Affordances for Science Learning in "Bush Kinders"

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Abstract

The European forest kindergarten movement has recently translated into an Australian 'bush kinder' approach. The affordances of bush kindergarten settings with relation to the science experienced through play has not been previously investigated. This pilot project followed three kindergartens in South Eastern Australia using a bush kindergarten approach. A phenomenographic case study approach was used, in which data consisted of observations of 'science learning through play' during bush kinder sessions and educator interviews. Using interactive video interviews, educators were asked to comment on their perceptions of the science that formed children's play. Findings suggest that the bush kinder environment enables children to experience and improve their understanding of a range of science ideas, however, there is an impact in the scope of children's learning based on the educator scaffolding. It is argued here that bush kinder provides affordances for science learning and makes an important contribution to science education.

Introduction

Over the last 50 years, there has been an international development in 'Forest Schools', resulting in many hundreds of different iterations of 'Forest schools' around the world (Knight, 2009). Forest schools use natural environments and outdoor play to develop children's learning (Campbell & Speldewinde, 2018). Recently, the 'forest school' approach has been taken up in growing numbers and in Australia it has translated into 'Bush kindergartens' (colloquially known as 'bush kinder'). Inspired by its European and UK predecessors, bush kinders have been adapted to suit Australian conditions. Research indicates that the most significant benefit children gain from interacting with nature settings is that participation helps children to appreciate and care for the environment (Harvey, Hallam, Richardson, & Wells, 2020). Australian research around the benefits of a bush kinder approach (Elliott, 2013) has tended to focus on the overall positive aspects in terms of children's love of nature that is the child's affinity with the natural world (Wilson, 1992). There has been no direct research into the specific science learning around biological and ecological systems, physical sciences and chemical sciences in bush kinders.

Science can be defined as knowledge or a system of knowledge covering general truths or the operation of general laws especially as obtained and tested through scientific method (Merriam Webster online dictionary, 2020). Both the method and the knowledge of science are important to taking a "systematic approach in which hypotheses are tested through observation and experimentation" (Turner & Williams, 2020; p. 3). The definition of science in kindergarten settings applied here is reliant upon pre-primary school level, science curriculum documents (Victorian Curriculum and Assessment Authority [VCAA], 2015) and what is commonly termed play-based learning. We interpret science to be where children become independent observers of everyday objects, materials and living things. Fieldwork observations and teacher interactions are applied in this paper to understand how science learning occurs in bush kinders.

Understanding the affordances (the significant properties which allow learning) apparent within these settings, as well as the impact of individuals within the setting, forms part of the consideration here. This paper also considers how the environment (bush settings) contributes to new learning and how the educator interacts with the child and the setting to enhance and enable new learning. It responds to two research questions:

- How science learning is occurring in a bush kinder?
- What are the conditions which afford science learning in the bush kinder?

Affordances in nature settings

The theory of affordance (Chemero, 2003; Gibson, 1979) indicates that most environments have significant properties that allow learning, depending on the relationship of the person to the environment. An affordance is a resource the environment offers to any person who has the capabilities to perceive and use it (Gibson, 1979). The person-environment relationship is based on practical activity within the environment. As a person acts, moves or interacts with an environment, new affordances become apparent. These affordances relate to the person's personal characteristics including body size and shape, motor skills, experience and motivation – and their ability to use these characteristics to enable learning to occur. These material affordances are present in the environment but may not be perceived by an individual – much depends on the purpose of person within the environment. The individual sits within a wider, dynamic socio-cultural network, which includes concepts, methods, tools, practices, commitments and people – which may extend across time and space (Barab & Roth, 2006). In this network, it is often the common goal of the group (rather than the individual) which sets the boundaries of the affordance.

Outdoor education emphasises direct experience with the environment and environmental learning (Greenwood & Hougham, 2015). There are a number of affordances specific to outdoor education (White, 2011). The affordances the bush kinder provides also allow educators to observe and appreciate how space is used, ensuring that more than the space's characteristics is considered in children's play (Änggård, 2017).

Within the setting of the bush kindergarten, the application of affordance theory allows for a consideration of the setting and the individuals within the setting: the children and their educators. Roles become different in outdoor settings for example, children's play using natural resources, which may be considered unscripted inquiry, allows the educator to deal with different learning challenges or flexible learning environments, leveraging child-led experiences to be meaningful. Outdoor learning also enhances inclusivity and meets the needs of individuals in active participation. With the specific focus on enabling and enhancing new science learning, features of the bush setting can be interrogated for their affordances. These features include the actual setting and its contribution to new learning; the educator's interaction with both the child and the setting in challenging new learning and; features of social networks and play dynamics that may augment children's science learning.

Defining science learning through play

Much has been written about how children learn through play with many educators accepting that 'open-ended play promotes children's exploration of a new concept' (Edwards, Cutter-Mackenzie, Moore, & Boyd, 2017). Indeed, the Integrated Practical Teaching Guide (Department of Education and Training, 2017; p. 8) positions children's play as a crucial aspect of their learning "*Child-directed play and learning occurs when children lead their learning through exploring, experimenting, investigating and being creative in ways that they initiate and control. The adult's role in child-directed play and learning may be to observe what the child knows and understands based on what they make, write, draw, say and do*." Children are

'social actors', actively engaging in the construction of their own knowledge through lived experiences (James, Jenks & Prout, 1998). Everyday learning is a foundation for scientific learning (Vygotsky, 1986) and a child's knowledge construction (working theory) provides both a mechanism and a mediating link for developing everyday knowledge and scientific knowledge (Hedges, 2012). Children's knowledge construction often evolves during inquiry activities as they attempt to understand and explain connections between experiences, information, and understandings (Hedges, 2012).

This study draws on definitions of play-based learning to consider that children's science learning can relate to skills or early observations of science phenomenon, where they explore and make sense of the world around them. Observations include children's experiences and relate to how they gather information through the five senses. They develop tentative or naïve understandings and apply senses "to gather information and learn that investigating objects, asking questions, seeking answers to questions and making observations are a core part of science" (VCAA, 2015). The children can share what they discover about the characteristics and properties of the world around them while exploring change in their environment.

Materials and Methods

Case Study

The research used a case study approach (Stake, 2005) informed by phenomenography to examine the observed material, cognitive, procedural and psychological affordances of the bush kinder for science learning. In considering 'bush kinder' and its affordances for specific science learning, we focussed on the phenomena we observed to understand how children, educators and the researchers experience, interpret, perceive and conceptualise bush kinder (Orgill, 2002). Influenced by van Manen's work (1990), we sought to categorise events as objects of human experience having collected data from individuals and groups experiencing the phenomenon. Benefits are apparent when applying the results of phenomenographic study to education research as they "probe how students experience understanding and constructing of new knowledge" (Ornek, 2008). Applying phenomenography in science education (Ornek, 2008), we anticipated that the participants (children, educators, researchers) would experience bush kinder science learning as a shared experience but react to that experience in unique and individualistic ways.

Case study is research that "investigates a contemporary phenomenon (the case) in a real-life context, especially when the boundaries between phenomenon and the context are not clearly evident" (Yin, 2014; p.2). It includes the distinctive condition of multiple variables, more than just data points, in case studies and where multiple sources of evidence can be used. Each bush kinder context was considered a case, bound in time and circumstances. A case study approach is used when researchers have questions related to 'how' and 'why' of the phenomenon; the behaviour or responses of the participants cannot be manipulated; contextual conditions are relevant to the study and; boundaries between context and research focus are not clear (Yin, 2014).

This research compared three individual cases, three bush kinder sites. The investigation of the individual cases sought to identify important elements and affordances that promoted children's science learning. Data gathering included interviewing and observing to describe the programs, the science experiences of the children at bush kinder and to illuminate science learning through play. Educator perspectives were sought to clarify the observations, along with researcher notes and video captured on site. The video was used to extract educator voice and opinions and to enrich researcher's notes. Children's engagement with natural science in the bush kinder was

observed until the children exhausted that line of play. It should be noted that in early childhood, children will frequently return to a previous play experience and extend and expand on it – and this occurred several times during the observations.

An interpretive analysis (Hittleman & Simon, 2002) was used for case analysis where we attempted to position the meaning-making practices of the children and educator as the central focus, leading to theoretically-based implications in response to the research focus. This study brings together the perceptions of educators and researchers across three bush kindergarten cases. Its purpose is to elucidate the factors which afford science learning in bush kinders, clarify the extent to which children's science experiences may lead to science learning and provide insight into the development of educator scaffolding of science experiences. Since this represented an interpretive study of a system that was 'bound' in both time and space, case study was identified as the most appropriate methodology.

Research Design

Context - sites

This research project studied three bush kindergartens in south-eastern Australia with the purpose of documenting the science learning through play observed as children interacted with the outdoor setting. The bush kinder sites were new, with one operating for 12 months, while the other two had been established for 24 months. The three settings were similar but exhibited differences despite being in the same local government municipality and being in close proximity to each other (Campbell & Speldewinde, 2018).

Site One was located on the fringe of natural bush with sparse vegetation and with the potential for children to move beyond the boundaries to undertake further explorations (under educator supervision). Play was restricted to an area within some 'invisible' boundaries determined by the children and educators at the commencement of the bush kinder establishment. Within the boundaries, children had access to trees, leaf litter, small animals such as frogs, insects, caterpillars, and lizards and occasionally, wet areas during rain.

Site Two was located in lightly treed parkland with significant ground cover comprising bushes, plants and grasses. It contained a free-flowing creek. Again, within invisible boundaries, children had access to trees, fallen tree logs, leaf litter, small animals, birds and significant vegetation. Access to the creek was limited. The boundaries of the second site were more extensive than the first site – taking in much more land, more natural material and a greater variety of natural material.

Site Three differed from the first two. A vacant block of land (a paddock) nestled next to the kindergarten and behind the local church, the site had been cleared of all natural vegetation and consisted of large conifers along the back edge of the perimeter and a few other trees dispersed across the block. It was a more restricted space than the other two sites, although, as with the other sites, outside the boundary areas there was access to quite a significant flowing river and natural foliage and birdlife along the river.

Because the bush kinders were managed through one government authority (Shire Council) there were similarities in approaches to the way the sites operated. All bush kinder sessions ran for three hours, once a week on a pre-determined day and regular kindergarten sessions were held at the regular kindergarten building at other times. Staff were provided some professional development around bush kindergartens and the benefits of learning in outdoor environments.

Participants

Each site included three educators and between 20 and 25 four-year-old children per bush kinder group. Overall there were nine adults and approximately 70 children involved in this study. The site directors were educators with significant early childhood experience, in excess of twenty years each, and they had generally undertaken a bachelor level degree. Assistants were more recently trained, with less than ten years' experience and were generally qualified at a diploma level (three year course).

Methods of data collection

Conducting observations and interviews

We employed an ethnographic methodology which included conducting semi-structured interviews and participant observations of the bush kinder sessions (Hendry, 1999; p.3) during approximately one hundred bush kinder sessions during 2015 and 2017. Overall, we collected ten hours of formal educator interview data, ten hours of informal educator interview data and 54 hours of video observation data. Initially, the three kindergarten directors were approached to gauge their willingness to involve their kindergarten in the research. Children were not interviewed or questioned (due to ethics restrictions). The children were research participants as they were observed, parents having provided consent for their children to participate including being videoed, and these observations were influential in the focus of educator interview discussions. Data is therefore from educators' opinions and experienced interpretation of children's play as well as researchers' documented observations.

From the outset of our field visits, we explained our method of interviews with early childhood educators and observations of sessions. Having gained consent (both ethical consent from the necessary jurisdictions and the kindergarten directors), we talked to the bush kinder educators to gain background information to how the bush kinders operated, how sessions were conducted and what philosophy the educator had when it came to running the bush kinder. We asked the educator for their perceptions around what was expected to occur at the setting in terms of children's activities and learning. Questions to educators included:

- Can you describe the bush kindergarten?
- What learning do you think is happening at the bush kinder?
- How is science learning and teaching being enacted in the bush kindergarten?

Further informal interviews occurred while we were observing as we walked around with educators. Often, these involved educators explaining their interactions with the children and their perceptions of children's learning. The short informal interviews were undertaken during and immediately after the observation session, and the researcher asked the educator to comment on particular instances that had been observed during the session. This instant and direct educator feedback was critical for gaining accurate interpretations of children's experiences.

Our observations ranged across four to eight sessions per term per kindergarten (dependant on the kindergarten) for approximately three hours. We applied an observation protocol to collect data (Figure 1). As participant observers, we wanted to understand how the bush kinder was experienced by the educator and the children in the setting and to find out exactly what it is like to be a member of this group by "participating in the lives of the people under study" (Hendry, 1999; p.3). We needed though, to frame what we hoped to observe. This protocol was refined following the initial visits to the bush kinder sites. We observed educators as they moved around the bush kinder site, scaffolding at point of need, the children at play through the lens of science teaching and learning. Circumstances dictated that sitting as a 'removed' observer

did not happen as both the educator and the children kept attempting to draw us into the play environment. We videoed all visits and extracted observation notes and educators' comments from the video after the session. This was complemented by our own reflections recorded upon return from the field in researcher diaries. There was no need for a later video-stimulated interview as this occurred at the time of observed child play and interaction.

	Observation/ Activity description	Reflection/teacher comment
Context – children at play		
Physical sciences – eg balancing, skidding, pushing, jumping		
Chemical sciences – eg mixing mud pies, texture of surfaces, evaporation/ condensation		
Biological sciences – eg plant or animal engagement		
Science skills – observation, classification, recording, measurement, use of tools		
Something unusual		

Figure 1: Observation protocol

Our entry into the bush kinder would often see us accompany the children and educator to the site, observing and making notes of children's interactions with each other and with the educators when some aspect of science was observed. Initially, we entered the field site looking out for instances where teaching occurred that aligned to physical, chemical, biological sciences and science skills. Participant observation permitted an easy entrance into the learning situation by improving the relationships with educators and children, and decreased the extent to which we disturbed the natural situation. This intensive immersion into the bush kinder site allowed us to interact with the educator and children while deep learning events occurred on site. This facilitated the collection of rich ethnographic data to understand the experience of the educator and child in the bush kinder context.

Data analysis

The qualitative data obtained through individual interviews with educators were considered through the process of thematic analysis (Somerville, 2003), specifically searching for occurrences of learning. This involved the identification of themes by careful reading and re-reading of the transcripts, and searching for recurring words. Pattern recognition within the data led to the identification of emerging themes that became the categories for analysis (Fereday & Muir-Cochrane, 2006). Following thematic analysis, the ideas were coded. For example, a number/code denoted the first idea, and similar ideas within the transcript were allocated this same code. A new idea was allocated a new code and so forth. After the numerical order was assigned to ideas within the whole transcript, similar ideas were clustered together into themes for further analysis. The themes were then specifically grouped to align with the ideas surrounding affordance theory: environment, educator and child (social networks).

Results

Educators' interviews

All educators were enthusiastic about the opportunity for children's involvement and learning to occur within this setting. The initial discussions revealed variations in the demographics of the kinder communities, but that seemed to have little effect on the educator expectations of the children and their learning. The questions and responses sampled across the three sites included:

What learning do you think is happening here (at the bush kinder)?

We have been watching the clouds, they are seeing the changes, they are feeling the wind, it's a whole sensory, visual, knowledge based way of learning for them.

When they don't know and love the environment, how are they going to respect it and look after it in the future?

She's teaching them to look very carefully at things. J. has a lot of incidental learning.

It is a holistic way for children to learn, actually experiencing it.

A lot of the learning is very sociable, learning about peers, learning about emotions, learning about empathy for not only themselves and their peers.

How is science learning and teaching being enacted in the bush kindergarten?

We are undertaking an observation of the spiders, the Leaf Curling spiders.

(Science is) completely and utterly embedded right from the start of the day.

She will gather them together and focus on something really well. R. does a lot of observation.

What is available for science play?

The natural resources are dirt, water, grass, things that they can mix with and explore with. When they are experimenting and doing things the reactions and actions and things like that. Just making a simple mud pie, mixing the water and the dirt together then it's something different.

The kids here are learning about gravity. When they are building shelters, sometimes things fall down. There's lots of weather when the sun comes out and the rain.

I suppose there's lots of physics involved. It's all to do with leverage, in nature, we're just discovering where they find things. Like, where does that hole lead, where's the bird for that nest. They are just discovering where things are. Because we've got a lot of branches, and we've got a lot of leftover tree trunks and stuff, they're actually also discovering sizes. In fact, a few weeks they actually doing, the little stumps that they found, from small to large and using them as steps to go on.

…when you add water to dirt to create a muddy puddle or the clay. The clay was a really good experiment to see the difference when it was dry and hard after it had been dried out on this log here and then putting it in the puddle and how it was manipulated.

Data: Researchers' Journal Notes – Observations of science content and skills

We observed scaffolding by the teachers around three areas of science (physical science, chemical science and biological science) as well as skill development. For example, teachers observed and supported children to classify as the children grouped various objects such as twigs or gumnuts. Teachers would support children on tree branches, sometimes holding an arm out, standing directly underneath or next to them, then discuss what the children were experiencing. Teachers would encourage children to slide down embankments so they experienced force, and friction and discuss with the children what they felt with their bodies as they rolled or slid down a grassy slope. Ethical behaviour to small animals was observed and teachers would encourage the children to sometimes handle where appropriate, but more often only observe snails, beetles and worms. Children observed and commented on changes to the environment due to weather and seasons.

The researchers' observations indicated that physical sciences such as gravity and forces were strongly represented in children's play. These related to the way children moved both themselves, the items they found around and their physical interactions with others. The researchers' data highlighted instances of children learning how to balance their bodies on rock or branches and how they would persist at this task until they had conquered it. Children were able to advise their peers on how to do it, using concepts of balance, weight distribution and body positioning. The children were demonstrating learning – previous to the experience, they were unable to articulate how to balance, but due to the experience and their thinking through what was occurring, they constructed new knowledge.

Vignettes

Making a potion

Two children took leaves, flowers, and water and put them in a small hole in the ground. They then dug deeper into the ground, making a slightly bigger hole, they then added water to see what would occur. They used words like 'mixing' to describe how the water turned muddy and 'not mixing' to indicate that the leaves and flowers didn't seem to change. They observed the difference in materials and used descriptive language to tell the educator what was happening.

Observing change

Two boys took mud and packed it around the tree. They left it on the tree and the educator asked them what they thought would occur. They thought about it for a few seconds and decided that it would all fall off. When they returned a week later, they observed that it was still there and had dried out. They observed the physical change that had occurred.

Problem-solving/ Technology/Science

A child found a piece of 'fluff' (animal fur) and wanted to move it away from the play area. She hunted around and found two sticks which she used as levers. However, one was too long, so her sticks did not function. She swapped one stick for a slightly smaller one and found that she could use them to pick up the fluff and move it away from her play site. She demonstrated knowledge of levers and how to use them. Underlying her use was an understanding of force – she knew that she had to push the sticks together hard to hold the fur.

Learning to balance

At the bush kinder there was a large fallen tree log which the Shire Council had trimmed to make it safer for the children to play with. The teachers informed us that they had approached the Council to leave the log as it would provide them with an opportunity for children to play and learn science concepts such as balancing. Two boys who had been running around the bush kinder had come to rest and sit on the log. The log began to move from side to side. Then another child, seeing the rocking, joined in and sat on the log and over the ensuing minutes, five children were sitting on a log. A teacher approached and asked the children to take different positons along the log to see what would happen. She asked what happened if they all sat at one end to which the five children moved to one end. The teacher asked the children what would happen if they placed their feet on the ground. As the children shifted around the log, the teacher would pose questions about what they were experiencing always including the word balancing in the discussion which went on for over twenty minutes.

Researchers' Journal Notes – Observations of science teaching

Site One

There were three educators at *Site One*, each with a slightly different approach to children's interactions. The lead educator organised a 'focus' for each week, whether it was a walk into a different area of the bush, an observation visit to see the fungi growing, or a visit to the nearby pond to observe pond life. Inevitably, each week's focus that we observed involved some form of science learning. The lead educator believed in augmenting children experiences as much as possible. She was purposeful in asking children questions related to the play activities that bush kinder afforded and moved towards play when she could see an opportunity for inquiry questions. The second educator was also quite involved with children's play, stepping into the play when a learning opportunity arose which related to something children were engaged in. She was particularly involved in children's tree climbing, helping them to see and assess tree branches for climbing opportunities. The third educator was more withdrawn from the play, unless specifically invited into the play by the children. However, when this occurred, she contributed fully to their play, including having her face painted with mud.

Site Two

Three educators were present at *Site Two* and each took the same approach to children's interactions. There was no 'focus' for each week, children would arrive and immediately begin interacting in the bush kinder space. As more children arrived, they would form their small groups and be free to explore. The educators would roam for the duration of the session after a short initial period in which each child would be greeted upon arrival. Children's learning would be augmented on a needs basis. If a child found a bird's nest or fungi or a group of caterpillars, and then alerted the educator to its presence, a discussion would take place. This was child directed learning with scaffolding by the educator. Again, we observed children's activity that was science based which drew upon the environment of the bush kinder.

Site Three

There were two educators at *'Site Three'*. One, a very experienced educator, took a small amount of additional material into the bush for children to use. These included magnifying lenses, containers, and drawing implements. She actively involved children in her discovery of 'things'. If she spotted a bird, she would call children to observe it with her. The second educator was initially more timid in the bush setting as she had to adapt herself to the idea of fewer constraints on children's behaviour and a more open learning environment.

The way the educators interacted with children's learning varied from site to site and, more particularly, from educator to educator. One educator had a very 'hands off' approach to children's experiences within the setting, preferring to only move into the play at the request of a child. At the other end of the scale was the educator who brought extra material (magnifying glasses, drawing implements) to the bush site so that children could more properly investigate things. She would also indicate things to children when she saw them, or would move into their play to scaffold their learning when she thought it appropriate. It was interesting to observe this educator who approached the setting with a sense of wonder at all the science that was within the setting – she seemed to want to share her excitement of discovery with the children. Another educator was interested in purposefully extending children's learning through moving them to 'outside' areas, particularly in response to changes in nature or children's interests.

Discussion

In analysing the data, we returned to the framework of affordances to consider how the environment (bush setting) contributes to new learning and how the educator interacts with the child and the setting to enhance and enable new learning. Before we entered the field sites of the bush kinders, our attention was drawn by the interviews with the learning directors, to the opportunities for science learning that occur in this setting. The idea of the natural environment was a common response to our enquiry of the benefits of the bush kinder as a place of learning with educators indicating a belief that children's science learning would advance in the natural setting. The bush setting contributed to children's science learning in allowing them to explore, to investigate materials and draw their own conclusions. This aligns with the literature around children's early learning through play (Edwards et al., 2017) and how these initial experiences, repeated over time, could lead to children's growth in understanding. Our data contained multiple examples of these aspects at each of the three bush kindergarten settings. The settings, with the changes in weather over time, children balancing and using natural resources for categorising, allowed for a setting where material in the environment fluctuated from week to week, enabling new activities to emerge and reducing the possibilities of others. Learning through play was identified as the development of new understandings in relation to science concepts surrounding weather, plants, small animals, mixing and forces, as well as skills such as observation, comparison, measurement and counting.

The initial interviews with educators, six in total, indicated that their expectations for the natural bush settings was that they would be productive spaces for learning about the environment and for children to develop an ethos of caring. This expectation then led the educators to seek and recognise those instances of science learning through play that related to various sciences. On occasions, educators highlighted a biological concept or process to draw children's attention to science related ideas in the physical environment where the natural phenomenon was the catalyst for a child's play (Berrington, 2012; Davis & Waite, 2005). Additionally, our attention was drawn by experienced educators to their own interaction with the bush kinder being as much a learning experience for themselves as the children. This is an avenue of research which requires future study.

It was observed that the physical phenomena children are closest to, such as manipulating objects and exploring the physicality of their own bodies, is generally related to physical sciences (for example, manipulations of force and energy). The science knowledge of the educator influenced the learning experiences. During the interviews, only one educator highlighted a knowledge of sciences (chemistry, physics) other than biology or ecology,

although researchers observed educators' greater understanding of this in some of the play experiences with children. In some instances, activities involving these sciences were appropriately scaffolded but in other cases, educators just did not move into these play situations.

Finally, children's own resources governed the extent to which they interacted with and through the environment. The children's prior knowledge and experience, procedural knowledge, their willingness to experiment, to test, explain, and take risks all were influential in determining how they played in the bush kinder. The advancement of this knowledge, skill set and process ability was considered to be a demonstration of learning from, and through, the environment and aligned with the theoretical positioning of play-based pedagogy. Some children initially were confused with not having 'toys' to play with and needed to be led by the other children. Some were afraid to get dirty or were too timid to climb trees or jump in puddles. Others mixed up mud and experimented with how it dried on different surfaces, or built 'cubbies' that became a variety of different places – depending on who was playing there. The tree-climbers experienced the slipperiness of wet surfaces and learnt to adjust their balance mechanisms. The characteristics of the children themselves, tended to change over time. It was observed by the researchers and confirmed by the educators that the children were taking more risks in the environment. This meant that they were tending to interact in a richer way with every aspect of the environment and therefore could gain more learning from it. In addition, their group behaviour changed with more children willing to take on the lead role in some situations and to allow others to do this in other situations.

Additionally, our own inability to capture every event that took place during our fieldwork limits our capacity to understand the rich science learning that was taking place. The wide panorama of the bush kinder allows for innumerable opportunities for learning, albeit bound by the seasons and the invisible barriers which limited the movement of these young children. Having the attention of one child or a small group of children as other groups roam freely around the space limited our capacity to capture every science learning moment however we believe the insights provided to us by the educators and our own purview of these field sites allowed us to capture an array of events that speak to the opportunities that the rapidly growing bush kinder movement is affording Australian early years learners.

Conclusion

In terms of affordances, the data and its analysis provides insights into the science learning opportunities provided by the bush kinder. Firstly, the bush kinder settings are rich in opportunities for children's learning in science. Learning in science is not just about conceptual learning, but also the richness of skill-based learning. There is sufficient research evidence in early childhood literature that indicates that children's interaction and experiences enable learning of early or naïve concepts as well as skills. The natural environment supplies materials, both loose and fixed, which enable children to learn science through play. The educators themselves become part of the 'affordances' in that they make use of the settings and the children's learning experiences in different ways to support learning. Some believed in only child-directed learning where children's autonomous learning was left alone, through to those who directed learning opportunities by attempting to make maximum use of the natural resources or by augmenting them with other material. Finally, the children themselves become the active agents of their own learning (despite the differentiation in the form that educator interaction takes) and become more so over time as their agency in the natural setting becomes stronger and they become more confident. It is the setting of the bush kinder and the social

networks that develop that augment and support children's developing understandings and enhances and enable new science learning.

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