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**Sustainable education through sustainable thinking:
No longer an optional extra**

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Abstract

An Early Learning Center to Year 10 co-educational campus in Melbourne has developed a whole school model for sustainable education based on sustainable thinking. Sustainable thinking develops students' inclination and skills as well as sensitivity to implications and applications of sustainable practices. Sustainable thinking encompasses all disciplines at the college. It is made visible by a thinking tool called the 'rings of sustainability'. This consists of four dimensions: Natural, Personal, Urban/Technological and Socio-Cultural. Inquiry learning is the pedagogy of practice. Sustainable education encompasses discipline and transdisciplinary knowledge and skills, and attitudes and values education. Schools structures required support sustainable education includes time, space, resources and teachers in teams.

Introduction

Educators and politicians have long maintained that education transforms individuals and societies (Apple, 2004; Sterling, 2001). At no time in history has this responsibility been so significant. Sterling (2001), a British environmental educator, argues that to be transformative, education needs to move to critically reflective learning, an understanding of different world views and the search for creative solutions. Rather than using the term 'education for sustainable development', he prefers the term 'sustainable education' as this implies a "...*whole paradigm change, one which asserts both humanistic and ecological values. If more education is to save us, it must be education of a different kind*" (Sterling 2001, p 54).

Sustainability forms the basis of a whole school model for teaching and learning at St Leonards College, Cornish Campus. This co-educational school is situated on 45 hectares of land 35 kilometres from Melbourne's CBD. It was this contact with the land that shaped not only the physical environment, but the philosophy of the school as well. Twenty years ago, the school community dug out a wetland, planted 10,000 trees and started a small farm. Today our 320 students from the Early Learning Center to year 10 (3 years old to 16 years old) see first hand the result of drought and climate change. Our wetlands, that ten years ago were so extensive that we could row boats through them, are now completely dry.

The Rings of Sustainability – making sustainable thinking visible

Our philosophical journey to sustainable thinking started ten years ago when we considered the Earth Charter as the basis for our teaching and learning. We made some inroads in our students' understanding of their responsibilities to the environment, but we still saw rubbish and waste - there was what Langer (1989) would have called a lack of 'mindfulness'. A crucial point in our journey was the decision to start an Early Learning Center (ELC) based on the Reggio Emilia approach. We have learnt much from our ELC colleagues. They challenged us to revisit the constructivist philosophies of Dewey and Vygotsky and we came to realise that the vision of children as rich as powerful learners, the importance of the 'hundred languages of children, and the environment as the third teacher were as significant for 15 and 16 year old learners as for 3 and 4 year old learners. We came to see that our

problem with ‘mindlessness’ in regard to the environment stemmed from our pedagogy which was very focused on content knowledge and skills. Just teaching environmental education was not enough. As Dewey realised in 1933, “*Knowledge of methods alone will not suffice: there must be the desire, the will, to employ them. This desire is an affair of personal disposition (p. 30)*”. Dispositions form the link between knowledge and action.

Over the next five years, we concentrated on changing our very traditional teaching and learning style. Integrated inquiry programs were developed in years 7 and 8 based on ideas from the Coalition of Essential Schools and Harvard Project Zero. Our teachers read widely to understand how constructivism, inquiry and conceptual based learning could be applied in the secondary school. We established connections with local indigenous groups to deepen our understanding of cultures, values and their impact on the land. Faculties were disbanded and replaced by multidisciplinary teams of teachers. Our timetable changed from 40 minute blocks to 80 and 135 minute classes and our primary school became authorised to deliver the International Baccalaureate Primary Years Programme (PYP). The power of inquiry which we observed through the PYP gave us the confidence to expand our integrated, inquiry approach through to years 9 and 10. Our secondary teachers developed a planning process based on a fusion of ‘Teaching for Understanding’ (Blythe 1998), ‘Understanding by Design’ (Wiggins &McTighe, 2006) and the inquiry frameworks of Murdoch (1998) and Short & Harste (1996).

We were starting to achieve our ‘education of a different kind’, but we had not forgotten about our journey to find a way to infuse sustainable education throughout the school. In our search for ideas, we looked at many models of sustainability including derivations using the Brundtland (1987) report’s triple bottom line of social, environment and economics. However, we found them limiting as a curriculum basis for the primary and secondary years. When we ‘deconstructed’ these models, we found a lack of concern about the sustainability and survival of the individual as part of a unique culture. This resonated with Gough (2004) and his analysis of bioregionalism advocated by a number of environmentalists. Bioregionalism proposed that landmasses be delineated into regions based on the location of watersheds, and nations would inhabit these areas defined by natural boundaries. However, “*descriptions of the physical world are not prescriptions for social life*” (Gough 2004, p6). His deconstruction of bioregionalism suggested a hatred of anything human that could lead to hostility to others, parochialism and persecution of minorities. Relationships between people and environment are complex and could not be pursued simply by looking at environmental studies as applied science in nature. What was needed was a more ‘rhizomic’ view of inquiring into complex and often hidden relationships (Gough 2002).

In response to our research, we developed what we initially referred to as a ‘framework’ or ‘model’ for sustainable education based on four distinct, yet interlocking spheres or dimensions of sustainability and some associated guiding essential questions (Figure 1):

- *Natural sustainability* - Do we understand the science and the limitations of science that explain natural systems? Do we understand the importance of biodiversity, natural areas and our responsibilities towards them?

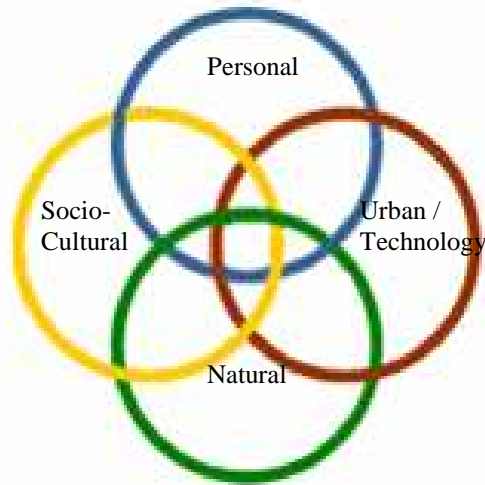


Figure 1 – Rings of Sustainability

- *Personal sustainability* - Are we healthy mentally, physically and spiritually? Can we communicate in English, another language and through the arts and mathematics? Do we have joyous activities so that we define ourselves by what we can do, not by what we can buy?
- *Urban / Technological sustainability* - Most of the world's citizens live in cities and many technological innovations were designed to support that demographic. What are the responsibilities of urban citizenship? How are

cities supplied; where does the waste go? What is responsible use of technology? Is a product sourced and manufactured sustainably? Can it be disposed of safely?

- *Socio-Cultural sustainability* - Do we understand our own cultural values and traditions? Do we understand that different cultures have different and valid perspectives? Do we understand that cultures impact on political, historical and economic events? Do we have the social skills to work cooperatively?

We came to realise that these rings were more than just an icon or a visual reminder; they were a way of making a thinking disposition visible. Thinking dispositions are the way we think creatively and critically in appropriate contexts (Tishman et al, 1992; Perkins et al, 2000). These researchers listed seven central dispositions including the 'disposition to be broad and adventurous' and 'the disposition toward sustained intellectual curiosity' but we believed that 'thinking sustainably' needed to be included as the eighth. A thinking disposition is more than just ability; it is comprised of three elements (Tishman et al, 1992):

- Inclinations *refer to the tendency to want to behave in a certain way.*
- Abilities *refer to the capabilities and skills required to carry through on the behavior.*
- Sensitivities *refer to an alertness to appropriate occasions for exhibiting the behavior.*

Thinking dispositions as defined through these three elements challenge a content, transmission centered approach and somewhat explains our experience of the relative ineffectiveness of environmental education to really change our students attitudes or 'dispositions' to sustainability. Listening to our students we could hear their concern about the environment and their futures; they were clearly inclined to make changes. They had developed the understanding and skills to conserve water and energy, recycle or re-use - but there was still something missing. They needed continual reminding and we were not seeing evidence of deep understanding indicating their

sensitivity to the impact of scientific research or political announcements or cultural perspectives on sustainability.

Perkins (2003) advocated that thinking must be made visible to develop all three elements. Besides teachers using the language of sustainability and modeling sustainable practices themselves, we used the ‘rings’ as a visible thinking process or routine to develop that sensitivity to the occasions when sustainable behaviour was required.

Thinking routines are simple patterns of thinking that can be used over and over again and folded easily into learning in the subject areas. They have a public nature, so that they make thinking visible, and students quickly get used to them (Perkins, 2003).

The rings formed a way for students and teachers to structure their inquiries and learning around any issue or understanding whilst keeping sustainability at the center of their work. They developed sensitivity to its importance in every facet of life. In Photo 1, year 10 students were structuring a genetics research project using sustainable thinking. Each ring offered a different perspective on the issue, and the more powerful the inquiry, the more the questions overlapped and moved to the center of the rings. Having used the tool many times to structure their thinking, they asked questions such as:

- *Natural* - “What is the genetic basis of inheritance? What is the connection to evolution? Has the incident of genetic diseases increased in areas of natural degradation? Why? What is the relationship between cancer and genetics? Are other species affected in the same way?
- *Personal* – How are traits that impact on our health inherited? What do inheritance statistics mean? What are the needs of individuals and families affected by genetic diseases?
- *Urban / Technology* - Are cancer rates or genetic abnormalities more common in urban areas? What is the latest technology in gene research and gene therapy? What is the cost? Is it only available to high income earners in developed countries? Where are treatment facilities located in Australia? Do rural populations have equitable access?
- *Socio-Cultural* - What are the laws regarding the developing gene therapies? What are the lawmakers concerns? What is the perspective of different religious and cultural groups

Photo 1 Students using Rings of Sustainability to structure a genetics inquiry



Photo 2 – Year 8 students’ analysis of geography data to determine the factors that have the most impact on the sustainability of Sierra Leone.

on the impact of genetic research and treatments?

Sustainable thinking as a tool can be applied through every discipline. Year 8 students were interested in what made countries and civilisations sustainable or ‘unsustainable’

(Photo 2). They analysed geography statistics of a country of their choice to determine the significant factor impacting on its sustainability. For Sierra Leone, one group decided it was foreign debt.

Photo 3 – Rings of Sustainability stretching under pressure at change points in history. This change point was the current global water crisis




In working with the rings, our students have sometimes demonstrated more sensitivity to its

implications and applications than their teachers! We didn’t know that our rings could stretch and shrink (Photo 3). A group of year 8 boys took great pride in pointing out our omission. They believed that the rings were only an ideal. To prove their point, they choose what they considered 10 change points in history including the fall of Rome, Industrial Revolution, Renaissance, and the current global environmental crisis. They researched and analysed the information they found in context of the rings. Their conclusion was that at every change point in history, the rings were significantly unbalanced. The country, civilisation or industry was unsustainable. There was either a political, economic or natural catastrophe that had to occur to start the re-balancing process.

The ‘rings’ are visible throughout the school and in our documentation (Photo 4). On the first page of their planning documents, teachers ask themselves how this unit will develop students’ understanding of sustainability: How will it make students more sensitive to the implications of sustainability? Students and teachers return to the ‘rings’ at the end of a unit as a self-reflection and evaluation. What did we learn about sustainability? What could be added or omitted the next time use this planner to enhance the sustainability focus?



Photo 4 (Left) Making sustainable thinking visible in school hallways and on the first page of teachers’ planning documents.

Year level:	Course	Prepared by	Duration	
1. Unit Title		3 Essential Understanding		
2. Conceptual Lens <ul style="list-style-type: none"> o Form o Function o Change o Causation o Connection o Perspective o Reflect o Responsibility 		An Inquiry into:		
4. Which sustainability rings of interaction are the focus of this unit?		5. Essential Questions		
		Entry Point Questions	Student Questions	
		VELS Strands and Domains to keep in mind for teaching and assessment: <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">Physical, Personal and Social Learning Health and Physical Education Interpersonal Development Personal Learning Civics and Citizenship</td> <td style="width: 33%;">Discipline Based Learning The Arts English Humanities – History Humanities – Geography Humanities – Economics LOTE Mathematics Science</td> <td style="width: 33%;">Interdisciplinary Learning Communication Design, Creativity and Technology ICT Thinking</td> </tr> </table>		Physical, Personal and Social Learning Health and Physical Education Interpersonal Development Personal Learning Civics and Citizenship
Physical, Personal and Social Learning Health and Physical Education Interpersonal Development Personal Learning Civics and Citizenship	Discipline Based Learning The Arts English Humanities – History Humanities – Geography Humanities – Economics LOTE Mathematics Science	Interdisciplinary Learning Communication Design, Creativity and Technology ICT Thinking		

Hetland's (2007) continuum looking at the learners' development of a thinking disposition was also applicable to 'sustainable thinking'. At a pre-engagement level (Figure 2), there is no consideration of sustainability or its important practices. Inclination is low, the abilities and skills are low and students are not sensitive to the sustainability of either natural or man-made systems. At the 'role and ritual' level, either the inclination or the ability and skills to act sustainably, but not necessarily both, are high. Learners may demonstrate a concern for sustainable issues or demonstrate sustainable practices in their everyday lives but they are not yet sensitive to the wider range of issues or the applications of those practices. To this point, students need explicit teaching and regular reminders. At the 'apprentice' level, inclination and skills are improving or already high, but learners are not yet sensitive to all of implications and applications around them. Research in thinking dispositions has shown that it is sensitivity, rather than inclination that appears to be the 'chief bottleneck' in developing strong dispositional performances (Perkins et al, 2000). In the case of sustainable thinking, this can be aided through guided inquiry using the 'rings' to develop questions. At the master level, inclination, ability and sensitivity are all high.

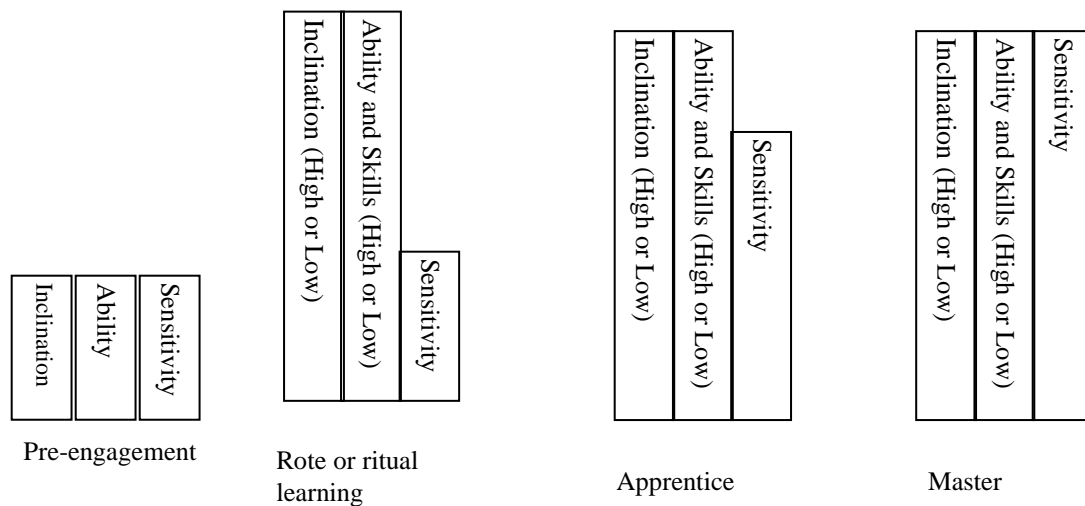


Figure 2 – Continuum in the development of thinking dispositions (Hetland, 2007)

Sustainable thinking dispositions made visible through the 'rings' form the center of our whole school model for curriculum reform (Figure 3). We believe that the method of teaching and learning must be inquiry. Inquiry starts with the interests of students and teachers and supports questions that require cross discipline answers. This encourages the development of inclination and ability and provides a context for authentic learning. In addition to being transactional between teacher and student, inquiry is also transformational– a criteria of Sterling's (2001) sustainable education.

Inquiry, as Dewey conceived it, takes on a transformational and transactional nature. Both student and teacher are called to be artists in the construction of a better life and a better world. Inquiry is also transactional art. The relationship that develops between teacher and the student enables each to grow and change (Wickersham, 2002, p. 128)."

This transactional and transformational nature of inquiry respects the traditional values of a community, but broadens the sensitivity of teachers and students to meet Bower’s concern that they ‘*articulate what should be conserved, as well as what new technological developments should be resisted*’ (Bowers, 2002, p. 811). Inquiry blurs the distinction between teacher and student whilst still respecting both.

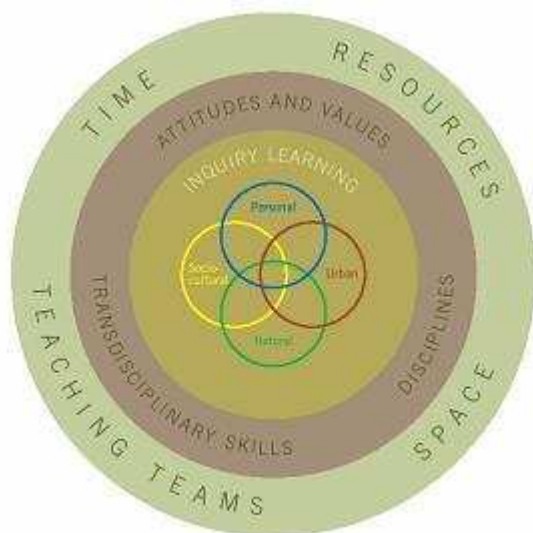


Figure 3 – Whole school model for curriculum reform based on sustainable thinking

The second of the concentric rings in Figure 3 represents components of good curriculum design. These are found in the Victorian Essential Learning Standards (VELS) as well as the International Baccalaureate Organisation’s programmes (IBO). Deep discipline knowledge and skills are still important. Teachers also consider what transdisciplinary skills can be developed through a particular inquiry. What research or ICT skills are needed? How will the findings be communicated? What skills do students need to manage complex, multifaceted tasks? After almost ten years of teaching under this model, our students perform very well on national standardised tests (see Appendix 1): we

are readily meeting our accountability demands. Sustainable education also considers attitudes and values. Are students developing qualities of appreciation, commitment, confidence, cooperation, creativity, curiosity, empathy, enthusiasm, independence, integrity, respect and tolerance¹ - all of which heighten their proclivity to sustainable thinking.

In the third ring in Figure 3 are the contributions to sustainable education that schools need to provide: time, space, resources and teachers working in teams. Learners need long uninterrupted periods of time to promote deep understanding, discourse and reflection. They need space to work in groups or individually, to move and converse easily and spaces where they can leave their work to return to at a later time. Resources need to devolve away from text books to include the wider community and the experiences of the students. Teachers need to be working in teams not only to support the interdisciplinary nature of inquiry but to model sustainable practices of co-learning and co-operation.

The education characteristics recommended by the United Nations for the Decade for Sustainable Development² included holistic, interdisciplinary, value-based, critical thinking rather than memorizing and multi-method approaches. Our integrated, inquiry approach based on the disposition to think sustainably meets all of these criteria and those of our local curriculum authority. Sustainable education with its

¹ Attitudes from the International Baccalaureate Organisation (IBO)

² http://portal.unesco.org/education/en/ev.php-URL_ID=23279&URL_DO=DO_TOPIC&URL_SECTION=201.html

foundations on sustainable thinking dispositions is no longer an optional extra for schools. We believe that it is essential for developing mindful world citizens that will not only survive, but help us all to thrive in the future.

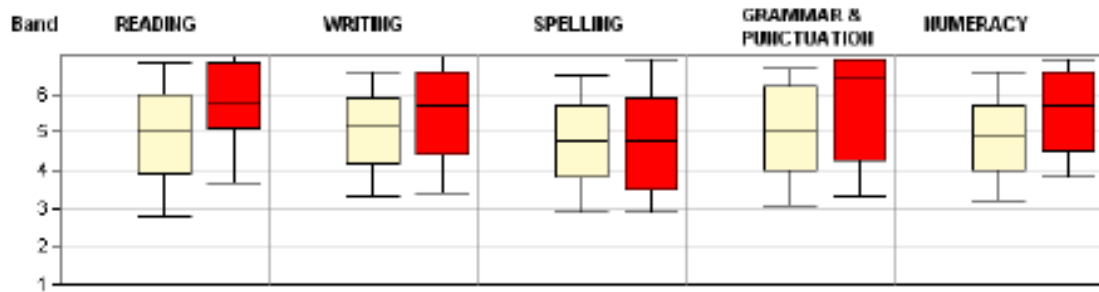
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Appendix 1

Summary of 2008 National Assessment Program – Literacy and Numeracy (NAPLAN)

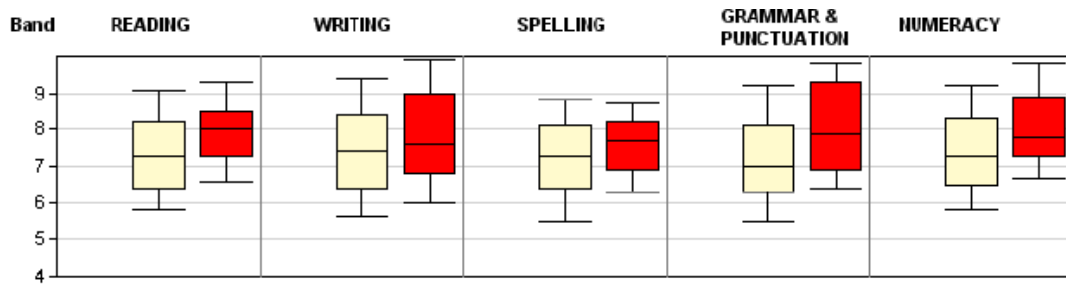
Year 3



Year 5



Year 7



Year 9

