

Nature and its use in Australian primary school classrooms.

By Glenn Wagland

Introduction

This report will look at a small selection of ways nature can be used to facilitate improved learning outcomes for primary school students. From learning about nature, using nature for restorative therapy, and multidisciplinary learning through nature. It will look at theories and current research that supports nature-based learning, and examine nature play and its benefits. Presently, a big push is moving through the education field, led by governments, and community concerns. In South Australia, agencies such as the Natural Resource Management Education (NRM), and Nature play SA have offered support to help hundreds of sites move forward, into a more sustainable nature based future. With a worldwide Environmental Education (EE) movement fuelled by the likes of Richard Louv's book 'Last child left in the woods'(Louv 2010)), and Claire Warden's forest school movement, as well as traditional theorist supporting nature based learning, such as Dewey, Montessori and Kolb, it is evident nature based learning is more than the latest fad, and more, a sound pedagogical choice for the future.

The Theories.

Nature based learning isn't a new concept. Froebel, mostly noted for his nature-based contribution to preschool education, the Kindergarten, argued back in 1896, that nature based 'learning through doing', was a salient learning tool for all ages (Fröbel & Hailmann 1896). John Dewey (1900, p.8) elaborated on this principle in his book 'School and society', stating, 'we cannot overlook the importance for educational purposes of the close and intimate acquaintance got with nature at first hand, with real things and materials', and much of Maria Montessori's theories embraced nature-based learning when she argued 'nature is a teacher, and it teaches the child the most arid part of language. It is a real school with methods. It teaches nouns and adjectives, conjunctions and adverbs, verbs in the infinitive', (Montessori 1949, p.175). In recent times Howard Gardner's theory of multiple intelligence (1998) added 'Naturalist Intelligence' to his ever expanding list, stating, 'due to students possessing abilities in this domain, teaching should attuned learning environments to support it'. David Sobel's book 'Children's special places' (Sobel 2001), looked at fort building and saw it as building blocks towards curriculum design supporting Geography, environmental education and social studies. With a plethora of supporting research (Brody 2005; Dowdell, Gray & Malone 2011; Kaplan 1995; Larson, Green & Cordell 2015; MacQuarrie, Nugent & Warden 2013; Payan 2012) teachers have a wide range of concepts to draw from.

The Australian Curriculum.

While theorist and current research support nature-based learning, it would be futile pursuit, if not supported by the Australian Curriculum. Luckily the Australian Curriculum discusses many benefits for nature-based learning. The Curriculum is design as a three-dimensional curriculum. These are:

- disciplinary knowledge, skills and understanding
- general capabilities
- cross curriculum priorities.

Disciplines.

If you look through each discipline's content descriptors you will see opportunities for nature-based learning. For example, year 5 HASS content descriptor 'Locate and collect relevant information and data from primary sources and secondary sources (ACHASSI095)' (Australian Curriculum Assessment and Reporting Authority 2017). You would be hard pressed trying to do that without leaving your classroom. The content descriptor for year 4 technologies states 'Investigate how forces and the properties of materials affect the behaviour of a product or system (ACTDEK011). The elaborations on this descriptor outline hands on construction and reflection. Bridge building, real measurement of force and multi-angled reflection of structure attributes. While linking disciplines such as science, HASS and technologies, to outdoor learning seems obvious, how does Numeracy and Literacy fit in. The world is mathematical, so finding links between nature-based learning and the curriculum are plentiful. The Australian curriculum's numeracy focus, is on real world applications for mathematical concepts (Australian Curriculum & Authority 2017). Year 1 mathematics content descriptor says students should be able to, 'Measure and compare the lengths and capacities of pairs of objects using uniform informal units (ACMMG019). In nature students can be observed using all sorts of uniformed measuring units. A child's foot, arms reach, and even a 'measuring' stick are valuable, convenient tools. What happens in a nature play-based activity when the distance between two trees are measured by one child as 'fifteen' of their own feet, while his big footed friend insist it's only twelve of his feet. How deeply is the contents of this descriptor analysed by this interaction. In regards to literacy the Australian Curriculum agrees with Montessori's (1949) quote 'nature teaches language in the infinitive", when they highlight nature's ability to introducing specific terminology used in outdoor contexts, or to enable students to become critical thinkers regarding analysing text assumptions. Year 7 English content descriptor reads, 'Use comprehension strategies to interpret, analyse and synthesise ideas and information, critiquing ideas and issues from a variety of textual sources (ACELY1723)'. How would this content descriptor be met, if a student challenges information on the internet related to the geographical location of a growling grass frog, which, according to the 'net,' is only found in central Victoria, when they find one under a rock in Tanunda. Year three Numeracy content descriptor states 'Make models of three-dimensional objects and describe key features (ACMMG063)'. Imagine constructing a 3-metre-high stick pyramid, and describing one of its key features, being, it could hold the weight of three students.

General Capabilities

One of the general capabilities are creative and critical thinking. Creative and critical thinking develops as students 'learn to generate and evaluate knowledge, clarify concepts and ideas, seek possibilities, consider alternatives and solve problems' (Australian Curriculum Assessment and Reporting Authority 2017). Some examples of critical thinking are testing, generalising, and hypothesising. These dispositions are evident when watching a group of students trying to create a tree house. They generalise the load capacity of tree branches, hypothesise the specific branches ability to hold the weight, and test the structure with a similar weight or another student who doesn't mind falling out of trees. Creative thinking is also evident when students are observed applying new ideas to a specific problem, such as creating a soft landing under the tree house, in case the structure fails.

Cross-curriculum priorities.

Out of the three cross-curricular priorities, Sustainability is prominent in outdoor play. Richard Louv (2010) asked 'where would the future stewards of nature come from', if nobody engaged with nature. Robert Michael Pyle (2003) echoed this, when he said children need to engage with nature, in order to bond with it, and grow up with a naturalist outlook. When children connect with a nature based outdoor learning environment, groundwork is laid to build an interest in protecting the environment. The learning is situated when it involves hands on meaningful engagement. Planting out a nature space with indigenous plants offers more to a child's concept of sustainability, than any youtube clip in a classroom could offer. Another of the cross-curriculum priorities is Aboriginal and Torres Strait Islander Histories and Cultures. The Aboriginal people have a spiritual connection to country, and this is evident when looking at the eight Aboriginal pedagogies, which includes the concept of land links (Yunkaporta 2009). Incorporating Aboriginal pedagogies in outdoor learning can be a valuable strategy in incorporating this cross-curriculum priority into a program. Many of the nature-play activities students create, are games played for the last 60,000 years by the Indigenous children (Haagen 1994).

What benefits does nature offer to the classroom?

Learning about nature, and environmental education.

Howard Gardner's multi-intelligence theory (1998) postulated, intelligence came in many forms. Some students were natural learners when it came to numeracy, some science, and others kinetically. Later he added naturalist intelligence. Some children learn best, when the subject is about nature. The huge popularity of David Attenborough would testify to the fact; many children are nature driven. While many students have an intrinsic longing for nature, with its spiders, snails, mushrooms and flowers, many are suffering what Richard Louv (2010) describes as nature deficit disorder. He has identified the need for learning sites to engage in nature based learning, as one of the steps to address this issue. Louv's reasoning for a connection to nature is not just about the health benefits (which are many). It is only when people connect to nature, that nature will have a chance to survive. Not only is Sustainability a cross curriculum priority to be embedded in everyday learning, it is a pressing issue that must be kept in front of every student's mind. The environmental education movement sees sustainability, positive environment action, biodiversity, and ecological awareness as salient tenets in a robust curriculum. David Suzuki (2014) said children who care about nature, will care about sustainability. So, learning about nature (in Nature) will support the students whose strengths are nature based, it will offer a more context based curriculum, and it will save the world, and that is something that will benefit everyone.

Nature and restorative practices.

Rita Berto (2005) notes two sorts of attention. One that has to be directed, while the other is effortless. She argues, nature is intrinsically fascinating and requires effortless attention, while classrooms require long hours of directed attention. Directed attention can cause a strain on the mind's ability to remain focused, stay on task, and fight off distractions. Kaplan (1995) refers to this as 'Directed attention fatigue'. Kaplan argues, unlike knowledge, perception or action, the ability to direct attention is fragile, and

practices need to be implemented to support it. Spending time in a natural environment that doesn't require directed attention allows a student to rest their mind, thus restoring their capacity to direct attention. It also gives them time to reflect, which Kaplan notes as a handy strategy for recovering from directed attention fatigue. The nature environment doesn't have to be rainforest, or rugged limestone coast, yet they need to offer extent. They need to capture the mind.

Multidisciplinary learning through nature, and embodied cognition.

The idea of learning through nature, is that engagement with nature will help multidisciplinary learning. Playing in mud will help students understand volume (maths), particle density (Science), soil types (Geology) and mud properties and how they were used over time by society (Aboriginal studies, HASS). Creating structures from sticks will promote understanding of geometry (maths), structural integrity (Technology and design), and housing construction throughout the world (geography). Observing patterns in pine cones, shells and trees will develop understandings of concepts such as the Fibonacci sequence (maths). There are many more learning opportunities available, in even the smallest of nature areas, and the one thing they all have in common, is the sensorimotor aspect. Piaget (1953) believed children made sense of their world through hands on manipulation of concrete materials. Vygotsky (1978) argued, children didn't make sense of their world by the manipulation of concrete materials, rather the mediation of the manipulation led to learning. Vygotsky's theory of the connection of mind and body, is a theme carried by many theorist and researchers in a line of psychological research called embodied cognition (Anderson 2003; Kontra et al. 2015; Osgood-Campbell 2015). Modern neuroscience also backs up this link. Kontra et al (2015) cites studies where they used fMRI scans to trace brain patterns, finding sensorimotor and cognitive pathways connect. Lakoff and Johnson (1999) suggest, "the same neural and cognitive mechanisms that allow us to perceive and move around also create our conceptual systems and modes of reason". This evidence supports the idea; deeper learning is achieved when cognitive concepts are created alongside sensorimotor activity. One studied showed college students could articulate concepts of force and motion (torque) better, when they used a spinning wheel and axle to manipulate force, while the students who passively observed the demonstration, had a lower test results. Advocates for embodied cognition see many learning environments focusing on the mind, leaving the body up to P.E. classes. Kontra et al (2015) posit, the neurological system is connected as a whole, and cannot be viewed in isolation. While obvious multidisciplinary learning opportunities, such as measuring sticks, water flow rates, and particle density can be gained through nature based learning, the evidence of embodied cognition suggest, all learning could benefit from hands on manipulation.

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RISK BENEFIT ASSESSMENT

Location / Activity:	Mobile Junk and Nature Playground	Date:	06/ 2022
Assessor:	G Wagland	Review date:	06/ 2024

Your overall risk rating – Low, medium or high – is based on your judgement about whether the BENEFITS of the activity or opportunity outweigh the RISKS.

ACTIVITY	How will young people BENEFIT from this activity?	Possible hazards	PRECAUTIONS in place to reduce the risk of injury	Overall risk RATING: L/M/H
Building using sticks, pallets and metal frames.	<ul style="list-style-type: none"> • Building self-confidence • Develop core body strength, plus arm and hand muscle development • Mathematical concepts; measurement, geometry and probability • Problem solving, prediction. • Learning through experience: accidents from which one might learn • Engagement with natural environment and natural elements • Potential for incorporation into imaginative games; e.g. building a jail, trap, house or ship. • Vestibular development 	Bruises, grazes and abrasions due to sticks falling or being mishandled.	<ul style="list-style-type: none"> • All sticks have had sharp ends cut at right angles and small sharp branches have been flattened • Choice of branch size (diameter no larger than 5 centimetres) reduces weight. • Pre-form frames are braced at right angles to prevent toppling over. • Supervision is heaviest at the beginning and reduces as the group experience grows. • Children are instructed in basic safety concepts such as ‘watch the ends of the stick as you manipulate it. • An area around the construction is kept clear • Children who are misusing the equipment will be removed until they are ready to engage in a safe manner. 	Low (based on matrix below)

ACTIVITY	How will young people BENEFIT from this activity?	Possible hazards	PRECAUTIONS in place to reduce the risk of injury	Overall risk RATING: L/M/H
Rock crusher	<ul style="list-style-type: none"> • Learn the different properties of rocks. Some consist of fine particles while others have fine particles • Learn about Indigenous Culture. Crushing rocks had many uses throughout pre-colonisation history. • Self-assess risks • Build fine motor skills • Build gross motor skills. • Develop hand to eye coordination. 	<ul style="list-style-type: none"> • Rock fragments may get into the eyes • Fingers may get crushed with metal pegs. 	<ul style="list-style-type: none"> • Chains are attached to the crushing pegs to limit the travel of the arc. • Rocks that don't split, or send out shards are used (Calcrete, clay and sandstone) • Children are supervised and alerted to possible hazards. • Crushing pegs have round heads and can't cut. 	low
Playing in the blue barrels	<ul style="list-style-type: none"> • Numeracy skills (understanding properties of 3d shapes such as cylinders roll, things tumble inside) • Build resilience to low level bumps and knocks • Learn that resources can be source from recycled material • Social development, as they work out how to use spaces together. • Problem solving skills (how to move their body to get the barrel to roll) • Gross motor development. Using core strength to roll the barrel • Coordination as they role the barrel • Self-risk assessment as they decide what grade slope to roll down. • Sensory integration. (vestibular, proprioception, and interoception) 	<ul style="list-style-type: none"> • Abrasions and bruises from rough use or rolling down steep slopes • Bruises from rolling into others. 	<ul style="list-style-type: none"> • Inside edges of the barrels have been sanded smooth • Gradients of slopes are assessed beforehand and children are notified whether they are safe. • Supervision is heavy to begin with, as children learn how to use them in a safe manner. • Children misusing barrels are given options to engage in a safe manner, or find a less hazardous activity to engage in. • 	Low

ACTIVITY	How will young people BENEFIT from this activity?	Possible hazards	PRECAUTIONS in place to reduce the risk of injury	Overall risk RATING: L/M/H
Using Tarpaulins, nylon fabric	<ul style="list-style-type: none"> • Problem solving • Creativity • Understanding wind movement. • Numeracy (i.e. area, coverage) 	<ul style="list-style-type: none"> • Suffocation due to fabric being tightly wrapped around their face or neck. 	<ul style="list-style-type: none"> • Students will be supervised at all times, and if any child wraps their head in the fabric, the hazard will be pointed out to them. 	Low

This document can be used to identify the level of risk and help to prioritise any control measures. Consider the **consequences** and **likelihood** for each of the identified hazards and use the table to obtain the risk level.

			Consequences				
			1 – Insignificant Dealt with by in-house first aid, etc	2 – Minor Medical help needed. Treatment by medical professional/hospital outpatient, etc	3 – Moderate Significant non-permanent injury. Overnight hospitalisation (inpatient)	4 – Major Extensive permanent injury (eg loss of finger/s) Extended hospitalisation	5 – Catastrophic Death. Permanent disabling injury (eg blindness, loss of hand/s, quadriplegia)
Likelihood	A -	Almost certain to occur in most circumstances	High (H)	High (H)	Extreme (X)	Extreme (X)	Extreme (X)
	B -	Likely to occur frequently	Moderate (M)	High (H)	High (H)	Extreme (X)	Extreme (X)
	C -	Possible and likely to occur at some time	Low (L)	Moderate (M)	High (H)	Extreme (X)	Extreme (X)
	D -	Unlikely to occur but could happen	Low (L)	Low (L)	Moderate (M)	High (H)	Extreme (X)
	E -	May occur but only in rare and exceptional circumstances	Low (L)	Low (L)	Moderate (M)	High (H)	High (H)

How to Prioritise the Risk Rating

Once the level of risk has been determined the following table may be of use in determining when to act to institute the control measures.

Extreme	Act immediately to mitigate the risk. Either eliminate, substitute or implement engineering control measures.	Remove the hazard at the source. An identified extreme risk does not allow scope for the use of administrative controls or PPE, even in the short term.
High	Act immediately to mitigate the risk. Either eliminate, substitute or implement engineering control measures. If these controls are not immediately accessible, set a timeframe for their implementation and establish interim risk reduction strategies for the period of the set timeframe.	An achievable timeframe must be established to ensure that elimination, substitution or engineering controls are implemented. NOTE: Risk (and not cost) must be the primary consideration in determining the timeframe. A timeframe of greater than 6 months would generally not be acceptable for any hazard identified as high risk.

Medium	Take reasonable steps to mitigate the risk. Until elimination, substitution or engineering controls can be implemented, institute administrative or personal protective equipment controls. These "lower level" controls must not be considered permanent solutions. The time for which they are established must be based on risk. At the end of the time, if the risk has not been addressed by elimination, substitution or engineering controls a further risk assessment must be undertaken.	Interim measures until permanent solutions can be implemented: <ul style="list-style-type: none"> • Develop administrative controls to limit the use or access. • Provide supervision and specific training related to the issue of concern. (See Administrative Controls below)
Low	Take reasonable steps to mitigate and monitor the risk. Institute permanent controls in the long term. Permanent controls may be administrative in nature if the hazard has low frequency, rare likelihood and insignificant consequence.	

Hierarchy of Control Controls identified may be a mixture of the hierarchy in order to provide minimum operator exposure.

Elimination	Eliminate the hazard.
Substitution	Provide an alternative that is capable of performing the same task and is safer to use.
Engineering Controls	Provide or construct a physical barrier or guard.
Administrative Controls	Develop policies, procedures practices and guidelines, in consultation with employees, to mitigate the risk. Provide training, instruction and supervision about the hazard.
Personal Protective Equipment	Personal equipment designed to protect the individual from the hazard.