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Handbook of Young Children's  
Thinking and Understanding

THE ROUTLEDGE  
INTERNATIONAL  
HANDBOOK OF YOUNG  
CHILDREN'S THINKING AND  
UNDERSTANDING

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## BABIES, BOYS, BOATS AND BEYOND

### Children's working theories in the early years

*Sally Peters and Keryn Davis*

#### **Introduction**

What are some of our youngest citizens thinking about and how can we support their creative, innovative and critical thinking? This chapter reports on some of the findings of a New Zealand study looking at young children's thinking as they make sense of the world around them. It highlights the depth of ideas young children were considering and questions some assumptions about young children's thinking. The chapter also reflects on some interesting challenges for adults in supporting this aspect of children's development. We found that developing a greater understanding of these issues for our youngest children has the potential to create opportunities for meaningful dialogue about the learning of *all* children, and connects to international interest in this topic. The chapter begins with a brief overview of the project and the New Zealand educational context. The following sections draw on data to outline the rich and varied world of young children's thinking before looking more closely at the depth of some children's thinking. We conclude by reflecting on the implications for adults working with children.

#### **Overview of the project and the New Zealand context**

Our interest in children's working theories arises from the learning outcomes in the New Zealand early childhood curriculum *Te Whāriki* (Ministry of Education, 1996). Early childhood education covers the years from birth to school entry (children usually start school at age 5 years although they do not have to be at school until they are 6). The learning outcomes in *Te Whāriki* are indicative rather than definitive and each setting develops its own emphases and priorities. The document emphasises holistic, active learning in early childhood and these are broadly described as closely linked knowledge, skills, and attitudes, which:

combine together to form a child's 'working theory' and help the child develop dispositions that encourage learning. In early childhood, children are developing more elaborate and useful working theories about themselves and about the people, places, and things in their lives. These working theories contain a combination of knowledge about the world, skills and strategies, attitudes, and expectations ... As children gain greater experience, knowledge, and skills, the theories they develop become more widely applicable and have more connecting links between them.

(Ministry of Education, 1996, p. 44)

The curriculum writers drew on Claxton's (1990) view that: 'Learning at its most general is the business of improving our theories, elaborating and tuning them' (p. 23) and our basic method of learning 'involves a gradual process of editing these minitheories' (p. 66). The term working theories therefore implies fluidity and the sense of an idea that is being worked on.

However, despite the explanations within the curriculum and the long history of practice associated with *Te Whāriki* we found that children's working theories and ways to support them are generally not well understood. In contrast, the learning disposition outcome of the curriculum has received considerable research and practice attention. Our Teaching and Learning Research Initiative (TLRI) project, *Moments of Wonder, Everyday Events: How are Young Children Theorising and Making Sense of their World?*, was designed to right some of this imbalance and looked specifically at the kinds of working theories about the world children were developing, and what they were theorising about (for details of the study see Davis and Peters, 2011). We were also interested in the adult's role in supporting children's working theories and offering more opportunities for children to stretch their thinking. There is interest in these issues in many other countries. For example, the OECD (2006) Starting Strong II report noted that a challenge exists in many countries for early childhood education to focus more on the child and for educators 'to show a greater understanding of the learning strategies of young children' (p. 207).

The research discussed in this chapter was based in five Playcentre early childhood education settings. New Zealand has a diverse range of early childhood services and includes both teacher-led, (where at least 50 per cent of the adults who educate and care for children must be qualified, registered early childhood teachers) and others that are parent-led, (where parents, families or caregivers provide the education and care). Playcentres are parent-led services and began as a parent cooperative during the 1940s to support families and promote new developments in early childhood education. Playcentres are collectively supervised and managed by parents. They have a strong focus on parent education as well as children's learning (Ministry of Education, 2009; see also Stover (1998) for an overview of the Playcentre movement's history). Typically, Playcentres offer sessional programmes for mixed-age groups of children, and this was the case for the five research sites. Like teacher-led early childhood services, adults involved in Playcentre are guided by the early childhood curriculum *Te Whāriki* (Ministry of Education, 1996), but unlike most teacher-led services, Playcentres rely on the services and time of parent volunteers to manage this.

### Examples of the rich and varied world of young children's thinking

Data for the project included assessments in the form of Learning Stories (see Carr, 2001; Carr and Lee, 2012), written observations, photographs, parents' written and spoken comments and observations, and video and audio recordings of interactions with children. When we analysed the data we were able to categorise some of the kinds of things children were thinking about. The following sections share examples of the data under the broad groupings of making sense of the social and physical world, and an interconnecting and overlapping theme of making sense of language.

#### *Making sense of the social world*

Within the children's developing theories about their social worlds, growing up (and 'growing down') appeared to be of particular interest to children. Many children were interested in their increased height and capabilities. For example, Barney explained:

Me's getting bigger and bigger and bigger and then me's be Jonathan [older brother] and then me's be daddy. Then me's be an orchestra man ... Tim Tim [baby] is getting bigger and bigger. Mummy is getting tinier and tinier. She is getting tinier than Tim Tim.

The idea that adults get smaller and smaller (grow down) was found across centres. For example, when one mother said she couldn't climb on the fort because she was too big, her daughter Emme comforted her by suggesting 'You'll be able to get up here when you are little - eh?' While the theories about getting bigger related to children's observations, the explanations regarding adults growing smaller were less clear. Much earlier Carr (1997) described how her 3-year-old daughter, when required to travel in the special child's car seat in the back of the car said darkly, 'When I grow up I'll be driving the car (pause) and when you grow down I'll put you in the kiddy car seat' (p. 2). Carr suggested that theories about significant adults 'growing down' might be a way to accept with equanimity the powerlessness that goes with being a 3-year-old.

Perhaps because the Playcentres were mix-aged there was a lot of discussion among the older children about babies. For example, is moving out of nappies a signal that babyhood is past? Can babies be naughty? Within this there appeared to be overlaps with developing meanings for language, such as when Hugh initially said, 'The younger you are, the naughtier you are,' but later reflected, 'Babies can't be naughty. They start being naughty when they're one.' This seemed to be as much a working theory about the meaning of 'naughty' as it was about babies.

In another centre one girl regularly played a game with an older child where she was a 'naughty baby'. In this play she appeared to be exploring working theories about babies, and testing the boundaries to make sense of 'good' and 'bad'

behaviour. Good and evil underpinned the interest another child (Ferdie) had in the book and film character, Harry Potter. However, the adults were not aware of this at first. In a number of instances we found it is easy to miss the child's central interest (Davis *et al.*, 2012; Peters and Davis, 2011); in the case of Ferdie's interest in Harry Potter, the adults tried to widen the exploration and include other children in what they saw as Ferdie's working theory focus by holding a 'wizard day' in the centre. The adults were surprised by Ferdie's lack of participation in this event but later when Eleanor (practitioner researcher) revisited his Harry Potter interest with him she noted that the ideas Ferdie was focused on in the Potter stories revolved mainly around the themes of good and evil, something the 'wizard day' had not touched on. Later Eleanor reflected, 'I wish I had just spent more time talking to him about Harry Potter and allowing myself to be genuinely interested instead of pursuing my own agenda.'

### *Making sense of the physical world*

Other examples of working theories included children's developing ideas about the physical world. For example, 3-year-old Barney had a theory that when a piece of electrical equipment was plugged into just one of the double wall sockets, *both* of the switches needed to be turned on for the equipment to work. His mother, having observed this several times, attempted to clarify:

M: 'So you need the top switch on, if the plug's in the top and you need the bottom switch on if the plug's in the bottom?'

B: 'No. You need them both on. It needs to make two noises.'

His mother commented, 'I tried to disrupt his theory but he wasn't in the zone to refine it even though I had encouraged him to experiment with switching various switches on and off. I thought this had shown flaws in his theory but he didn't accept this.'

We reflected that perhaps for Barney his theory was difficult for his mother to change because, at this time, it was successful; if both switches were in the 'on' position the equipment worked. Claxton (1990, p. 24) noted that even as adults many of our implicit theories are treated by us as reality rather than hypothesis and are 'remarkably resistant to change even in the face of good evidence,' while other theories we know to be conjectures and are willing to revise them.

Barney's view about plugs continued over several months, as did another child's (Tim's) exploration of water travel. However, while Barney's working theory was unchanged, Tim's working theories expanded and refined throughout the period. At 20 months, Tim's theories were implied by his actions more than his speech. For example:

Today the older boys were playing in the sandpit and had made a complicated water flow system with pipes and guttering and what not. Tim was fascinated with it. He would go over and look at the water flowing into one end of the pipe

and then go round to the other end where it was coming out and lean right down to peer in and see what was happening. Then back to the start and have a good look at that and back round again.

(*Observation notes*)

After six months of Tim's water travel exploration his mother noted:

I left Tim in the bathroom brushing his teeth. I should have known with child number four that was a mistake. I came back and this little voice said, 'Mum the water's not going down the pipes.' I rushed into the bathroom and of course the water was indeed NOT going down the pipes. He had the plug in – the whole bathroom was under about an inch of water. Shows he's still thinking a lot about pipes though!

Tim, now age 2, began building water races and seeing balls, then coloured water and later wooden boats go down. Now his explanations were accompanied by a verbal commentary, e.g. 'It's coming, it's coming'. Many other children joined in these investigations and an eight-month focus on water led to a wide range of theorising and increasingly sophisticated thinking that progressed to complex waterways, water-wheels, seeing whether water can go up, what makes a boat float and how to make it sink. Some of these discoveries disrupted the adults' theories, such as the day one child made holes in the bottom of a cardboard 'boat'. Eleanor, one of the practitioner researchers, recalled:

Barney thought he would make a big boat out of some large cardboard boxes we had at Playcentre. He started by drilling holes in the bottom. Then he got the hammer and was ready to bash some bigger holes in it. At that point I noticed him. 'What are you doing, Barney?' 'Making a boat,' he replied. 'But what do you think will happen to your boat if you have holes in the bottom?' I asked. Rhetorical question I thought. 'It'll sink.' We decided to test it in the water trough. But do you know that boat floated? We tried to push it down but it was really difficult. If we pushed really hard we could make the water squeeze up through the little holes where we were pushing ... We were really surprised! Our theories about floating and sinking were disrupted here – the ones about the materials that float well (cardboard was not top of my list) and the ones about holes leading to sinking.

### *Making sense of language*

While for the youngest children their ideas were implied by their actions, language played an increasing role in children's theorising. As we listened to their talk it was evident that some of the theorising related to their growing vocabularies and making sense of language. Elsewhere we have written about one child's theorising about why a see-saw is called a see-saw (Davis and Peters, 2010).



Listening to the ways children were exploring language raised questions regarding the nature of their thinking. For example, deliberations about 'Is it a boy or is it a baby?' appeared to relate to puzzling about class inclusion (whether one can be both baby and also a boy) and also about determining what the words 'baby' and 'boy' meant. In these examples the children seemed to be trying to work out if 'boy' represented a stage of development synonymous with 'child' rather than a category within the concept of baby, based on biological sex. Similarly, children were exploring ideas about place that reflected ideas about hierarchical relationships and classes and also an exploration of word meanings. In the following excerpt a child was thinking about 'Canterbury' (a region in New Zealand) and its relationship with a 'Christchurch' (a city, within that region).

- C: 'Mummy, have we ever been to Canterbury?'  
 M: 'We live in Canterbury.'  
 C: 'No we live in Christchurch.'  
 M: 'Well Christchurch IS in Canterbury.'  
 C: 'Do you mean Canterbury is in Christchurch?'  
 M: 'No I mean Christchurch is in Canterbury.'  
 C: 'Oh, but when we were in Australia we weren't in Canterbury were we?'  
 M: 'No.'

While class inclusion is about an understanding of hierarchical relationships, we felt an intersection between conceptual understanding and making sense of language was at play for these children.

As with their working theories about the social and physical world, children's considerations of language opened up a spirit of inquiry for many adults who found their own working theories were edited and refined as much as the children's in response to some of the children's questions. These seemingly simple issues opened up rich and complex puzzling for the adults too. Once the meanings of words such as 'boy' or 'see-saw' were pondered, the history of the word and the breadth of definitions could draw adults back into the awe and wonder of the seemingly familiar in the world around them.

### The surprising depth of young children's ideas

While the examples above present some of the ideas the children were thinking about in our study (and many of the associated challenges for adults), a closer look at some of the examples of children's thinking reveals the depth of some of their ideas and the ways children are developing agency through their participation in learning communities.

When mice were spotted in the worm farm at one of the Playcentres, Hugh (4 years old) took the situation very seriously. First he made a trap to catch the mice out of an egg box with sellotape in the bottom 'so their feet would stick on to it'. He baited this trap with cheese. A few days later Hugh got a piece of sequined material and proposed to use it to catch the mice in, whereupon they would take them to the far end of the field and release them. Eleanor wrote:

Seeing Hugh's sequined cloth one of the adults commented, 'Oh, that won't do,' and grabbed a transparent container and an exercise book and headed off in the direction of the worm farm. Well, I strongly questioned her theory too but dared say nothing. Off we went. After some digging and various mouse spottings, we gave up trying to catch them.

Later, when the adults were weighing up the options of how to get rid of the mice, Keryn asked Hugh (who was standing there fascinated but largely ignored by the adults) what he thought. Hugh decided to ask everyone else in the community about what they thought should be done about the mice. He created a poster to put on the door. He drew a picture of a mouse and got Eleanor to scribe for him. They wrote:

What should we do about the mouse in the worm farm?

Option 1: Keep it as a pet.

Option 2: Get rid of it ... but how?

The survey led to a number of proposals from the children, which were more empathetic to the mice than (in most cases) focused on getting rid of them. For example, 'Find some other mice and put them with the other mice so they won't be lonely' (Georgia). 'Maybe the mouse would like to come and play' (Ferdinand). Eleanor's older daughter spent time at home surveying the family too, and decided it was acceptable to have more than one vote because you might agree with more than one idea. Hugh's idea to survey the community helped to grow this interesting, real-life problem into one that the whole learning community could be part of solving.

In this example Hugh's ideas were as valid as the adults' ones (which included using dogs to chase the mice as well as catching them in a plastic container). He actively resisted the adult dominated discussion of potential solutions to the problem and instead shifted the response to a more democratic one, transforming the situation into one that was more complex and sophisticated. Hugh was both experiencing agency and developing agency through positive participation in, and contribution to, the shared activity (Rainio, 2008). Although Hugh's ideas, together with the early decision by adults to follow Hugh's lead, helped ignite an interest for many of the children and adults, the investigation of the mice in the worm farm wasn't an easy one for the adults. The inquiry caused tensions and discomfort as many adults struggled with letting go of control and allowing time for the problem to be solved more slowly together with the children:

It was very interesting. There is a genuine strong desire among the adults at our centre to empower the children and give them real life opportunities for decision making but obviously not if the topic is too sensitive.

(Eleanor)

Hugh recognised and used the support of others (particularly Eleanor) to transform the activity, something Edwards and D'Arcy (2004, cited in Rainio, 2008) refer to as

'relational agency'. The five practitioner researchers in our study were trying to become better at 'growing' children's working theories by positioning the child as the professor and themselves as the student, an idea adopted from Shafer (2002), while at the same time attempting to add more breadth and complexity to the working theories. The practices the adults in our study were working on were very like the practices Martin (2004) describes as supporting agency. Practices that support agency, according to Martin, emphasise 'students' active engagement within richly furnished curricular settings with the support of teachers who encourage student risk taking and active, self-directed experimentation with the alternative possibilities available in such settings' (Martin, 2004, p. 144).

When children's ideas had been fostered in this way they sometimes exceeded everyone's expectations. In another Playcentre Sarah-Kate had been sharing a number of facts about animals with Nikki, one of the practitioner researchers. All the while Nikki listened and talked with Sarah-Kate at the same time trying to work out what she might do next to support Sarah-Kate's growing expertise. One day Nikki suggested to Sarah-Kate that she might like to make a book about her ideas. Nikki wrote down the text dictated by Sarah-Kate and Sarah-Kate illustrated it with drawings. A short time later Sarah-Kate and her mother shared a new story with Nikki, *Tuatara Expansion Lizard*. Sarah-Kate had dictated the story over the weekend and her mother had written it into a scrapbook. Sarah-Kate had spent a lot of time illustrating the story. Nikki suggested that they could publish it into a book and put it in the book case as well, which they did.

Another story, *Meerkaat Manor*, arrived from home a few weeks later and Sarah-Kate wanted to publish it into a book again. Soon Sarah-Kate telling stories and having them recorded and made into books had become a well-established practice at home and at the Playcentre. Nikki's decision to introduce authoring and illustrating books shifted Sarah-Kate's interest to a new level and provided new opportunities for her to develop and practice her creative and critical thinking. It also let others in the learning community in on her ideas. Eighteen months after her first story a devastating earthquake struck Christchurch. This was a significant event in the lives of many New Zealanders. Sarah-Kate (now recently turned 5), dictated the following story to her mother the morning after the quake:

I got these lizards as babies. They are horned geckos. I started training them two days after they were born. I trained them to be search and rescue lizards so that they can help people stuck in the rubble and wreckage of the Christchurch quakes.

I trained them how to go under bricks and rubble. They have a really sensitive tip on their tail. They feel around with their tails and if it comes in contact with someone, they bark out to get one of the teams to come and rescue the person. They draw a picture in the dust with their tail and then point with their tails to show the rescuers exactly where that person is.

I have sent them out to do their job. Christchurch really needs them now. I absolutely didn't know this until they had gone out – they have had babies. They give birth to live young. I went and looked into their favourite ditch and there was a pile of babies. I am going to train these babies as well.

The females range in colour when they are young but the males are only one colour. I can tell from my research by looking at these babies that there is only one male.

This powerful story moved many adults and was later used to assist in considering how to support children's agency in the devastation and trauma following the earthquakes.

### Implications for adults working with children

Although traditional Western theorising has tended to consider children's thinking as immature and illogical, the children's thinking revealed in this project's close documentation of working theory development highlighted that far from being illogical, their understandings were generally logically derived from the information they had available. Many examples showed thoughtful consideration of the world around them and the language they were making sense of. In a number of cases children's views were as valid as, (and challenged or extended) the adults' thinking. As the OECD (2006) noted, two valuable approaches in early education are a focus on agency and the child's natural learning strategies, including 'intense research on matters of interest to the child' and listening to children, which is a sign of respect for 'the child's capacity to guide his or her own learning, when supported by well-trained educators in a rich learning environment' (p. 208). When both of these were evident in the research Playcentres, and adults were authentically listening and engaging, we saw rich opportunities for thinking to be shared and developed. In New Zealand we have the framework in place for supporting these approaches with the curriculum *Te Whāriki* (Ministry of Education, 1996). However, in practice working with children in ways that respect and foster their thinking was not always easy.

Many of the children's ideas were also richly creative. Creative, innovative, and critical thinking have been described as twenty-first-century capabilities (Bolstad *et al.*, 2012; Gilbert, 2005; Ministry of Education, 2007), yet the claim has been made that we are educating our children away from creativity (Robinson and Azzam, 2009). Although not the focus of this chapter, we did see examples of adults who shifted children's complex thinking back to much 'safer water' and familiarity for the adults concerned. Hennessey and Amabile (2010) argue for greater attention to student creativity and to how teachers can support rather than hinder this learning, as creativity is 'crucial for economic, scientific, social, and artistic/cultural advancement. It is essential that we come to a far deeper understanding of how teaching techniques, teacher behaviour, and social relationships in schools affect the motivation and creativity of students' (Hennessey and Amabile, 2010, p. 585).

The emphasis in these early childhood education settings was on what the children were curious about or found interesting. Importance was put on fostering children's interests and curiosities rather than on retelling preconceived 'adult' facts or truths. Many of the children's interests emerged in seemingly unpredictable ways, and in many cases these developed over extended periods of time. Often interests were

recognised retrospectively, but adults found they could sometimes 'grow' the interests of one into becoming an interest of many. The focus on interest as both the *what* and the *how* of learning stems mainly from the desire to protect and inspire the children's motivation to learn. While the link between learning outcomes and intrinsic motivation has been well established (Broussard and Garrison, 2004; Bjørnebekk *et al.*, 2011). There is still much to be learnt about how to support motivation as children progress through their education. A high focus on interest helps maintain the worthwhileness of the activity for children (Drummond, 1993). 'Worthwhileness' can be understood in terms of how well the interest in an activity or a situation captured children's attention and effort, and for how long issues central to learning and teaching in both early childhood settings and schools.

### Conclusion

Our findings concur with the point raised in Lucas and Claxton (2010) that some assumptions about children's minds that have traditionally underpinned education may not be as valid as once thought. As our project's title suggested, there are moments of wonder in many everyday events. Working theories are revealed when we take time to listen to and understand what children are saying or expressing through their actions. It is important to resist pedagogical practices that underestimate young children's competence and decrease their interest and motivation. Instead it is timely to reconsider pedagogy with young children and explore ways to recognise, support and stretch their thinking.

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