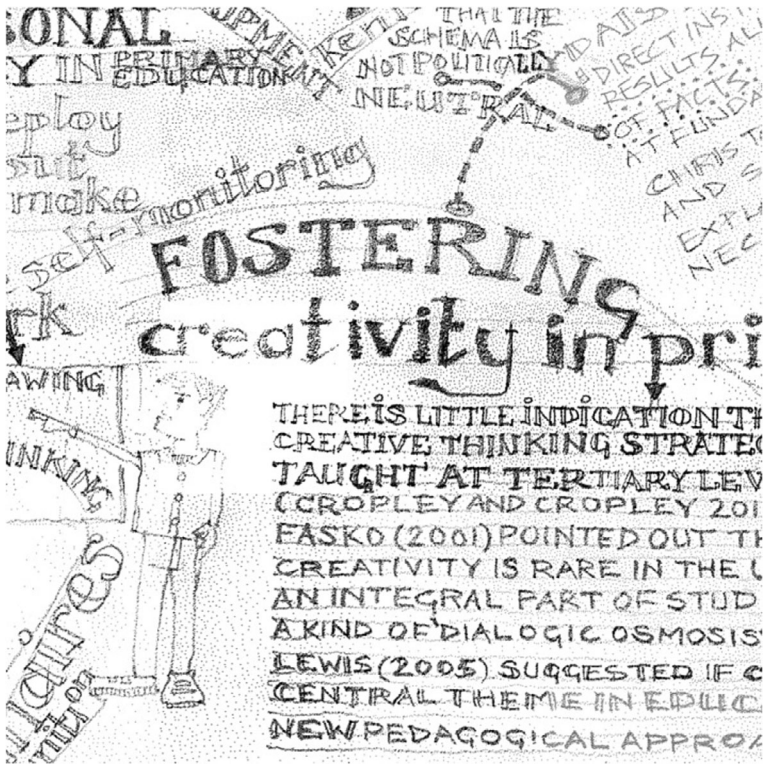

Figure 6
An abstract from my Research Journal (2018).

Student (2) felt that remaking drawings and models '. . .makes you want to do it better'. Student (3) felt that drawing 'helps you see if it's right . . . if it matches your ideas.' Student (4) believed that visualising ideas for sea creatures provoked good discussion, '. . .sometimes you see how the magic power is supposed to work but if you're not sure you can ask' (Research Journal, 2016). These students reframed their attitude to making as thinking.

One-to-one and small-group discussion helped to interpret the thinking of children. Student (4) said she found the idea of magical sea creatures fun but had to overcome her limited skill when it came to making the wire sea creatures, 'I bent this bit by mistake and thought, okay that can be its magic power . . . like a Dyson for the water'. Serendipity provoked abductive thinking through making on a regular basis during the workshops (Research Journal, 2016).

Student (4) marked herself high in confidence at the pre-workshop stage and placed her sticker in the 'ummm?' circle at the post-workshop stage. When asked about her self-evaluation, she said, 'I thought I knew how to draw but now . . . it's like a new thing'. Student (7) was an 'outlier' as she placed stickers in all available circles. It was no coincidence that Student (7)'s playful attitude translated into a myriad of sea creatures, one wire-sketch informing another in quick succession.

Confidence grew out of creative experimentation in the part two workshop when children made videos of their sea creatures. Students (5) and (6) raised the idea of using the puppets as communication tools for children who speak different languages (Research Journal, 2016).

Design Entrepreneur (1) explained that combining physical making, digital video recording and computer animation was possible because digital technologies are now ubiquitous in many primary education. He suggested 'Life Below Water' provided an opportunity to demonstrate digital–analogue synergy while fostering haptic skills in the process of learning (Learning Circle, 2016).

Teacher (3) noted that making puppets for animations 'created a buzz' and encouraged storytelling. Administrator (2) suggested that knowledge of basic skills related to design and making could help busy teachers gain the confidence to use the creative toolkit. The 'Learning Circle' touched on the potential to nurture teacher motivation through this 'new kind of procedural knowledge'.

By developing haptic skills through drawing from her imagination and manipulating wire, Student (7) created 'Rubbish Kisser' which triggered abductive thinking connecting her prior knowledge and a solution to pollution in our oceans.

According to Student (7):

> Rubbish Kisser touches rubbish with her lips. No rubbish is left behind – she turns plastic waste into sand and oxygen to make the sea clean again. Her friend Hexapus absorbs sunlight through his head, and spreads sunbeams. . .we are helpful creatures . . .

Responsible stewardship

Arguments for and against the contested global goals framework were debated. A point of view expressed by Student (8) concerned the target dates 'way into the future'. She felt this might give people licence to continue offending because changing behaviour is difficult. Other participants felt that 'the rules need to change' and one participant compared the problem to careless driving and not thinking about other people (Learning Circle, 2016).

All participants assessed the global goals as being of low importance at the pre-workshop stage. The level of change in the post-workshop assessment constituted a conclusive shift in perception—by far the highest across the entire questionnaire. Part one and part two workshops were designed to reinforce the connections children made between local and global environmental concerns and to nurture design thinking about how their interventions might help.

Feedback from teachers and parents at the exhibition suggested that the link made between Global Goal 14 and sea creatures with magical powers inspired children to think about how they might change destructive behaviour. Student (3) suggested, 'Designing means you can think nonsense . . . then think why not?' The magical sea creatures illustrated that grappling with the complexity of pollution in our oceans is not beyond 7-year-old children. Without exception, participants offered ideas to help improve the quality of 'Life Below Water'.

Posters and videos produced by the UN left little to the imagination. Administrator (2) noted how children '. . .began to take ownership of the problem' and commented on the link between designing and making, global learning and storytelling. He declared, '. . .there is (ethical) value related to effective communication and teamworking through making things' (Learning Circle, 2016).

Student (8) discovered that light-penetrating seawater provides the energy to fuel phytoplankton, an essential source of food and oxygen for the planet. She also learnt that global warming is heating our oceans and causing coral reefs to bleach through discussion with Teacher (1). Her answer to this problem was 'Hexapus', a magical sea creature that extracts heat energy from sea water before transforming the collected energy into light. She explained, 'Hexapus and Rubbish Kisser are best friends who want sea creatures to get food and not get hot' (Research Journal, 2016)

Student (1) wondered if discarded plastic bottles could be collected from the beach and recycled to make 3D printed models of their sea creatures. Teacher (3) directed her towards 'The Better Future Factory', a Rotterdam-based sustainable design consultancy who developed 'Refil', a company that makes high-quality filaments from recycled plastic bottles (Klaus & Bleijerveld 2020). Working with this group of children improved my agency as a teacher and researcher.

Discussion

In answer to the research question, 'How can creative practice nurture personal agency and global citizenship in primary education?, the 'Learning Circle' felt that the design of the constructionist workshops and the transfer of signature pedagogies were significant. Evidence collected from children, and considered by the Learning Circle, illustrates how thinking through making fosters metacognitive skills. Declarative, procedural and strategic thinking skills were all in evidence in the service of innovation.

'Life Below Water' transferred signature pedagogies to help children and their teachers to engage with the global citizenship agenda while nurturing empathy and self-regulation. Working as a design studio fostered reciprocity between peers and teachers and helped to embed knowledge. The special powers given to the magical sea creatures echoed various human characteristics that enabled primary school children to propose and discuss solutions to complex problems through abductive thinking.

This study set out to collate the creative ideas of participants generated through making. We were very mindful of the value of the interventions of children and endeavoured to give them equal status in an attempt to highlight the development of creative agency. The work and outcomes provide guiding knowledge for future action, including the potential for new policy development and resource reallocation.

Qualitative analysis highlights potentialities, not certainties. The time required to assess the impact of 'Life Under Water' is extended to enable future efforts by teachers and practitioners to form new interpretations in whole-class projects. The body of feedback gathered from 'Life Below Water' workshops suggests that children and teachers exhibit reflexivity and innovative thinking when making artefacts in duets and quartets.

Future action taken by teachers and researchers to adapt 'Life Below Water' and to use the artefacts as rhetorical devices will be the measure of success. 'Bags of Magical Stories' were designed to support storytelling and video animation across a nascent international network of teachers and fellow researchers. Copies of these artefacts were requested by a colleague from the Helen Hamlyn Centre for a study into new ways of learning for children with special educational needs. She wrote (17/02/2018):

> Great to hear from you:) . . .the magical sea creatures proved very helpful as a reference point when discussing design and (school) education. Last year one of our graduates developed an Object Based Learning platform for schools. We discussed the Sea Creatures as an example of integrating the very much needed:
>
> - Tactile work with materials (lacking in today's dominancy of screens)
> - Objects as key elements in generating discussion and collaboration (as in Co-design methodologies, objects are used for 'Tangible Conversations')
> - Design Education as a catalyst for generating involvement and activism (the importance of self-expression and interpretation, design as communication)
>
> It is interesting when a project travels and gets a life of its own, how people interpret it and use it. . .. Best, (*international research colleague*).

Robert Pulley completed a research degree at the Royal College of Art in 2019. His PhD focussed upon the role of creative practice in primary education. Pulley is an award-winning designer-maker with extensive teaching experience having also studied furniture design at the RCA. His work in art and design education includes subject leader for three-dimensional design at Ravensbourne; dean of art and design at Falmouth; and principal of West Dean College, a postgraduate partner-college of the University of Sussex. Robert gave a key address at the Indian Institute of Technology conference 'Designing for Children', in September 2021. He is a visiting lecturer at the Royal College of Art and a designer of educational toys for children.

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