Section Eight: Children's multiliteracies

Materialities, multiliteracies, and makerspaces: Design-based experiments in teacher/researcher collaborations

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Introduction

With increasing digitization and multimodality, text production forms a key element of what it means to be literate in today's literate culture where interactions between children and young people and digital texts, tools and resources are embedded in everyday practices. This shift, along with changes to work practices and the economy, has also resulted in text production becoming a more collaborative practice. When we think about literacies for current times – we usually think about multimodality and digital technologies. Digital tools, resources and technologies have had a radical effect on how we produce texts, how we communicate with each other, the kinds of interactions we can have – the very social organization of the spaces in which we engage. When we acknowledge this, we are acknowledging that everyday life involves an entanglement of social with material; human with non-human; technological and non-technological. These sociomaterial ways of thinking challenge our preoccupation with single individuals using literacy tools (Fenwick, Edwards, & Sawchuk 2011) whether traditional print or digital, in order to get things done. From this way of thinking, 'technology' in whatever form is valuable, meaningful and worth studying as people actually engage with it to get things done. But we move beyond being interested just in what a young child can 'do' with technology, toward thinking about how the material as well as the discursive and the virtual works with the human and non-human world. This is the key contribution of sociomaterial theories (Fenwick, Edwards, & Sawchuk 2011) as 'human' is decentred and so knowledge is no longer conceptualised as inseparable with humans.

In this chapter we consider literacies and learning to be literate for current times and thinking, and then present data from one study of how children learn to write and produce texts in their early school years. We highlight data collected as part of one design-based research project from the larger study, where teachers and researchers worked together to plan and implement a series of lessons which began with opportunities for children to engage in makerspace activities, before moving to produce texts in other modes. We are particularly interested in the materiality of these activities and how they shifted the roles of children and adults in the classroom space.

Reflecting on literacies for current times: Foregrounding text production

Much has been written about the changing nature of literacies as we adapt to being literate in the complexities of current times. The New Literacy Studies (see for example Gee 1996; Heath 1983; Street 1993) brought to the fore understandings of how texts produced by people were linked to the everyday practices in which they engaged. It is within these foundational ideas that we find the beginnings of our understandings of multimodality. In putting forward a pedagogy of multiliteracies, the New London Group (2000) extended thinking about literacy pedagogy in light of multimodality and new social, economic and political spaces. Central to their theorising are the links between literate practice and our civic, work and leisure lives.

The shifts in thinking about literacies though, are about more than literacy as a social practice and multimodality. Instead, they also involve shifts between the receptive and productive dimensions of literacy. Brandt (2015) discusses that while the implications of the shift to digital ways of working has been foregrounded as instrumental in our understandings of

literacies, there has been a subtler shift that is highly relevant to educators and to education systems and society more generally – although to date, one that has been largely ignored. This shift, to use Brandt’s term, is the rise of mass writing. With the shift from an industrial state focused on manufacturing things toward a knowledge state that relies on production and supply of services, texts and information become both the fundamental means of production and the most likely output of the production cycle.

As a result, our society has moved to an increasingly sharp focus on writing rather than reading as the foundation of being literate (Brandt, 2015). Writing and text production are now paramount to all that we do. This is different from even our recent past where there has been an assumption that ‘readers would be many and writers would be few’ (Brandt 2015, 3). What it means to ‘be’ literate in today’s society across many dimensions of our economic, social, and political lives, involves the ability to produce texts as it never has before.

As educators we should be interested in what happens when everyday literate experience is about writing as well as reading. As such, text production must take up a more equal or balanced place in our understandings of literacy, and this will require shifts in our understandings of the partnership between the receptive and productive dimensions of literacy. The challenge for educators is to ensure our social institutions, tasked with preparing children and young people for learning, work and leisure, catch up with these changes, and that curriculum teaching and learning parallels this shift in literate practices (Brandt, 2015). Current education research has ensured that we know less about writing and text production and how people learn to write, than we do about reading and the receptive dimensions of literacy. Current debates about literacy and literacy policy continue to focus on reading and phonics or decoding, and less about writing and text production (see for example the recent edited collection by Clark 2017). We also know little about how writing is impacted upon by the current situation in classrooms, where old and new technologies are often drawn together for a variety of purposes, or about the implications of considering writing as a collective or collaborative process, rather than an individual one.

In Australia at least, we do know that children often do better at learning to read than they do at learning to write. Students’ writing performance is regularly reported to lag behind reading, despite significant resources being focused on possible solutions to this gap in achievement. Here, we use an Australian example to demonstrate our point. On standardised measures of literacy such as the National Assessment Program – Literacy and Numeracy¹ (NAPLAN) there is traditionally a gap in all cohorts between writing and reading. While 2017 saw improvements in writing as compared to reading for children in year 3 (ACARA 2017), as children spend more time in school the gap between reading and writing increases. By year 9, 10% less young people meet the minimum standard in writing than they do in reading (81.5% in writing as compared to 91.7% in reading reach minimum standard; ACARA 2017). Outcomes are even lower for Indigenous students and those in remote areas, where the attainment of National Minimum Standard in writing of year 9 students is as low as 30.5% (ACARA 2017) in some instances. Of course, these standardised measures are only one way of thinking about writing, and they focus only on print-based text production, but they provide some insight into performance levels of children in learning to write that warrants additional investigation. There is also evidence that this is not an issue specific to

¹ The National Assessment Program of Literacy and Numeracy – NAPLAN – was introduced in 2008. In its current form the program involves all Australian children in year 3, 5, 7 and 9 sitting tests in May of each year. There are tests in five domains: Reading, Writing, Spelling, Grammar and Punctuation, and Numeracy.

Australia. In a recent report of writing outcomes of children in primary school, Fischer and colleagues (Fisher & Twist 2010) claimed that literacy data collected as part of accountability initiatives in the UK provided evidence that standards in writing trail reading and that there are concerns ‘pupils are leaving primary school without necessary skills to flourish in the secondary system’ (14). Whether children and young people are learning to write and produce texts well in classrooms or not, we do know that they are being expected to use the skills of writing and text production to demonstrate competence in all other dimensions of schooling life, every school subject and most assessment tasks. Writing and text production matter in schools because of their role in demonstrating skills, understandings and knowledge across all disciplines. This heightens the importance of learning to write and produce texts well in schools.

So, as mass literacy has become more focused on the productive dimensions of literacy, digital tools and ways of working have shifted the relationship between text production and print. Therefore, it is important to think more about how children and young people are being taught, and how they learn to be producers of texts. Additionally, educators need to think about literacy as a material practice as well as a social practice (Kuby et al. 2015; Kuby & Rucker 2016). In the rest of this chapter we further unpack these ideas and provide examples of how these things might come together in classroom spaces.

Working with teachers to reconceptualize literacy theory and pedagogy: Methodology and conceptual thinking

The data presented here is drawn from a larger project² which investigates what it means to learn to write and produce texts in the early years of school, when growing up in communities of high poverty. In this project, our focus was to think about socially just literacy education, so our research is located in communities of high poverty where access to new technologies, resources and tools continues to be problematic in at least some schools. The aim of the larger project was to find out more about how schools were dealing with what it means to teach young children how to write and produce texts, and to problematize the relationship between learning to write traditional texts and producing texts using digital technologies.

Material changes to text production and how we use texts to communicate with others (and how we learn to do these things) have pedagogical implications. We argue that it is not useful to separate engagements with print texts from digital texts, and as such, nor is it useful to separate our ways of working or researching them. We know that print texts have certainly not been made redundant by digital technology, but we are interested to know more about the implications of material changes brought about when new and old technologies sit on the same school desks, and when children look toward whiteboards and smart boards more often than blackboards and butcher’s paper. Our interest is in how this changes how children are, and could be, learning to write and produce texts in schools.

To investigate these ideas further we need first to conceptualize three approaches that inform our work. We begin by detailing our thoughts on design-based experiments as a way to

² The project is known as the Learning to write in the Early Years project (LWEYs). We would like to acknowledge the support of the Australian Research Council (DP150101240). Our colleagues in this project include Barbara Comber and Lisa Kervin. We thank the schools, school leaders, teachers, students and their parents and communities for their support of this project. Special acknowledgement goes the teacher and children of year 1Purple for their participation and insights during this project.

support research partnerships between teachers and researchers in classrooms. We also lay out our thoughts on sociomaterial understandings of literacy, before briefly discussing makerspace as a pedagogical approach.

Design-based experiments

Gutiérrez and Jurow (2016) suggest that when researchers work with teachers on projects such as design-based research experiments, we are able to ‘promote social equity and learning’ that can expand and transform the ‘educational and social circumstances’ of communities (565). As such, design-based experimental methodology provides an approach that supports the underlying social justice imperatives of our work. By working with researchers, teachers can develop an ‘inquiry stance’ (Cochran-Smith & Lytle 2009) that can span their careers. This approach allows for experiences, knowledge and interactional expertise to build and generalise beyond specific contexts, and for a worldview that is connected to broader social formations and agendas. These formations include a focus on social justice and achieving quality literacy pedagogy for children growing up in communities of high poverty.

This empirical chapter provides an example of design-based research that was centred on a technological intervention to improve the writing of 6-7 year old children in one classroom setting. We used design-based experiment methods that recognize the importance of researchers collaboratively working with teacher practitioners to improve teaching and learning. The purpose of this approach was to highlight links between designing quality pedagogy and conceptualizing theories about how teaching and learning literacy occurs. In this instance, we were acutely interested in how children learn about writing, but also how literacy is taught to facilitate this learning. In the examples provided later in this chapter, the researchers support the teacher in developing and implementing an instructional intervention (Bradley & Reinking, 2011) with the goal of motivating children to write, by considering links between making meaning through production of texts across a range of modes and with a range of materials.

We draw on the work of Cobb, Confrey, diSessa, Lehrer, and Schauble (2003) and their strategies for implementing design-based experiments that ‘result in greater understanding of a learning ecology—a complex, interacting system involving multiple elements of different types and levels—by designing its elements and by anticipating how these elements function together to support learning’ (9). Design-based research is framed by the notion that ‘systematic and disciplined inquiry into real problems in authentic classrooms is vital to developing workable solutions to support teachers if they are to implement instructional practices that benefit children’ (Bradley & Reinking 2011, 305). Importantly, when researchers and teachers work collaboratively on authentic classroom inquiries they ‘close the gap between research and practice’ (Bradley & Reinking 2011, 306) as well as providing teacher professional learning that works towards improving ‘teachers’ instructional practice and transforming classroom environment’ (Bradley & Reinking 2011, 309). As such, design-based experiments, while taking place in a naturalistic context, are highly interventionist and iterative (Anderson & Shattuck 2012; Barab & Squire 2004; Cobb et al. 2003). Consequently, research undertaken through design-based classroom experiments ‘moves beyond simply observing and actually involves systematically engineering these contexts in ways that allow us to improve and generate evidence-based claims about learning’ (Barab & Squire 2004, 2).

Design-based experiments can adopt various approaches, with the intent of informing practices and accounting for any changes to teaching and learning. In this way, design-based experiments focus on developing particular forms of learning experiences and systematically studying the outcomes (Cobb et al. 2003). Barab and Squire (2004) identify numerous studies that utilize the various design-based approaches. One of the reviewed studies theorized about students' learning gains based on the degree of collaboration during learning, developing a set of guiding practices for implementing collaborative learning (Barb & Squire 2004). In other examples, The Design-Based Research Collective (2003) reviews additional examples of education-related design-based approaches - for example, a study that developed theoretical principles related to interest-based curriculum development. In a final example, Kucirkova, Messer, and Sheehy (2017) investigate the effectiveness of tablet applications such as iPads in increasing children's narrative skills. As can be seen here, the various approaches to design-based experiments can develop locally-based ideas for modifying practices and/or theoretical principles that can drive change across many contexts.

Sociomateriality and literacies

Sociomaterial ways of thinking about literacy require us to move beyond thinking about the learning environment as creating certain conditions for learning literacy, thereby seeing where, when and with what children learn literacy, as a substantial component of literacy or becoming literate. The importance of material, social, and spatial elements of literate practice are thus brought to the fore in our thinking. However, human actors remain important in the networks of people, tools, resources and texts that form literate practice – or in this case, the practice of producing texts. As children engage with texts, in certain spaces and within certain timescales, they are engaged in making and naming their worlds. Consequently, there is a strong relationship between the material, human and what Burnett (2015) has labeled the (im)material. As materials of literacy events shift, or the ways of working shift, so too do the patterns of interaction between the humans involved in the event, and the relationships between the humans, materials and spaces in which the event is occurring. However, ideas or knowledge used in any literacy event are connected to other ideas, meanings, knowledge, and emotions. That is, the intangible things that are not part of the material space but which are still absolutely central to the meaning making that will occur (Burnett 2015). When we engage in literacy or being literate we rarely work in novel meaning making practices, instead connecting and building on the many experiences that have come before and also those that will follow.

It follows that it is important to consider the texts, tools, resources – the *with-what* of literacy events – as well as an individual's use of materials and individuals' emotions, cognitions, understandings and capacities. By focusing on literacy as an individual pursuit, the result is to background the collaborative nature of literacy or becoming literate. The data we present in this chapter demonstrates the collaborative – the role of the teacher and other adults, the children, and the many complex experiences that they bring to the literacy events described as part of this design-based experiment. The individual capacities available in classrooms are a resource for all to draw on when the pedagogical approach allows – and the classroom interactions evident can be shifted once collaborative practice is enabled.

Makerspace pedagogy

Makerspaces are defined as 'sites for creative production ... [using] digital or physical technologies to explore ideas, learn technical skills, and create new products' (Sheridan, Halverson, Litts, Brahms, Jacobs-Priebe & Owens 2014, 505). This approach acknowledges the multimodal nature of literacy and that it comprises language as well as other modes such

as ‘image, gaze, gesture, movement, music, speech, and sound-effect’ (Kress & Jewitt 2003, 1). A significant aspect of makerspaces is that they follow a collaborative mind-set where children ‘do-it-with-others’ (Peppler & Bender 2013, 23). As the name suggests, makerspaces involve children ‘making’ something.

The concept of makerspaces has evolved from a hobbyist paradigm. There are numerous websites and books such as Graves and Graves (2016) that provide teachers with ideas for maker projects. However, more recently in the field of education, there is significant interest in how the engaging nature of makerspaces can be utilised to develop future science, technology, engineering, and mathematics (STEM) (Peppler, Halverson, & Kafai 2016) as well as STEAM, which includes the arts. Within their two-volume edited collection, Peppler and colleagues (2016) have provided a wide range of examples of the educational applications of makerspaces. For example, Berland (2016) uses makerspaces to enable children to develop their computational literacy by presenting them with opportunities to engage in what he calls mindful tinkering. Through the process of building, children express themselves and develop their literacy to explain what they have built or how it works. These examples demonstrate the diverse range of uses of makerspaces.

The materiality and multimodality: Makerspaces and becoming text producers

The data reported in this chapter was collected as part of a larger school reform study, *Learning to write in the early years*. The project involved two schools across two different state systems. The school involved in this chapter was in a high poverty community where access to digital technology both at school and in the home was limited for many children. This mid-sized school of approximately 500 children was culturally diverse with approximately 10-12% of students identifying as Aboriginal or Torres Strait Island children, and more than 50% of the student cohort having a language other than English as their first language. Outcomes on national standard assessments (NAPLAN) record student achievement in literacy and numeracy as being below that of peers attending other schools. The school leaders, teachers, children and their families and communities were focused on improvement and the provision of an equitable, quality education. As one part of this the school leaders and teachers actively participated in the research project as a way to support their school improvement agendas.

The larger project involved three phases. We first conducted an audit of current practices at each of our research sites. In phase two, researchers worked with teachers to plan and implement design-based interventions as a means to reform pedagogical practice in the teaching of writing and text production. Finally, in the third phase of the project, we produced case studies of a number of children as they became writers and producers of texts in the early years of their schooling. Here, we draw on data collected as part of phase two of the project at one school, as we document the instructional and technological learning interventions undertaken by one of the researchers and a teacher in a year 1 classroom³. Data sources include children’s writing samples; photographs; classroom observations; and teacher, researcher, and student reflections. The project draws on Bradley and Reinking’s (2011) framework for conducting a design-based experiment as a tool for analyzing the goals, processes, and outcomes of the three-cycles of the instructional and technological intervention.

³ In this Australian state, children in year 1 are 6 years to 7 years old and are in their second mandatory year of schooling.

Teachers at the school were asked to consider an area of their pedagogy or classroom practice that they felt could benefit from review and reform. When asked about the teaching of writing, the classroom teacher featured in this chapter identified that her students had little or no enthusiasm for writing. She wanted this to change, but reported feeling unable to provide opportunities that were engaging to the students at the same time as managing the classroom. The children routinely wrote individually at their desks. Writing practice was not daily, and there was little or no text production work in modes other than print, or collaborative text production with small or whole class groups. Working with the teacher, we collaboratively designed a three-cycle intervention that included various instructional and technological interventions that aimed to a) encourage children to become enthusiastic about writing and making meaning through text production across a range of modes; and b) improve children's multimodal text production. We decided to focus on makerspace activities, drawn from the maker movement (<http://makerspacesaustralia.weebly.com/>) as a means of inspiring the young children to write. The makerspace activities were identified as a way of encouraging an interest in text production within this group of children who were already quite reluctant writers. The play-based makerspace activities provided the children with the inspiration as well as the time to think about the object they were creating. The objects and the makerspace process became stimulus for individual and collaborative writing. This was followed by the writing of a story.

In all, there were three cycles to this design-based experiment. In the first cycle, the researchers took the lead in designing and delivering the intervention lessons that were planned in collaboration with the teacher. In the second cycle, one researcher provided background support and the teacher took a greater role in the planning and delivery of the lessons, while in the third cycle, the teacher took the lead in planning, teaching and assessing. The first cycle was a problem-solving activity called 'Trap the witch' (Anderson n.d.); the second focused on 'Something interesting happened last week'; and the third was 'Life in a fish tank' which was linked to the children's technology assessment. In each cycle, the children made something and then produced a written or multimodal story about their creation and/or the process of making.

Cycle 1: Trap the witch

The activity was based on the Hansel and Gretel fairy tale. After a shared reading of an abridged version of the story, the children were introduced to the small cardboard boxes resembling matchboxes that represented Hansel, Gretel and the witch. The witch was represented by a larger box, while the children were smaller and thinner. This was followed by a question and answer session with the children to help them identify the differences between the boxes. The children then worked in groups and with their teachers, to plan a design for a witch trap and identify and list the materials they needed (see Figure 1). The cage was required to allow the children to escape but to trap the witch. The children then collected their building materials and proceeded to construct witch traps in groups. Materials provided included cardboard, pipe cleaners, paddle-pop sticks, scissors, string, masking tape, ribbons, bottle caps, and straws. After the children constructed the traps, they tested these with their cardboard box characters to see if they were successful in trapping the witch. As there were additional adults in the room, the teacher was able to work with small groups of children. Her role changed from regulator of behaviour of the whole class, to supporting problem solving investigations of smaller groups. She asked questions, laughed when she required help from the children to construct particular aspects of the construction, and listened to the children's ideas. Her questions had shifted from rhetorical questions with prescribed answers to questions of inquiry – What if we tried this? She sat on the floor with the children, head down

to focus on the developing construction. She and the children vied for staplers, paper and glue as they collaborated to construct the trap – using oral language and their bodies (stretched hands and moving heads) to indicate what they needed from others in the collaboration. As researchers we were struck by the shift in roles available to this teacher through the introduction of different materials. Bodies had moved from individual desks to the floor-paper and pens were used for different purposes. One researcher wrote in her field notes *the difference that the materials and the shift in pedagogy made to the roles of the children and teacher, and to how the classroom space was used, was very visible.*

Following the maker session, the children used iPads and the *Book Creator* application (<https://bookcreator.com/>) to write collaboratively with their peers and their teachers about the makerspace activity. The use of digital technologies to produce multimodal texts encouraged writing, particularly collaborations between children of various confidence and proficiency levels. As Kalantzis and Cope (2012) suggest, the pedagogy was purposefully selected to meet the teaching and learning goals of young children to write.

The teachers/researchers made a few suggestions about what the eBooks might contain:

- A story cover page with ‘Trap the witch’
- A page with the sentence starter: ‘The members of the group are: ...’
- A page with the sentence starter: ‘The story was about...’
- A page with the sentence starter: ‘The challenge was ...’
- A page with the sentence starter: ‘I liked ...’

Figure 2 shows the different interpretations of the sentence starters and the story. The eBooks were also converted to video and shown to the class using the interactive whiteboard.

Additionally, the videos were shown to the children’s parents when the class hosted a ‘Literacy Party’ as part of National Literacy and Numeracy week. This enabled the teacher to engage parents in the literacy lives of their children in new ways, ways that extended their range of thinking about literacy to be beyond print. Later the children also used this experience as a stimulus for other writing as part of the reformed individual writing time in the class. Children were asked to consider other aspects of the story including flipping the story, for example, ‘How did the witch feel about the children destroying her house?’ or ‘How did the children feel when they were trapped?’

As this was the children’s introduction to makerspace activities, it is understandable that they would be excited about the newness of the experience. However, as the lesson progressed, the potential for sustained literacy learning became apparent. The makerspace activities promoted exploration, collaboration, as well as developing cooperation, creativity and problem solving. Here, the assumption is that children become more fully engaged with writing and more efficient and effective thinkers when they experience something first-hand, such as through these play-based approaches (Larson & Rusk 2011, 91).

A: Group planning

B: Witch traps

C: Working together

Figure 1: Trap the witch makerspace

The story is about Hansel and Gretel. The witch tried to grab them and put them in the cage. The kids trapped the witch in the cage.

Then story was about two children who were hungry and looking for food. We built trap to hold the witch and let the children out.

Figure 2: Excerpts from eBooks

Cycle 2: Something interesting happened last week

The second makerspace activity was drawn from the children's own experiences. The teacher and the researcher worked together to plan and deliver the lesson, but there was a shift of responsibility to the teacher as leader. A brainstorming session enabled the children to list interesting things that had happened to them the week before. Topics included fishing, a dog having puppies, and a party. The children used these topics as a spring-board to think about something they wanted to make and write about. The maker activity was completed

individually and the children were photographed with their creations. Additionally, a 'gallery' of the children's work was created by placing the object on their desks, and the class moving around the room looking at other people's creations.

Following the display gallery activity, the children were given two sentence starters: 'I made...' and 'I like ...'. These sentence starters were provided for the children who needed prompting to start writing. Many of the children continued to write beyond these two-sentences or used their own ideas (see Figure 3).

During this makerspace activity, and the writing task that followed, the children expressed enjoyment with both activities. While their enjoyment was likely to be related to the scope for self-direction and choices about their curriculum, there is little doubt that the play-based nature of the task, and the shift in materials and rules about how to 'be' in the room, also encouraged engagement. In addition, as with the other two cycles, many of the children demonstrated pride in their writing and wanted to share their stories with others in their class, particularly the adults.

As expected, all children in the class were keen to participate in the makerspace activities. What we also saw was highly engaged children during the writing phases. They demonstrated productive talk and movement during the lessons. They responded to the makerspace sessions with a high degree of responsibility and there were fewer behaviour management incidents during these lessons. As such, we found the makerspaces to be inclusive spaces (Wohlwend, 2008) that enthusiastically engaged all learners, including those who were reluctant to write or more disengaged with the teaching and learning in other learning contexts within the classroom.

Figure 3: An alien was sighted last week

Cycle 3: Life in a fish tank

This activity was planned and taught by the classroom teacher as part of an assessment piece that was linked to the children's technology lessons. They were required to create a diorama of a fish tank. In the lead up to the makerspace, the teacher spent a number of lessons reading and discussing *The Rainbow Fish* by Marcus Pfister (1992). This was as followed by the children watching excerpts from *Finding Nemo* (Disney), which showed the fish tank and the marine life. These were each attempts by the teacher to bring texts of multiple modes into the core curriculum of her classroom. The teacher designed a worksheet that acted as a planner for the design of the fish tank (See Figure 4). This involved the children identifying the items in the fish tank and providing a drawing. It also included a cut and paste activity where sentences had to be unjumbled.

A range of materials were provided (see Figure 5) to create the various components of the fish tank, including the rocks and seaweed and water. These included paints, crepe paper, cello paper, beads, pipe cleaners, googly eyes, printed marine animals, and various sized boxes and bottle caps. The fish tanks were made in shoe boxes, positioned vertically.

After the children constructed their dioramas, they were photographed with their creations and were able to move around the room to see what other people had created. A few children were called upon to explain the components of their fish tank and any special innovations, for example, one child created a container with 'fish food', another child created seaweed by twisting a pipe cleaner around a pencil to create a stand-alone, three-dimensional object that represented the seaweed.

Figure 4: Designing the fish tank

Figure 5: Material used and Diorama example

When the children were ready, they started writing their stories. They were given some ideas as to what they could include in their writing. Some focus questions included:

- What are the names of the creatures in the fish tank?
- What type of creature are they?
- Describe the fish tank - What is inside the fish tank?
- Is there anything interesting happening inside the fish tank?
- What are the creatures doing in the fish tank?
- What are the creatures feeling inside the tank and why?

Figure 6 provides an example of the writing. This writer, while having grasped many of the functional elements of writing, was reluctant to write. When asked to write, this child would routinely write only what was mandated by the teacher and no more.

Following this makerspace activity, the child wrote a substantial amount about the fish tank he had created. The comment, 'I love my seaweed'

references a situation where many of the children around him wanted him to show them how he had made the seaweed, that is, by twisting pipe cleaners and securing them to the base of the 'tank'. It was obvious to us that he enjoyed having his idea shared with others and being recognised for his imaginative use of the materials. So much so that he wrote about it in his prose.

Figure 6: Writing sample

Reflection and conclusions

In drawing this chapter to a close, we reflect on the practices of literacy learning in this class as a part of the design-based experiments conducted with the purpose of reforming writing pedagogy. By focusing on the sociomateriality of the lesson we are able to tease out examples of intra-active and de-territorialised pedagogies (Kuby & Rucker 2016; Lenz Taguchi 2010).

As Barad (2007) states, 'our knowledge-making practices are social-material enactments' (26). From the makerspace writing, the enactments of the social and the material, the human and the non-human, the technological and the non-technological gave rise to intra-active learning experiences. Ideas flowed, as did creativity and imagination, as materials took on a multitude of forms. These materials become active agents that constructed various realities and discourses (Lenz Taguchi 2010). Plastic beads simultaneously became air bubbles blown by fish and fish food floating at the surface of the tank (cycle 3) or the eyes of a monster alien that very interestingly had landed on earth (cycle 2). Pipe cleaners imaginatively produced seaweed in a fish tank (cycle 3) as well as the bars of a jail trap (cycle 1), all through the discursive practices of 7-year-old children and the dynamics of intra-active pedagogies (Kuby & Rucker 2016). The materials were able to 'speak back to the children in the entanglement of intra-activity' (Kuby & Rucker 2016). For example, the pliability of the pipe cleaners

made them (un)suitable for constructing a cage to trap the witch. In other examples, limitations were sometimes placed on the agency between the child and the materials. For example the ruled lines in Figure 6 which are meant to restrain children's writing practices compared to the blank page in Figure 3 which affords greater freedoms. Interestingly, in an example of the messiness of intra-activity, the child (see Figure 6) did not (or perhaps could not) adhere to the restrictions of the ruled lines, instead moving beyond the confines of the allocated spaces.

Drawing on the work of Lenz Taguchi (2010) we note that 'meaning-making and the learning we do is dependent on the material world around us. The material world acts upon our thinking just as much as our thinking acts upon it' (49). Therefore, by 'focusing on the intra-active relationship between people and materials', materials become 'active agents' within 'entangled becomings' within pedagogy (Kuby et al., 2015, 399). The concept of entangled becoming, has allowed us to shift the focus from the teacher or student or material, but rather to the 'in-between' (Kuby et al., 2015, 404). In examples of this intra-activity (Kuby & Rucker 2016) and meaning making, we observed that some children were asked to demonstrate or explain their making techniques and choices, or their use of adjective and noun groups to the rest of the class or to other children. During the desk gallery displays or when the stories were flipped to create different narratives, the children made meaning of their material world through the objects they created by thinking and seeing others children's maker-objects, stories, videos, or eBooks⁴. One of the observable effects of these intra-actions was the evidence of the pride that swelled as the children were praised for their work or as they were asked by other children to assist them with something they had already accomplished themselves. In the chatter during the sessions, we frequently heard, 'How did you do that?'; 'Can you show me?'; 'Could you read out your sentence to the class'; or 'I like how you did that'. Consequently, the children were more open to experimenting with writing and different perspectives and seemed inspired and motivated to write based on the powerful stimulus of the makerspace experience. This included the children who were more likely to be hesitant to write in other learning contexts. On these occasions, we saw improvements in quantity and the quality of their writing.

The intra-active entanglements also had the effect of de-territorialising (Kuby & Rucker 2016) the classroom spaces and identities. During making sessions, adults and children worked together, around desks and not always at them. There was a temporary blurring of the identities of 'teacher' who is spatially positioned at the front of the room, and 'students' who are seated at their desks. The teacher was sitting on the carpet with groups of children, working on the task. Desks were abandoned by many and the children who had full use of the classroom space. There was movement and sharing, discussion and critique, experimentation and the refinement of designs. New opportunities presented themselves, through the engagement of the human and the non-human, for the best way to build their objects including artefacts and texts. The teacher was lost in the mess of bodies scattered across the room, making their creations. Agentic relationships between adults and children in the room gave rise to increased opportunities for successful literacy learning. Through the de-territorialising of spaces and the de-centring of the teacher, there was a shift in roles and identities. Children had choices about where they worked, who they worked with, or the topic of their writing. Ideas were cross-fertilised through discussion and debate, or the casual glance over the shoulder to see what the others were doing.

⁴ eBooks are electronic books published in digital form. Other terms include 'digital books'.

What has emerged from these reflections of a design-based experiment are new ways of teaching-learning-writing between teacher and student, adults and children, made possible through a focus on the sociomateriality of classroom practices and pedagogies. As the connections between the humans in the room, and between human, material and spatial resources, tools and texts were shifted, new ways of being, and learning writing became possibilities for children. The new possibilities which resulted from the changed pedagogical approach enabled shifts in the social interactions of the class as well as in how children engaged with texts as writers or text producers (Kuby, Rucker & Kirchhofer, 2015). The focus of pedagogy became children learning to produce texts, rather than children who refuse to write.

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