DRAWING AS A TOOL TO SUPPORT CHILDREN'S EXECUTIVE FUNCTION IN PLAY

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ABSTRACT

Young children's drawing is recognised as a rich communication, meaning making and problem solving tool (Brooks, 2009). This article explores the role of drawing in young children's thinking and learning. We consider how drawing can be used as an intentional teaching strategy to support children's development of Executive Function (EF) skills. Comprised of working memory, inhibitory control and cognitive flexibility, EF skills are higher order mental functions such as focused attention and flexible, logical thinking (Center on the Developing Child at Harvard University, 2011).

This paper highlights the process of using drawing as a tool to develop guided and reflective planning for young children's play ideas. The authors share examples of children's drawing and planning, and encourage readers to consider possibilities to strengthen potentials for further learning.

INTRODUCTION

The significance of children's drawing as a meaning making, communication tool is well recognised (Brooks, 2004, 2009; Malin, 2013, Matthews, 2003; Papandreou, 2014). The literature about young children drawing reveals a shift from viewing children's art in isolation to the child as a means to assess intellect, development or expressive capacity (Hall, 2009; Matthews, 2003). Drawing is now predominantly seen as deeply situated in and reflective of sociocultural contexts (Brooks, 2004, 2009; Erkoff & Urbach, 2008; Malin, 2013; Papandreou, 2014). The collaborative interchange between the active child and the social environment is critical to this sociocultural view (Berk & Winsler, 1995; Bodrova & Leong, 2006; Brooks, 2004, 2009; Malin, 2013; Vygotsky, 1978*).*

The active, agentic child is central to *Belonging, Being & Becoming: The Early Year's Learning Framework for Australia* (EYLF) (Commonwealth of Australia Department of Education, Employment & Workplace Relations (DEEWR), 2009). This document, which guides early childhood pedagogy, principles and practices in Australia, positions children as co-constructors of their learning. Play based learning, responsiveness to children and intentional teaching are three underpinning practices of this document. Play offers many opportunities for children to access, refine and build on their knowledge to make sense of their world, and represent their experiences and learning in personally significant ways (DEEWR, 2009; Hunter & Sonter, 2012). Educators are responsive to children's strengths, ideas and interests, and maximise thinking and learning opportunities through the use of

intentional teaching which encompasses “deliberate, purposeful and thoughtful…decisions and actions” (DEEWR, 2009, p. 15).

This paper investigates the role of drawing as a tool to support children’s thinking in play. We draw on our experience as early childhood teachers in Queensland, Australia. The article opens by highlighting the correlation between drawing as a meaning-making tool and the development of children’s executive functioning: higher order cognitive skills. The role of intentional teaching to support children’s thinking is explored. Examples of practice and play exemplify the intentional use of drawing in scaffolding children’s thinking through experiences such as make-believe play. Finally, links between drawing plans for play and higher order thinking are demonstrated.

EXECUTIVE FUNCTION

Executive functioning comprises interdependent skills of working memory, inhibitory control, and cognitive flexibility. The capacity to hold and manipulate information in our heads for short amounts of time (working memory); the skills used to master and filter thoughts and impulses (inhibitory control); and the capacity to switch and adjust to changed demands, priorities or perspectives (cognitive flexibility) underpin “deliberate, intentional, goal-directed behaviour required for daily life and success at work” (Center on the Developing Child, 2011, p. 1). Recalling information and processes (working memory), staying focussed (inhibitory control) multitasking and planning (cognitive flexibility) are necessary for purposeful goal-directed behaviour (Shonkoff & Phillips, 2000). Acquired during the early years, these complex, higher order cognitive skills continue to develop into adolescence, and are used throughout adulthood.

Executive function and play

As children play, a myriad of challenges and obstacles arise, requiring the use of executive function skills. Recalling processes and updating ideas (working memory); persisting, following rules and social etiquette (inhibitory control); problem solving and creative thinking to find new solutions (cognitive flexibility) are constantly demanded. As children’s play matures, make-believe play becomes more evident. Kindergarten and pre-school aged children engaging in pretend or make-believe play take on explicit roles and follow the implicit rules inherent in a constructed imaginary situation (Bodrova & Leong, 2007). This type of play allows children an opportunity to represent their ideas and as such can be seen as a feature of “powerful learning environments” (Laevers, 2008). Such play influences development in several ways including creating a zone of proximal development for many aspects of intellectual development, separating thought from actions and objects, developing self-regulation, increasing motivation and facilitating decentration or the ability to take other people’s perspectives (Bodrova & Leong, 2007, p. 131).

The influence of make-believe play can also be seen to support children’s executive function. As they represent imaginary situations they employ aspects of cognitive flexibility to plan scenarios and problem solve how to implement their ideas. In taking on and acting out roles, they recall aspects of previous experiences and often these play scenarios extend over days and weeks requiring the use of memory capabilities to continue the flow of ideas. In addition, as they follow the set of rules determined by the

specific roles they assume, inhibitory control is required to play within the constraints of that role and within the rules of the game. As well, being cognitively flexible enough to begin to understand the perspectives of other players ensures a continuation of play (Bodrova & Leong, 2007).

Environmental stressors and the complexity of the task at hand significantly affects the development of executive function skills. If the challenge is too simple, or the environment unstimulating or unresponsive, sustained interest is not generated. As a result, executive function skills are not engaged. Conversely, if the activity is too difficult and the environment too stressful, executive function skills shut down (Center on the Developing Child, 2011; Diamond, 2013). Warm responsive support, scaffolding, is crucial to balance the complexity of the environment and the stress of the challenge at hand.

Scaffolding children's thinking

Parallels can be seen between the environmental and cognitive conditions required for activating both the zone of executive function and the child's zone of proximal development. As children play within and with their social contexts, many chances for creative decision-making and problem solving occur (DEEWR, 2009; Hunter & Sonter, 2012). Educators can support and extend children's thinking and learning in their play by scaffolding, an approach used to capitalise on the child's zone of proximal development (Vygotsky, 1978). Subtly shifting the complexity of the task or information and the environment is the basis of Vygotsky's zone of proximal development (Berk & Winsler, 1995; Blair & Raver, 2015; Vygotsky, 1978). Offering challenges just beyond the child's current level of competency, coupled with thoughtful, responsive support is key. Responses and support should be carefully measured and constantly adjusted to enable children opportunities to "grapple with questions and problems" (Berk & Winsler, 1995, p. 30). Recognising the child as an active co-constructor of their learning, effective scaffolding can lead to the child operating in the zone of executive function (Diaz, 1990 cited in Berk & Winsler, 1995). The use of scaffolding as an integral intentional teaching tool is advocated in the EYLF (DEEWR, 2009). Thoughtful, intentional teaching approaches such as scaffolding can support the development of higher order cognitive skills such as creative thinking, problem solving and focussed attention (Bodrova & Leong, 2007).

Drawing and executive function

Drawing also offers rich and varied opportunities for children to engage these complex thinking skills. While drawing, children isolate particular aspects of an experience they consider important (Hall, 2009; Matthews, 2003; Papandreou, 2014). As they focus their attention on important aspects that may include specific materials or subjects, they need to inhibit broader environmental or personal feelings, experiences or distractions (Hall, 2009; Matthews, 2003; Papandreou, 2014). Drawings change and evolve as children's ideas shift and develop. Cognitive flexibility is demonstrated as the drawing and the children's thinking transforms while the act of drawing enables children to see their thinking (Brooks, 2009). Shifting back and forth from their mental thinking to the visual representation of the drawing demands cognitive flexibility. As children's use of drawing becomes more complex, they recall previous ideas and thinking (Papandreou, 2014). This entails the use of working memory. Focusing their attention on different aspects,

children bring new ideas to their work, and as a result, a shift in thinking is required. As new possibilities are considered, or new understandings or interpretations are realised, previously applied strategies or information may need to be supressed. Thus, inhibitory control is required. This new information is organised (Papandreou, 2014), and working memory is updated. It can be seen that there are strong connections between executive function and drawing.

DRAWING AS A THINKING TOOL FOR PLAY

Drawing is a powerful thinking tool through which young children make meaning of their world (Brooks, 2004, 2009). Through drawing, their ideas are made visible (Brooks, 2009). Likewise, play affords opportunities for children to develop, express and represent their ideas and experiences in personally significant ways (Hunter & Sonter, 2012). Correlations between drawing and play as complex meaning making, representational thinking tools are apparent.

The use of drawing as an intentional planning process for enriching the complexity of children's play is advocated by Bodrova and Leong (2007). The best time to help children plan their play is immediately before they begin playing, as without this, "they will not make the connection between their planning and their actual play" (Bodrova & Leong, 2007, p. 150). Drawing plans prior to play facilitates children's capacity to recall and express prior experiences and knowledge, elaborate new information, and organise this into a play script or scenario (Bodrova & Leong, 2007; Papandreou, 2014).

RESEARCH CONTEXT

Our interest in investigating how drawing can be used as a planning tool to support children's thinking in their play underpins this paper. This article draws upon our work as experienced early childhood teachers in two community kindergarten settings in Brisbane, Queensland. Children attending these settings are aged between three years, six months and four years six months. As teachers, we acknowledge the significant role of play, particularly make-believe play, on children's development. We share a common interest in using an executive functioning lens to understand and extend our work with young children.

Data for this study (children's drawings, photographs and anecdotal observations) was collected over a seven-month period, April to October. Children's assent was gained for the use of images and drawings in this paper. Pseudonyms are used throughout and children's work has been de-identified.

Intentional teaching approaches

Specific intentional pedagogical approaches promoted children's spontaneous and reflective thinking about their play and play environments. These included affording opportunities for children to draw plans for their ideas as individuals and in small groups before commencing play, or as a reflective tool after play. With their consent, these drawings and plans were collated and stored in sketch books or folders, easily accessed by the children and families. In addition, observations of children's spontaneous use of drawing to support their play were taken.

As often as possible, the children's plans (or photocopies of these) were collected and added to their portfolios, contributing to a record of their time, and experiences, at kindergarten. The child always maintained the right to use or keep their plan as they chose and initially some children preferred to take them home on the day they were created. However, when plans were kept together, opportunities arose for them to be reviewed, revisited and reflected upon (Brooks, 2004). Children, parents and teachers were invited to consider these plans as a record of the changes that had occurred in both the child's drawing, and their thinking in terms of the ideas they generated for play.

Drawing plans for play

In one centre, children were involved in individual and collaborative planning for outdoor and indoor play including contributing to an instructional book for construction play; contributing ideas towards the renovation of a sandpit space; and planning an obstacle course. A brief description of these planning opportunities follows.

The collection of children's construction designs was kept together in a 'how to make' book. Children chose to contribute a drawing of an object they built or made in their play. The purpose of the drawing was instructional: to show others how to make a particular item. This book was always available, and children were encouraged to review the book as a guide to prompt further thinking.

The opportunity to renovate the existing sandpit afforded the opportunity for children to engage as co-designers and co-contributors. Informal conversations and discussions with the children ensued, and children were encouraged to contribute their ideas to a planning book. The children, parents and teachers spent time discussing and reflecting on the ideas presented in the planning book, which then informed discussions with the landscape architects.

Each week two children worked together to make a plan for the obstacle course (Figure 1). They selected two pieces of equipment each from a bank of photos of the outdoor environment. Initially the children were asked to draw the chosen resources. Once they were familiar with this, they drew the apparatus in the sequence they wished the equipment to be used.

Figure 1. Working together to make a plan for the obstacle course.

Drawing plans to support thinking and make-believe play

Children at the other kindergarten were encouraged to draw plans for their make-believe play ideas before commencing play. These plans were drawn individually or in consultation with co-players. The process of drawing was seen as an intentional teaching approach to help children consolidate their ideas for play and to begin to formulate the steps required to bring an idea to reality. The children were encouraged and supported to draw a plan for the game they intended to create on their first day of each week at the centre. Over time this process became a regular aspect of the weekly routine and was conducted as a group experience, although many children also pursued it as an individual activity at other times.

As a whole group, the children had a brief discussion about ideas that individuals or small groups were considering for their play for the week. Everyone then moved to an area of the room where tables were set ready for the children to draw their plan for play before embarking on establishing their 'game'. The children were not required to adhere to the specific plan they drew; however, verbalizing ideas, (and committing them to paper as a drawn plan), did appear to promote mutual understanding and established a sense of shared activity (and goals) (Bodrova & Leong, 2007).

As the responsibility for establishing ideas, and the subsequent games, was shifted from the teacher to the children, and shared among the whole group and smaller groups, "a richer and more dialogic learning environment" (Brooks, 2004, p. 48) was provided. As teachers moved between the children, supporting them to name, date and give a title to their plans, the discussions that ensued provided opportunities for the adults to understand "what the child (was) trying to depict and what the emerging ideas might be" (Brooks, 2004, p. 47). This process assisted teaching staff in considering what roles they might then play within a child's efforts to establish and play out their game, whether that was as resource person, as co-player, as observer, as mediator.

When the children moved from the drawing space to begin the establishment of their game, they taped their plan in the vicinity of their game where it could be seen both by the children playing that particular game and by others (teachers, other children, parents) moving through the space. A child's drawn plan thereby became "a common point of reference that can be shared amongst others" (Brooks, 2004, p. 47) for discussion, reflection, or as a guide for joining play.

To illustrate the use of drawing as a thinking tool for play, we now share some children's experiences. The following examples showcase the intentional teaching practices utilised to support children's thinking in and for play.

PLAY PLANS

A truck garage: Drawing for instruction

Edward was building a road from the project and interlocking blocks with another child. He gathered two small wooden trucks from a nearby shelf and was keen to protect these from other players. He constructed an enclosed rectangular shape from the interlocking blocks to house the trucks. When asked by another child what he was making, Edward explained, *"You need to keep your car in the garage. You park it there and it's safe".*

Recalling his real-world knowledge of garages, he was hopeful that this structure would protect the trucks in this play.

Edward was keen to share his idea with others. He enjoyed drawing and writing and was a regular contributor to the design book. Often his drawings and designs would detail the materials required. He photographed the garage and asked an adult for assistance to spell the words as he wrote, *"truck garage, I used six blocks"* next to the printed photograph as seen in Figure 2.

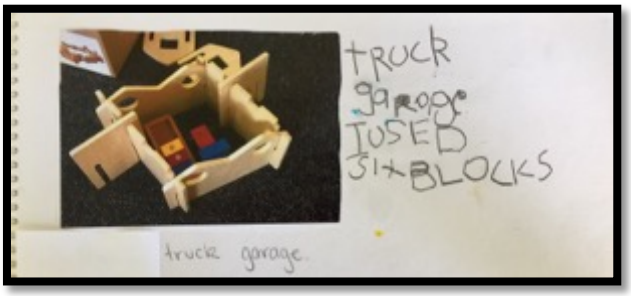

Figure 2. Truck garage.

Edward then drew the design of the garage, as shown in Figure 3. Once again, he asked the adult to specify the quantity and shape of blocks required. However, his design was more elaborate than the actual construction, including many small triangular structures with holes along the longer sides of the garage. Edward explained that he wanted to make the garage tall enough for ropes to be inserted through the holes in order to hoist the trucks. He also accommodated a trailer in his design by affording more length. Asked if he could try constructing this revised plan, Edward declined, commenting "someone else can see it now and they can!". It can be seen that Edward recognised drawing as a social, communication tool. His drawing evidenced his working memory of truck maintenance.

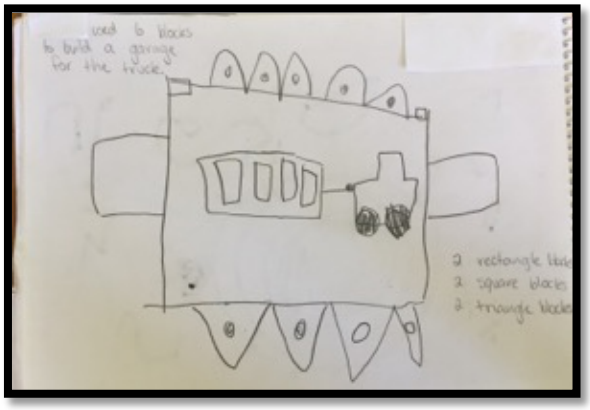

Figure 3. Truck garage drawing.

His ability to shift his thinking from the block construction to reveal other possibilities of garages demonstrated his capacity for flexible thinking and problem solving.

Re-imaging a sandpit space: Drawing for design

The sandpit was originally housed in a gated wire enclosure. Teaching staff were keen to modernise and naturalise this space and increase children's access to the area. Discussions with the children arose, with many conversations focused on managing the existing wildlife in the heavily treed kindergarten garden; negotiating possum scat was an everyday, familiar event at the centre. Concerns arose as to how the children could play in the sandpit amid the droppings!

Figure 4. Sandpit design.

James' plan drew on flexible thinking and working memory. His design included a cover over the sand with rocks in place to hold the cover down (Figure 4). James attended two kindergarten settings and the other setting had an open plan sandpit, which is covered at night by a rollout pool cover arrangement. James often arrived very early to this centre and helped the staff unclip and roll up the cover. He drew on this knowledge to suggest a solution to the sandpit space. Knowing there are many rocks available in the setting, he incorporated rocks as weights to hold the cover down. James' capacity to transfer and modify knowledge to suit a new environment demonstrated his use of working memory, problem solving and creative, flexible thinking.

Planning for the obstacle course: Drawing for outdoor play

When initially undertaking this planning task, it was common for children to draw a picture depicting a garden or outdoor environment, usually including the sun or trees or rainbows. Over time their drawings become more specific as they limited their drawing to the chosen photos (Figure 5). Engaging in this experience supported children's inhibitory control as they built on their ability to isolate particular aspects of experiences (Hall, 2009; Matthews, 2003; Papandreou, 2014) and persisted at a task. As children engaged in this process, they needed to keep in mind their perception of the playground and moveable equipment. While drawing, they shifted their thinking between this perception, the photographs and the drawing. Complex thinking comprising working memory, inhibitory control and flexible thinking occurred.

Figure 5. Obstacle course planning.

A dinosaur museum: Drawing to support social play

A group of children spent several days constructing a dinosaur museum game. A range of materials, including books, were gathered, relevant to the play. The children drew pictures of dinosaurs as well as signs for the exhibits. Drawing of specific dinosaurs and signs displayed the children's understandings of both dinosaurs and museums as well as their capacity to focus on an idea (inhibitory control). These drawings added detail and information to visitors to the game (Figure 6). The children's drawing supported further thinking about dinosaurs and museums.

Figure 6. Dinosaur museum.

Preferring to spend time painting or constructing cars, Andrew observed the play with some interest. He did not usually play with this group of children; however, he visited the game to see the drawings and exhibits. While the players welcomed him as a visitor to the museum, Andrew was keen to join the play. Inhibiting his usual preference of cars as subject matter, Andrew decided to draw a dinosaur that was not on display as a means of contributing to the game, as seen in Figure 7. Andrew's use of drawing as a play entry tool highlighted his capacity for flexible thinking and recall of working memory.

Figure 7. Brachiosaurus.

The article turns to examining make-believe play, a predominant play preference for kindergarten aged children. The use of drawing used as a tool for guided and reflective planning for young children's make-believe play ideas is explored.

PLANNING FOR MAKE-BELIEVE PLAY

Figure 8. Playground plan.

Caroline planned a game about a playground. It can be seen from her drawing (Figure 8) that she had recalled what she would find at a playground including a maze, a slippery slide with a ladder to climb and a double swing. It can also be seen that Caroline had labelled her own drawing - PLAGRAD - spontaneously adding a written explanation to her drawing as a way to convey a clear message (Papandreou, 2014). Caroline had combined her own symbols (her drawing of the play equipment) with symbols she had derived from her environment (for instance, letters). In this way, she was revising and improving her own symbolic code and developing representational competence in an effort to improve communication as discussed by Papandreou (2014). Caroline's plan can be seen taped to the nearby fence (Figure 9). Her game had attracted the engagement of another child, Adrian, who was following the rules of the playground game by bringing his baby to the playground and using the play equipment as intended by Caroline. Caroline's establishment of a specific theme to her play had encouraged

Figure 9. Playground game.

Adrian's inhibitory control to play along with the role inherent in being a visitor to a playground.

In March Sean planned an ice skating game, as seen in Figure 10. His developing cognitive flexibility enabled him to solve the problems involved, such as how to make the skates. In this instance he had found cardboard boxes in the making (art) area to fulfill the role, demonstrating his ability to separate the meaning from the object (for instance, boxes are for holding food) and his developing potential for abstract ideas and thinking, as identifed by Bodrova and Leong (2007). Anthony had come to the skating game and was having lessons in how to skate. Sean can be seen looking back to check that Anthony had his skates on and was able to manage the skates before proceeding with the lesson (Figure 11). He was coordinating roles with Anthony and using his reflective thinking capacities to think of his own actions and the actions of others.

Figure 10. Ice skating plan, March.

Figure 11. Ice skating game.

Figure 12. Ice skating plan, July.

Sean replayed his skating game in July. His new plan demonstrated how his representational abilities had changed over this time (Figure 12). Reflecting on these plans led the children to revisit and replay their ideas. Furthermore, as children described and discussed their plans with others, they remembered details about their play and suggested accommodations to their game. Sean explained that if he were to make the game again, he would build a larger space for the skating rink. The drawn plan was a catalyst for the cognitive flexibility required to evaluate and reimagine his game.

Henry's plan for 'a rainy day near the tree' was rich in colour and detail, as seen in Figure 13. "Through drawing, children create representations of not only objects, but also movements, action, changes, sounds, emotions, and ideas, and they narrate complete stories" (Papandreou, 2014, p. 91). In respecting Henry's idea, he was not asked to account for each feature but rather teachers trusted that the idea he was communicating through his drawing was a reflection of his experience of rainy days. To represent such an abstract idea as rain in his play was a challenge for Henry but in consultation with the teacher, the blue netting was elected as being a suitable symbol for this weather feature, a futher example of the ability to separate meaning from the object. Henry was using green cardboard to cut eucalypt leaves to attach to the tree for the koala to eat (Figure 14).

Figure 13. A rainy day near the tree plan.

Jeremy's plan for the 'SeaWorld' game, as seen in Figure 15, was less detailed than Henry's rain plan, but still showed a sense of the idea he was wanting to represent. In introducing the children to the planning experience, it was imperative to show that all ideas and efforts were valued. In discussion, it was explained that the children had options for how they made their plans: they might want to draw the house or the tree or the spaceship in their game, or they might choose to use the colour that represented their idea, for example, 'You might just draw the colour of the water.'

Figure 14. Rainy day near the tree game.

Jeremy's game had been planned in conjunction with a group of peers who regularly played together. After the planning session, they then worked together to paint bubble wrap plastic to be the sea (Figure 16). The shared meaning behind their activity reflects a social constructionist learning context in which "expertise is shared in order to negotiate and construct meaning" (Brooks, 2004, p. 41). Later in the week, greater meaning was given to this game when this same group of boys extended the ideas within the game (cognitive flexibility) by shifting their focus to hold a demonstration of feeding time at SeaWorld to a group of children who visited from other games.

Figure 15. SeaWorld plan.

Figure 16. SeaWorld game.

Reflections on drawing plans for make-believe play

Bodrova and Leong (2007) suggest that there are many missed opportunities to make drawing the rich intellectual activity that it can be. Certainly in drawing plans for their games the children have had experiences that have facilitated their developing executive function skills. In recalling previous experiences and knowledge through both their drawings and their play they displayed both long and short term memory capacities. Inhibitory control was evident as they isolated particular aspects to focus on while considering and drawing their plans, and in focussing on their own plan as they established their game within a busy room. In putting their ideas into operation through establishing their games, their developing cognitive flexibility allowed them to extend or alter ideas, incorporate ideas of others within the same game, and develop strategies for organising a range of ideas, planning actions and problem solving.

CONCLUSION

This article has explored the role of drawing as a tool to support children's executive function development. The use of drawing as a meaning-making tool and its relationship to the development of children's thinking has been demonstrated through these stories. Intentional teaching within the Australian EYLF (DEEWR, 2009) has been discussed, and linked to examples of practice and play exemplifying the intentional use of drawing in scaffolding children's thinking. These examples have illustrated how the use of drawing in and for play further supported children's executive function skills. These examples provide explicit support for Bodrova and Leong's (2007) suggestion that potentially there are many missed opportunities to utilise drawing as the rich intellectual activity that it can be. Incorporating drawing as a means to enhance children's planning, recording and reflecting adds depth to their use of the higher cognitive skills that are the basis of their executive function.

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Note

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Biographies

Lisa Sonter is an experienced early childhood teacher, consultant, and recipient of a NEiTA Community Merit Award for leadership and innovation in early childhood teaching methods. Currently a sessional academic at the University of New England, Lisa is also President of the Queensland Early Childhood Sustainability Network. Her PhD explores the lived experiences of a small group of teacher aides in Queensland Prep settings: under-represented voices in research. Co-author of *Progressing Play: Practicalities*, *Intentions and Possibilities in Emerging Co-Constructed Curriculum*, Lisa has a strong interest in children's play in varied contexts.

Desley Jones has over 30 years' experience in early childhood education and is currently director of Ballymore Kindergarten, Brisbane. She has a degree in education and an honours degree in psychology. She is a recipient of an Inspirational Teaching Award for her emphasis on children's social and emotional wellbeing.

Lisa and Desley share and promote perspectives and practical strategies using an executive functioning lens to understand and extend their work with young children.