

2014

Western Australian Graduate Diploma of Education (Primary) Students' Perceptions of Sustainability

Judith Clare Odgaard
Edith Cowan University

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Western Australian Graduate Diploma of
Education (Primary) Students'
Perceptions of Sustainability

Judith Clare Odgaard
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**Western Australian
Graduate Diploma of Education (Primary) Students' Perceptions of
Sustainability**

Judith C. Odgaard

M. A.

B. A (Hons)

This thesis is presented in fulfilment of the requirement for the degree of

Doctor of Philosophy

Faculty of Education and Arts

Edith Cowan University

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ABSTRACT

In late 2011, the researcher investigated a cohort of Western Australian (WA) Graduate Diploma of Education Primary (GDE-P) students' perceptions of Sustainability across a broad range of biophysical/natural, social and cultural, economic and political spheres. The study occurred during the seventh year of UNESCO's Decade of Education for Sustainability Development, and when Sustainability Education became one of three cross-curriculum priorities of the new Australian Curriculum. Importantly, the students' perceptions were interpreted during the context of the Post Global Financial Crisis and after Julia Gillard replaced Kevin Rudd as the Labor Prime Minister. The intense political context was often supported by controversial media debates covering a range of themes linked to Sustainability: Climate Change, the introduction of a carbon tax, global economics, population and the refugee crisis associated with the Christmas Island detention policy.

The researcher sought to use an explanatory mixed methods approach for the investigation. However, measuring GDE-P students' perceptions of Sustainability through a quantitative instrument proved to be unreliable and the researcher focused on interpretivist-constructivist qualitative methods. Subsequently, rich feedback from 18 students was obtained using semi-structured interviews that linked to both UNESCO's definition of Sustainability and associate themes within the Australian political debate.

The research findings underscore the multitude of factors that frame perceptions of the term Sustainability and the subjectivity that even well educated people encounter when dealing with this global priority. In addition, the research emphasises the need for its inclusion in pre-service teacher training, supported by ongoing professional learning for both pre-service and established primary teachers. It is vital teachers are aware of the complex themes within Sustainability as a key multimodal literacy and cross-curriculum priority in the emerging Australian Curriculum.

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Signed.

Date.....*11/11/14*.....

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TABLE OF CONTENTS

ABSTRACT	II
COPYRIGHT AND ACCESS DECLARATION	III
ACKNOWLEDGEMENTS	IV
TABLE OF CONTENTS	V
LIST OF FIGURES AND TABLES	XII
GLOSSARY	XIII
PREFACE.....	XV
CHAPTER ONE: INTRODUCTION	1
The Research Rationale and Context	1
Sustainability and Globalisation.....	1
Interpreting Competing Narratives	2
Australian Curriculum, Assessment and Reporting Authority	4
The Australian University Context and Social Sustainability	6
Assumptions Regarding GDE-P Students	8
Australian Institute for Teaching and School Leadership (AITSL)	10
Australian Research Institute for Environment and Sustainability (ARIES), Tertiary Education and National Standards	10
Research Questions and Methods	11
Research Questions	12
Conceptual and Theoretical Framework	12
Research Methods	12
Structure of the Thesis	12
CHAPTER TWO: LITERATURE REVIEW	14
Introduction	14
Part One: The Emergence of the Notion of Sustainability	15
The United Nations' Initiatives	15
United Nations Conference on Trade and Development (UNCTAD) Definition of Sustainability	16
The Decade of Education for Sustainable Development	17
The Australian Research Institution in Education for Sustainability	19
Sustainable Communities within Universities and Schools	20

Summary of Part One and Links to Research Questions	21
Part Two: Key Sustainability Issues Impacting Lifestyle, Attitudes and	
Behaviours	23
Anthropogenic Global Warming: Climate Change	23
Towards a Tipping Point	24
Anthropogenic Carbon Dioxide: The Positive Feedback Loop ...	25
Politics, Sustainability and Climate Change Refugees	27
Factors Feeding into Climate Change	28
Heat	28
Water	29
A Vulnerable Australia	29
Agriculture and its Environmental Effects	30
Incalculable Loss of Biodiversity.....	31
Depletion of Soil Quality	32
Sustainable Wild Harvest	32
Fossil Fuels	33
Food Security	35
Renewable Energy	37
Adaptations	37
Summary of Part Two and Links to Research Questions	39
Part Three: Awareness of Economic and Political Issues Linked to	
Sustainability	40
Australia: A Self-Supporting British Convict Colony	40
Australia's Production of Carbon	41
Economics and Growth	41
The Stern Review (2006)	42
Political Power	42
The 1944 Bretton Woods Conference	43
Globalisation: China and India	44
Political Stalling	44
Vested Interests in Maintaining Business As Usual (BAU).....	49
Sceptics, Commercial Media and Anti-Scientific Rhetoric	50
Ethical and Political Engagement	56
Unsustainable Use of Resources	56
Summary of Part Three and Links to Research Questions.....	58

Part Four: Attitudes towards Sustainability Population Policy	59
Population as a Socio-Political Problem	59
Population a Historical Perspective	61
From Genesis 1.28 to the Radical Reductionism of Nature	62
Petty and Malthus	64
The Sierra Club and the Club of Rome	65
The Correlation Between Poverty and a Large Population	66
Chinese and Indian Trade with Australia	66
Australia: <i>Populate or Perish</i>	68
The Curtin Government	69
Rudd: <i>Big Australia</i>	69
Gillard Did Not Believe in a <i>Big Australia</i>	70
Population, Climate Change and Natural Disasters	72
Fukushima 2011	72
Summary of Part Four and Links to Research Questions	73
Part Five: Other Sustainability Studies	74
Factor One: Sources of Information on Sustainability	74
Hawkins (2005)	74
Wall (2007).....	74
Kagawa (2007).....	75
Leiserowitz, N. Smith and Marlon (2011).....	75
National Earth Science Teachers Association K-12 Climate Change Education Survey (2011)	76
Nielsen’s 2011 Global Online Environment and Sustainability	76
Weber and P.C. Stern (2011).....	76
L.C. Hamilton (2012)	77
Effeney and Davis (2013).....	77
Factor Two: Lifestyle, Attitudes and Behaviours Towards Sustainability	78
Wong (2001).....	78
Popken (2007).....	78
Nielsen’s 2011 Global Online Environment and Sustainability	79
Bezbatchenko (2011) Doctoral Thesis.....	79

Factor Three: Awareness of Economic and Political Issues Linked to Sustainability	80
O’Toole, Wallis and Mitchell (2006)	80
Mission Australia’s 2012 Youth Survey	80
Factor Four: Attitudes Towards Sustainability Population Policy	81
Swinburne University of Technology Study (2010).....	81
Summary of Part Five	82
Summary of Chapter Two	83
CHAPTER THREE: CONCEPTUAL AND THEORETICAL FRAMEWORK ..	85
Introduction	85
The Interpretive Paradigm	85
Insights into Complex Social Phenomena.....	86
Participants’ Interpretations	87
The Subjectivity of Human Experience	87
Social Constructivism as a Conceptual Framework for Sustainability	87
Education and Social Constructivism	88
Summary	89
CHAPTER FOUR: RESEARCH METHODOLOGY AND PROCESSES	91
Introduction	91
Mixed Methods Approach	91
Quantitative Methods	92
Qualitative Methods	93
Research Method	93
Ethics Clearance	94
Sampling.....	94
Quantitative Data.....	94
Construction of the Questionnaire Instrument	95
Piloting the Questionnaire	96
Phase One	96
Phase Two	97
Qualitative Data.....	99
Coding Processes.....	99
Limitations of Methods	100

Summary	100
CHAPTER FIVE: FINDINGS FROM THE INTERVIEW DATA	101
Introduction	101
Demographic Profile of the Interviewed Students	101
Sources of Information on Sustainability	102
Education, Scholarly Internet and the Scientific Community	100
Non-commercial Media	104
Mistrust of Commercial Media	105
Mistrust of Politicians.....	105
Lifestyle, Attitudes and Behaviours Towards Sustainability	105
Climate Change	106
Resource Depletion and Population	106
Renewable Energy	107
Education	107
Cost to Consumers.....	108
Sustainable Consumption	108
Education for Sustainability	109
Sustainable Food	110
Sustainable Transport	110
Sustainable Energy	111
Awareness of Economic and Political Issues linked to Sustainability	111
Climate Change, Carbon Footprint and Sustainable Lifestyle	112
Taxation, Subsidies and Trading Schemes	113
Government and Business Compliance	116
Ecological Protection and Water Conservation.....	117
Educational Research for Global Sustainability and Wellbeing	118
Nuclear Power, Pollutants and Renewable Energy	118
Ethics and Globalisation Aid	120
Globalisation and Skilled Immigration	121
Economic Compensation to Developing Nations.....	122
Climate Change Refugee Relocation.....	123
Attitudes Towards Sustainability Population Policy	124
Population Planning and Policy.....	124

Family Size and Family Support	126
Equity Issues and Moral Support for Overseas Refugees	128
Immigration	129
Summary	130
 CHAPTER SIX: DISCUSSION	 133
Introduction	133
Sources of Information on Sustainability	135
Key Issues Linked to Lifestyle, attitudes and Behaviours Towards	
Sustainability	139
Awareness of Economic and Political Issues Linked to Sustainability	145
Attitudes Towards Sustainability Population Policy	150
Implications for Pre-service Teacher Education	154
Summary	156
 CHAPTER SEVEN: CONCLUSIONS	 158
Introduction	158
Reflection on Research Questions and Methods	159
Who and/or What Influence Graduate Diploma of Education (Primary)	
Students' Perceptions of Sustainability?	159
What are the Graduate Diploma of Education (Primary) Students'	
Attitudes Regarding Sustainability	160
Personal Actions Undertaken by GDE-P Students	160
Behavioural Choices Reported by GDE-P Students	160
What are WA Tertiary Students' Perceptions of Economic and Political	
Factors Regarding Sustainability?	160
What are WA Tertiary Students' Perceptions of Sustainability Linked to	
Population?	161
Conceptual and Theoretical Framework	161
Research Methods	162
Limitations of the Research Project	162
Quantitative Approach to Data Collection	162
Limits of the Qualitative Approach to Data Collection	164
Intense Media Debate at Time of Data Collection	164
Recommendations for Further Research	165
Interventions at the Tertiary Context	166

Support for Primary Teachers to Successfully Accommodate Sustainability and Climate Change in Teaching and Learning	168
Development of a Quantitative Instrument to Measure Perceptions of Sustainability and Climate Change	168
Sustainability Risk Management Research Implications	169
Summary	170
REFERENCES	172
APPENDICES	201
Appendix A: Global Warming Projections (N. Stern, 2006)	201
Appendix B: Renewable Energy Sources	203
Appendix C: Newspaper Reports Prior To Interviews	214
Appendix D: Ethics Documentation	216
Appendix E: Questionnaire Instrument (Pilot Phase One)	221
Appendix F: Questionnaire Instrument (Pilot Phase Two)	223
Appendix G: Cronbach's Alpha Coefficient Result Tables	227
Appendix H: Interview Script	232
Appendix I: Interview Data	235

LIST OF FIGURES AND TABLES

Figure 1. The Education for Sustainability Development Pyramid	15
Figure 2. A Tripartite Model of the Factors Linked to UNESCO's Notion of Sustainability	19
Figure 3. 1991 Definition of Sustainability (Adapted from UNESCO, 2006)	23
Figure 4. Framework for Research Processes	85
Figure 5. Quantitative Data Collection Processes	95
Table 1. Demographic Information from the 18 GDE-P Interview Participants	100

GLOSSARY

- A** Anthropocentric – regarding man as central, caused by man
- B** Bagasse – sugar cane pulp
Biochar –charcoal type biomass formed by pyrolysis (burning in a reductive atmosphere low in oxygen), improves soil fertility by addition and retention of carbon in the soil
- C** Carbonisation – undesirable addition of carbon to atmosphere
- D** Deep ecology – a philosophy that regards the living environment as being worthy, of importance as of itself not just that which may be of use to/for man.
Dryland salinity – refers to land that has become saline due to rising ground water (rising water table) bringing salt to the surface or just below into the root area of plants, more often the result of unwise land clearing
- E** Eutrophication – accumulation of nutrients in bodies of water that produces a proliferation of algae growth depleting the water of oxygen
Externalities - water, air and products of the natural environment that have been previously considered a free resource for mankind
- F** Fracking – a method of extracting unconventional fossil fuels within rock formation from below the Earth’s surface by fracturing such by means of pressurised liquids.
- I** Inuits – an indigenous group of people living in the Arctic areas of Greenland, Canada and Newfoundland
- M** Mallee Belt – an area tending to the semi-arid that supported large stands of the dwarf Eucalypt tree, Mallee, much of which been converted into an agricultural/grazing region
- N** Neolithic – latter stone age
Nuclear fission – energy produced from splitting atoms
Nuclear fusion – energy produced by causing atoms to fuse to form a heavier nucleus
- P** Palaeolithic – earliest part of the Stone Age
Punic Wars - a series of three wars fought between Rome and Carthage from 264 to 146 BC
- R** Reductive acetogenesis – a chemical reaction produced in an oxygen reduced environment by a specific bacteria during the digestive processes of animals

- S** Socio-cultural – which simultaneously deals with society and culture
Sovereign power – power which previously came from a king or queen or some form of monarchy now from a country/nation’s government
- T** Tar sands – a viscous form of petroleum also known as oil or bituminous sands, are partially consolidated sandstone or sands, clay and water saturated with bitumen
Tipping point - a term used in a number of systems indicating a point at which addition of further or prolonged happenings, condition or facts may throw that system not only into chaos, but the process becomes impossible to reverse. Used here within the context of universal climatic conditions.
Thermohaline circulation – referring to the ‘vertical’ circulation of ocean currents, usually the Gulf Stream
- U** Urban heat island – the area of raised temperature due to urban infrastructure radiating absorbed heat plus that from air conditioners, machinery and transport etc.
- W** White Australia – though never actually named as such, an immigration policy that precluded non-Caucasians entry to Australia in the late 19th and earlier half of the 20th centuries

PREFACE

I spent much of my childhood travelling the station and wheatbelt country of this State with my parents, while my father selected suitable sites to drill for water. Hearing his comments regarding condition of the land and whether good or bad management practices had evidently been carried out, I absorbed, in an osmosis-like way, an appreciation, a love of and concern for country.

For the greater part of my life I have lived on semi or rural holdings, breeding a variety of livestock. As time moved on, I became deeply disturbed by the non-recognition of practices and policies that have caused, and still cause devastation to lands and peoples. Many of Australia's present disasters, such as loss of bio-diversity, degradation, salinity and soil erosion, could have been avoided with a little consideration to future consequences. Arrogance and ignorance, coupled with a perverted view of progress/economic growth held, and still today, holds sway. I am no greatly concerned as to whether Australia is likely to or even be capable, of having a sustainable future.

Seven years of my employment, at the University of Western Australia, were spent as a laboratory assistant at the Institute of Agriculture, a few years in a geological laboratory and 33 years as a science technician in several secondary schools. I am currently a member of several environmental activist groups, a committee member and past State Representative of Sustainable Population Australia, and a founding member of the Sustainable Population Party.

My undergraduate degree was in visual arts and psychology. The visual arts practice involved sculpture and installations dealing with salinity and the question of sustainability.

It became apparent to me that, short of calamitous and catastrophic events, education was going to be the only means by which change in our consumerist Western lifestyle could be achieved.

The traditional role of school science education was of a professional career preparation, whereas now in contemporary science education, the desired outcome is for all to be science literate so people may identify, query, understand and resolve questions

and information arising from real world circumstances. However, this is a slow process and it is doubtful as to whether we have that much time left before the world is in a perilous, non-retrievable state.

Many school students will emerge, over the next decade, as the future planners, policy makers and influential members of our society and hence it is imperative that they are well prepared for the future. This requires teachers confident in their knowledge and competent in teaching that is required for sustainably.

Information gathered on attitudes and behaviours of Graduate Diploma of Education (Primary) students, could facilitate the formulation of future education policies, practices and working strategies. Such would be a preparation for the implementation of adjustments to environment use, the economy and lifestyle that are required to mitigate, by the mid-21st century, the predicted conditions caused by over population and climate change in an effort to achieve a sustainable future.

CHAPTER ONE: INTRODUCTION

The Research Rationale and Context

The research coincides with the United Nations Education, Scientific and Cultural Organization's (UNESCO) Decade of Education for Sustainability Development (2005-2014). UNESCO (2005) explains:

Education for Sustainable Development means including key sustainable development issues into teaching and learning; for example, Climate Change, disaster risk reduction, biodiversity, poverty reduction, and sustainable consumption. It also requires participatory teaching and learning methods that motivate and empower learners to change their behaviour and take action for sustainable development. Education for Sustainable Development consequently promotes competencies like critical thinking, imagining future scenarios and making decisions in a collaborative way. (para. 1)

The notion of achieving Sustainability, both globally and within Australia, is premised on an informed workforce, constituents and polity. Primary school teachers are an essential part of the transformation to a sustainably aware society because they provide the initial understandings that position Sustainability as part of interconnected systems in the taught curriculum of both primary Science and Humanities and Social Sciences. Therefore, exploring Graduate Diploma of Education (Primary) students' perceptions of Sustainability gives researchers an appreciation of their understanding of factors that contribute to Sustainability, and their potential to engage primary students to meet the expectations of the Australian Curriculum. These pre-service teachers' intersubjectivities will also influence their future students, who will additionally bring a range of understandings on Sustainability in the years one to six classrooms.

Sustainability and Globalisation

During the first 50 years of the twenty-first century Australian primary school teachers will confront a time of transition for facilitating programs, which educate children for Sustainability development, both in Australia and globally. These teachers will also be confronted with competing interests and policies. New learning and teaching of Sustainability will occur when Australian's population will move from circa 22.8 million to 35 million by 2050 (Australian Bureau of Statistics, 2012), and in the same period the global population will reach circa nine billion (Flannery, 2010). In the process of interpreting policies accommodating Sustainability many Australian teachers,

communities and institutions will have to balance competing political, economic and philosophical constructs, not only as Australians, but global citizens. As indicated by major reports (for example, Stern, 2006), this will be a planetary period that will see critical stresses across the ecosphere due to competing anthropocentric interests. Locally, there will be huge economic opportunities, as well as significant ethical responsibilities for Australia (Flannery, 2010). International conditions will extend opportunities for a wealthy Australia, linked to the export of many billions of dollars of resources including fossil-based energy commodities to China and other Asian economies:

China is Australia's largest export market and accounted for one quarter of Australia's total exports to the world in 2011. Exports to China have grown from \$8.8 billion in 2001 to \$77.1 billion in 2011, representing average annual growth of 25.6 per cent. ... Resource and energy commodity exports dominated exports, accounting for 80.9 per cent of Australia's total exports to China in 2011, up from 44.5 per cent in 2001. (Australian Government Department of Foreign Affairs and Trade, 2011, p. 1)

China's importance to Australia is reflected in *Asia and Australia's Engagement with Asia* as one of the nation's three cross-curriculum priorities of the Australian Curriculum, with the others being: *Aboriginal and Torres Strait Islander histories and cultures*, as well as Sustainability (Australian Curriculum, Assessment and Reporting Authority (ACARA), 2011).

Interpreting Competing Narratives

In a secular and open society, Australians socially construct their knowledge from a variety of narratives from within their culture, including the popular media, social networks, family, as well as the three levels of formal education. Therefore, lifeworld interactions result in the cognitive constructivism of how an individual interprets their world from the influential collaborative effect of diverse social interactions, including by the language of ideas, values and symbols (Vygotsky, 1978; Habermas, 1984). The process of social construction applies to both pre-service and established practising teachers.

In the transition to a globalised world, the interpretation of complex understandings such as Sustainability (ACARA, 2011; UNESCO, 2005), or *Asia and Australia's Engagement with Asia* (ACARA, 2011), requires a range of highly complex integrated disciplinary skills and literacies. This critical capacity expects an educated public to be able to engage with a range of multifaceted socio-scientific Sustainability literacies in

order to negotiate: conservative public institutions, international agreements, skilful lobbyists, a plethora of media messages, as well as curriculum documents (ACARA, 2011).

The context of this study is ontologically linked to the interpretivist lifeworld experience of contemporary tertiary students, a lifeworld rich with competing narratives, a process of fluid transactions of intersubjectivities, coming together as the cultural experience of 'Australia'. The ontology was especially intense during the context of the study, due to the Post Global Financial Crisis (Post-GFC) and the tensions associated with the Federal Government's policy agenda covering Climate Change and economics. During this period, Climate Change was a dominant narrative in the public domain. Climate Change is an outcome of global warming as a result of excessive anthropogenic carbon emissions, released since the 1970s (see Appendix A). Salmon (2007) disclosed the significance of the emissions as being linked to planetary carbon dioxide levels being the highest for over seven hundred thousand years. The issue of competing narratives and power of the media was clearly demonstrated when the mining sector was united as a movement to negate the full implementation of the Federal Government's proposed mining tax (Canning, 2010).

The power of certain sections of the media was also seen as polemic, or misleading (Edis, 2012) when it criticised established science, as demonstrated by Australian Radio 2BG's Alan Jones' opinions regarding Climate Change. As Edis (2012) explains:

On Climate Change, Jones is full of hyperbole [he] feels little compulsion to cross-reference his statements against the bulk of research published in scientific journals. He stated to an anti-carbon tax gathering outside Victorian Parliament that, "the notion of global warming is a hoax" and "witchcraft". (para. 3)

Therefore, the notion of Sustainability for contemporary Australians involves a complex interpretivist process, including an ongoing assessment of intersubjectivities, arriving at a construction of a collective or shared human cognitive system (Walsham, 1995).

Powerful media voices, such as Alan Jones, or influential business people can exercise a privileged capacity to add to the intersubjective construction of the collective knowledge for good or misleading purposes, within the dynamic of the collective lifeworld. Narratives (such as those from Jones) compete with international science (Flannery, 2010; Lovelock, 2006), government policy (Australian Research Institute for Environment and Sustainability (ARIES), 2010), and curriculum expectations (ACARA, 2012). An example of the competitive narrative can be found in 2010 in the

lead-up to the removal of former Prime Minister Kevin Rudd in 2011. Additionally, there was public controversy associated with the Federal Government's intention to introduce a super-profits tax on the mining sector. In the WA context of the nation's most significant mining interests, a great deal of media investment was focused on changing the Rudd Government's policy: for example, Andrew Forrest and Gina Rinehart were involved in massive multi-million dollar advertising campaigns to coerce the Federal Government into modifying policy (Canning, 2010). In addition to the competing narratives, primary teachers have to interpret curriculum documents (ACARA, 2011) that advocate Sustainability themes.

Australian Curriculum, Assessment and Reporting Authority

Central to this study is the Australian Curriculum, Assessment and Reporting Authority (2011), which is the:

[I]ndependent authority responsible for the development of a national curriculum, a national assessment program and a national data collection and reporting program that supports 21st century learning for all Australian students. (para. 1)

According to ACARA (2011), Australian primary school teachers are required to include Sustainability Education as a cross-curriculum priority. This research study provided an introductory audit as an interpretation of a cohort of pre-service teachers' potential capacity to implement ACARA's expectations regarding Sustainability.

Importantly, this study occurred during a fluid national and state curricula context confronted by change due to competing interests and accountability of both human and physical resources during the Post-GFC and the period of transition after the removal of Australian Prime Minister Kevin Rudd, a pro-Sustainability and Climate Change advocate, by the Labor Caucus. As such, the study also records, in part, the discourse of background tensions within the environmental (biophysical/ecological) conservation versus economic benefits to Australia from mining (Canning, 2010). The Australian Curriculum was of major importance to the former Gillard leadership group, and the policy priorities are reflected in ACARA documents.

The scope of this study involving tertiary students has four important dimensions. Firstly, Australian universities are being encouraged by the Commonwealth Government (ARIES, 2010) to engage Sustainability praxis within the university

learning and teaching experience across a range of degrees/awards as part of the associated 2005 UNESCO initiatives. Even though the rhetorical statements of support for Sustainability are on many Australian university websites (e.g., see the home pages of *The Australian National University*, *The University of Sydney University*, and *The University of Melbourne University*) at the time of writing, success of this praxis is unknown.

Secondly, ACARA (2011) has Sustainability as one of its three cross-curriculum priorities, declaring that:

Sustainability will allow all young Australians to develop an appreciation of the need for more sustainable patterns of living, and to build the capacities for thinking and acting that are necessary to create a more sustainable future. (para. 1)

Thirdly, if ACARA sees Sustainability as a priority, then emerging primary school teachers require an adequate pre-service preparation to teach or facilitate 'Learning Sustainability', which has implications for Australian educational standards as well as of teaching and school leadership. ACARA considers that for a world-class national curriculum focusing on the future there needs to be knowledge and comprehension of the environmental, social, cultural and economic issues pertaining to Sustainability. To this end, advice has been sourced Australia wide from a range of professionals with expertise in Sustainability ACARA (2011).

The above indicate that ACARA assumes Australian primary school teachers have the professional capacity to facilitate these outcomes in schools, as underscored by the Australian Institute for Teaching and School Leadership (AITSL) Charter (2010) (AITSL, 2010). The fourth dimension relates specifically to the local Western Australian lifeworld. WA has some the world's largest mining projects, supporting the world's second and third largest economies, China and Japan (not including the 'Eurozone'), as well as other emerging North and South Eastern Asian economies with populations greater than the Eurozone and the Americas combined. It is also assumed WA, as an outcome of Prime Minister Gillard's proposal to allow Uranium exports to India (Coorey, 2011), will provide a range of commodities including Uranium to the emerging Asian economies.

Therefore, primary school teachers in WA will be continually confronted with a dynamic of intersubjectivities of competing values, covering the science of biophysical Sustainability and Climate Change; the economic dividends from mining and fossil fuel extraction; competing social and environmental discourses that are inclusive of both political and ethical judgements. Whilst potentially benefitting from the value of Australia's rich resources, primary teachers will be faced with the process of interpreting a notion of Sustainability praxis across a variety of interest groups and political discourse. The complexity of intersubjectivities is underscored by the *Australia in the Asian Century* White Paper on the 29th October 2012 ("Lifting Prosperity," n.d.).

The Australian University Context and Social Sustainability

Universities have an obligation to support social Sustainability. Hammond and Churchman (2007) cited Barron and Gauntlett (2002), who offer five principles of social Sustainability. The following is adapted from Barron and Gauntlett (2002):

1. **Equity:** The overarching principle from which the other four principles are appreciated. Universities should aim to survey or audit their internal community to access its capacity to provide equitable outcomes for staff and students; to identify and support those who are either vulnerable or disadvantaged relative to the overall university community, as well as the national and international benchmarking.
2. **Diversity:** Refers to the university community's capacity to seek diversity, to value difference over uniformity. That is diversity of: opinion; background; perspective; function; to challenge assumptions; and to encourage creativity and originality.
3. **Interconnectedness:** This includes the university community's internal networks and its connections with all other communities both local and global.
4. **Democracy:** The way a university community structures and processes need to be democratic encouraging participation and inclusion, with governance prioritising transparency and accountability.
5. **Wellbeing:** Their final principle, quality of life, should enable community members to have a sense of wellbeing and an ability to thrive including; a sense of self-worth, belonging, engagement, safety and a sense of place as well as pride in the individual's own contribution.

The above principles lend themselves for interpretation across a range of university situations, including pre-service primary teacher education.

Therefore, as an outcome of UNESCO (2002), many universities have incorporated Sustainability policies and practices that promote environmental Sustainability initiatives (ARIES, 2009). In Australia, as well as in other first world economies such as the United Kingdom (UK) and the United States of America (USA), education systems now promote Sustainability through policy and application through various levels of education, be it formal or informal. In particular, many university online profiles claim to foster initiatives that link into academic programmes, research and community engagement: for example:

Tilbury et al. (2005), in conducting a national review of the status of further and higher education in regard to Sustainability practices, explicitly draw attention to an institution's ability to sustain their social systems and support the social capital of staff and students... (Hammond & Churchman, 2007, p. 236).

Universities in Australia (through ARIES), and globally, are engaging in education for Sustainability: for example, Portland State University (online) discusses how Sustainability means meeting the economic, social and environmental needs, without compromising the needs of future generations. This university sees Sustainability as a process and as a *continuum* rather than an *endpoint* ("Green: it's more", n.d.).

Online policies underscore Sustainability as a human construct (Hammond & Churchman, 2007) inclusive of the essential value of social connections linked to biophysical parameters, as included in the researcher's data collection instruments. In generalising the rhetoric of the global university sector, as exemplified by Portland State University, it is the notion of *connectedness* that accommodates a theme of *relationship enhancement* from the anthropocentric to the biophysical real, where university staff and students augment economic and intrinsic value of an institution in the *continuum of Sustainability*: for example, the design of this research accommodates the notion of a continuum. In the context of the GDE-P students, it would be reasonable to assume that universities embracing Sustainability, provide the modelling that will transfer into other external organisations locally (ACARA, 2011; ARIES, 2009) and globally (UNESCO, 2002).

In May 2008, Teaching Australia commenced a consultation process to seek responses for standards for advanced teaching and leadership. Many respondents expressed concern that:

[T]here was no mention of advanced teachers having a detailed knowledge of subject content and curriculum. They emphasised that having a deep and extensive knowledge of the subject taught and the curriculum is paramount in improving student outcomes.

As a result, amendments have been made to the capability statements to capture this requirement, while maintaining their generic nature, and the intention that they cover not only subject specialisation but also specialisation in a stage of schooling (early childhood or primary) or a cross curricula teaching discipline. (Teaching Australia, 2008, p. 3).

Therefore, with so many interrelated policies initiatives linked to UNESCO (2002), and the Australian Qualifications Framework (AQF) (2012) as the national system that underpins national post-compulsory education standards, would deem Sustainability attributes of graduating pre-service primary school teachers as important. It could be assumed that positive lifeworld relationships (Habermas, 1984) developed at universities centring around Sustainability praxis (ARIES, 2012), would lead to a situation in which graduating primary teachers would naturally think of others as part of enhancing social sustainable awareness (ACARA, 2012; ARIES, 2012; United Nations Conference on Trade and Development (UNCTAD, 2012; UNESCO, 2002). In respect to this study, as it applies to a WA University School of Education educating pre-service primary teachers (AQF, 2011), the connectedness as a community outcome should realise the cultural-transmission of Sustainability to future primary teachers and primary school leaders (ACARA, 2011; AITSL, 2012).

Assumptions Regarding GDE-P Students

In both the Bachelor of Education (Primary) and the one-year GDE-P pre-service teacher education courses at a large WA pre-service teacher education provider, students do not have the opportunity to enrol in units specifically focussing on education for Sustainability. The rhetoric surrounding positive university Sustainability policy is not supported by easy access to education for Sustainability within pre-service teacher courses. If any exposure to Sustainability occurs, it happens in either primary Science or Humanities and Social Sciences education as a minor or incidental theme. Therefore, any Sustainability understandings and values in which graduating primary

teachers will engage to interpret ACARA's expectations will most likely rely upon the cultural transmission of knowledge from: their personal primary and secondary schooling, private lifeworld narratives, the media, interpersonal relationships (family and friends). It is these pre-service teacher intersubjectivities or perceptions of Sustainability that will form the basis of teacher leadership in engaging primary students in Sustainability Education.

Unlike the Bachelor of Education (Primary) students, those who enrol in primary teaching through the GDE-P pathway have a range of degrees including a mix of Sciences, Humanities, Creative Arts and more. Many of the degrees are from local Western Australian universities, and a minority are from other interstate or internationally recognised universities (see the demographic information in Chapter Five). In addition, students do not have to have any pre-requisite qualifications in Science Education or Sustainability studies, but it is assumed if they graduated from or completed the WA secondary system, they would have had some basic exposure to general science at the Year 10 secondary level. It would be a basic understanding of Chemistry (at a Year 10 level), which would provide the scientific literacy for some of the GDE-P students to interpret how the carbonisation of the Earth's atmosphere accommodates global warming and climate change.

The researcher also assumed some GDE-P students might have a special interest in Sustainability or environmental policy. Within the broad context of Sustainability, as defined by United Nations Conference on Trade and Development (UNCTAD, 2012), it was assumed that most university graduates would have formed some personal opinions covering some of the scope of Sustainability, including issues surrounding Climate Change and the anticipated social and environmental causalities.

In order to understand pre-service primary school teachers' engagement with ACARA's cross-curriculum priority area of Sustainability, it was deemed necessary to audit 2011 pre-service GDE-P students' perceptions of Sustainability. The researcher assumed the GDE-P students' perceptions would link to many factors, including:

1. Demographic backgrounds (e.g., age, economic, cultural and family backgrounds);
2. The influence of former teachers and information shared by peers;
3. Media preferences (e.g., print, online, radio, television and reference material);

4. Personal levels of interest in political rhetoric associated with Sustainability; and
5. Education specialisation (i.e., existing degrees and interests in popular scientific discourse).

In addition, the researcher anticipated diverse perceptions across GDE-P student cohort with some students potentially expressing: strong or polarised views; views and opinions that conflicted with the personal views held by the researcher; low levels of interest in Sustainability issues and misconceptions regarding key Sustainability understandings. However, without any formal attempt to initiate a diagnostic assessment of GDE-P students' perceptions of Sustainability, pre-service teacher institutions and governments would be limited in judging how to best invest in appropriate learning and teaching policies, Sustainability Education initiatives, or professional learning opportunities as required by authorities supporting Sustainability Education (ACARA, 2011; AITSL, 2012; UNCTAD, 2012; UNESCO, 2005).

Australian Institute for Teaching and School Leadership (AITSL)

Since its conception in early 2010, AITSL has been engaged in supporting professional learning to promote teacher and school leadership as essential to educational equity and excellence. AITSL, in collaboration with diverse stakeholders across school education sectors and systems, seeks to facilitate the goals established in the Melbourne Declaration (MCEECYA, 2008). Its purpose is to promote successful learners and partnerships, to enhance confidence and creativity, as well as active and informed citizenship. The AITSL Charter, in promoting a rich professional learning culture, is underpinned by the *Australian National Professional Standards for Teachers* and *Australian National Professional Standard for Principals* linked to the 'Australian Teacher Performance and Development Framework' (AITSL, 2010).

Specifically, the research linked into the facilitation role of the AITSL Charter, ACARA and Sustainability as a national cross-curriculum priority (AITSL, 2010; ARIES, 2010).

ARIES, Tertiary Education and National Standards

Policy initiatives from UNESCO often flow into Commonwealth policy: for example, the Australian Government commissioned the Australian Research Institute in Education for Sustainability (ARIES) at Macquarie University to facilitate, "research into how to move beyond simply raising awareness to achieve the attitudinal and

behavioural changes necessary to live sustainably” (Departments of Sustainability, Environment, Water, Population and Communities, 2011, para. 1) Priorities were established with identified projects managed by the Department. The program identified key factors and impediments influencing education for Sustainability. The program:

- Evaluated existing approaches;
- Developed effective educational materials; and
- Developed programs to promote behavioural change towards sustainable practices.

The transfer of policies from UNESCO (2005) can be seen to flow into Commonwealth initiatives (ACARA, 2011; ARIES, 2003, 2010) and these, in turn, are transferred to diverse university learning and teaching. Australian universities have established Sustainability committees with broad policies accommodating Sustainability initiatives. By extension, Sustainability awareness (ARIES, 2003, 2010) is expected to flow into learning and teaching initiatives, in the anticipation that informed professional decisions regarding Sustainability will somehow be facilitated across diverse professional contexts including: The Arts, Business, Engineering, Law, Pre-service Teacher Education and Science.

In addition, the study engaged a cohort of participants that already held a diverse range of degrees, including some with higher degrees in research (Master or PhD). Unlike tertiary students working through undergraduate courses, such as the Bachelor of Education (Primary), it was assumed that the GDE-P student would represent a highly qualified demographic, and may have higher levels of Sustainability awareness compared to undergraduate cohorts.

Research Questions and Methods

The purpose of the study (consistent with ACARA, 2011; ARIES 2010; UNESCO, 2005) was to investigate students’ perceptions regarding four interconnected factors associated with Sustainability. The following four factors were investigated, as informed by UNESCO, ARIES and ACARA:

1. Sources of information on Sustainability;
2. Lifestyle, attitudes and behaviours towards Sustainability;
3. Awareness of economic and political issues linked to Sustainability; and
4. Attitudes towards Sustainability population policy.

These factors informed the construction of the research questions.

Research Questions

In 2011, the researcher investigated the following questions:

1. Who and/or what influence GDE-P students' perceptions of Sustainability?
2. What are the GDE-P students' attitudes regarding Sustainability?
 - a. What personal actions do GDE-P students undertake?
 - b. What behavioural choices do they report?
3. What are GDE-P students' perceptions of economic and political factors regarding Sustainability?
4. What are GDE-P students' perceptions of Sustainability linked to population?

Conceptual and Theoretical Framework

The qualitative dimension was emphasised in the research project. The very nature of the word *perception* assumes a dynamic of intersubjectivities from both the researcher's viewpoint, as well as the participants or respondents (Walsham, 1995). Therefore, the research approach engaged an Interpretivist paradigm, informed by Social Constructivism. The research approach provided a window into the complexities of Sustainability in a particular sociocultural context and time.

Research Methods

The research initially followed an explanatory mixed methods approach; the first phase involved a two-phase pilot of a questionnaire instrument. Phase one of the pilots was conducted with secondary teachers, and Phase Two engaged 113 Western Australian GDE-P pre-service teachers who had entered a School of Education with at least one degree. However, following the administration of the questionnaire and subsequent analysis, it was determined a quantitative approach was unreliable. Therefore, the researcher conducted 18 interviews with the GDE-P students to gauge their perceptions of Sustainability.

The Structure of the Thesis

The thesis is divided into seven chapters:

1. **Introduction:** In this chapter the researcher introduced the rationale for this research and placed it within the context of: the United Nations Education, the

Scientific and Cultural Organization's Decade of Education for Sustainability Development (DESD); the Australian Research Institution in Education for Sustainability (ARIES); the Australian Curriculum Assessment and Reporting Authority (ACARA) and the Australian Institute for Teaching and School Leadership (AITSL). In addition, the research questions, conceptual and theoretical framework and research methods were introduced.

2. **Literature Review:** Chapter Two follows the four interconnected factors underscoring the research. Part One introduces sources of information on Sustainability; Part Two explores key Sustainability issues impacting on lifestyle, attitudes and behaviours; Part Three introduces economic and political issues linked to Sustainability (Systems Thinking) and Part Four explores the issue of population as a prime factor of Sustainability. In addition, a number of previous studies exploring perceptions of Sustainability are discussed in Part Five.
3. **Conceptual and Theoretical Framework:** Chapter Three backgrounds Interpretivism and Social Constructivism as a framework for the research.
4. **Research Methodology and Processes:** Chapter Four details the methodologies used and specific methods undertaken within the research. The mixed methods approach is discussed due to the research's initial grounding as a mixed method study; however, it also discusses the benefits and limitations of quantitative and qualitative approaches individually. The chapter summarises the construction of the initial questionnaire, the two-phase pilot of the questionnaire, the reliability and analysis conducted on the pilot data, and the subsequent move a semi-structured interview method of data collection.
5. **Findings from the Interview Data:** Chapter Five examines the qualitative data elicited from 18 semi-structured interviews, organised using the four interconnected factors introduced in Chapter One.
6. **Discussion:** Chapter Six discusses how the findings linked to key literature and previous studies on Sustainability using the four interconnected factors.
7. **Conclusions:** Chapter Seven provides a closing summary of the researcher's project and her conclusions.

CHAPTER TWO: LITERATURE REVIEW

Introduction

According to population expert and Stanford Professor, Paul Ehrlich (1986):

The main hope for changing humanity's present course may lie ... in the development of a worldview drawn partly from ecological principles - in the so-called deep ecology movement. The term 'deep ecology' was coined in 1972 by Arne Naess to contrast with the fight against pollution and resource depletion in developed countries, which he called 'shallow ecology'. The deep ecology movement thinks today's human thought patterns and social organisation are inadequate to deal with the population-resource-environmental crisis – a view with which I tend to agree. I am convinced that such a quasi-religious movement, one concerned with the need to change the values that now govern much of human activity, is essential to the persistence of our civilisation. (p. 41)

The issue of unsustainable development across the planet as limiting humanity's common future is deeply connected to ancient ecological principles (the interconnection of biodiversity, as explained by Lovelock, 2006). However, recent awareness of the scientifically measured impacts of poor human practices, and previously weak regulation by governments, has made Sustainability a priority for the United Nations and developed economies, such as the USA, UK and Australia (Gore, 2006; Stern, 2006). In discussing the threat of Climate Change at Georgetown University US President Obama said, "The question is not whether we need to act.... The question is whether we will have the courage to act before it's too late" (Graves, 2013).

This chapter explores the historical emergence of the global interest in sustainability, the complexities around defining sustainability, the four factors of sustainability, the Australian context and recent research on sustainability. The existing literature review underscores the interdisciplinary dimension of Sustainability. The chapter is structured around four interconnected factors associated with Sustainability:

1. Sources of information on Sustainability;
2. Lifestyle, attitudes and behaviours towards Sustainability;
3. Awareness of economic and political issues linked to Sustainability; and
4. Attitudes towards Sustainability population policy.

These factors provide the structure for Parts One to Four of the literature review, with Part Five exploring other studies relating to Sustainability. A summary of each section

is provided to link the politico-historical discussion to the research questions for this study.

Part One: The Emergence of the Notion of Sustainability

Information on the notion of Sustainability has emerged from many public organisations and has transferred culturally through diverse media interests, as well as interpersonal relationships. The notion of Sustainability occupies an evolving history of ideas linked to the early environmental movement. However, its current appreciation extends into social Sustainability. Importantly, the researcher will cover the development of the term, from the United Nations, as well as how the theme of *Education for Sustainability* developed into the Commonwealth of Australia initiatives: The Australian Research Institute in Education for Sustainability (ARIES). The figure below (Figure 1) underscores a hierarchical policy flow from the United Nations through to ACARA.

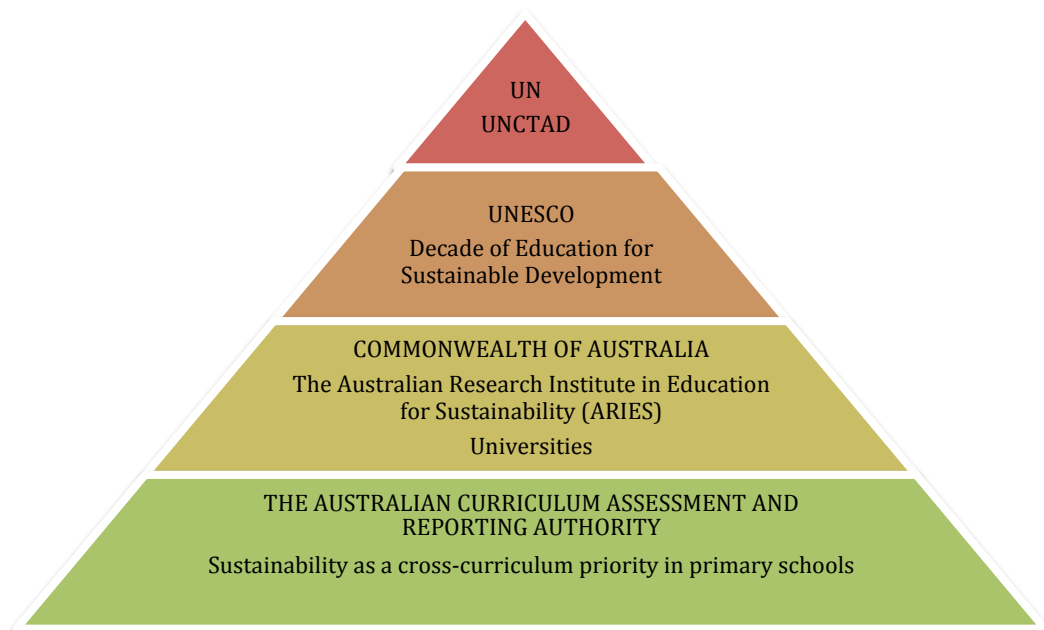


Figure 1. *The Education for Sustainability Development Pyramid.*

The United Nations' Initiatives

In 1964, the United Nations Conference for Trade and Development (UNCTAD) was established to promote the politically sensitive integration of developing countries into the world economy during a period of Cold War tensions and the beginning of Carson's (1962) *Silent Spring* era. UNCTAD has worked to shape policy debates on development that engage domestic and international action accommodating mutual outcomes under the notion of sustainable development (UNCTAD, 2012). However, the start of the

global push to elevate the protection of the Earth's fragile ecosphere into international policy and law is linked to The Stockholm United Nations Conference on the Human Environment in 1972 (UNCTAD, 2012).

In 1987, the Brundtland report *Our Common Future* introduced the notion of 'sustainable development' as: "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (UNCTAD, 2012, para. 1). The Report underscored that economic development across the planet will not be sustainable if the systemic relationships between pillars of sustainable development, the economic, environment and social; are not managed through a mutual beneficial process to all pillars.

According to UNCTAD (2012), the *Building upon the initiatives of Our Common Future* established the foundations for the Rio Earth Summit in 1992. The Summit saw sustainable development become a significant global focus, with three essential agreements establishing a new global mandate known as Agenda 21, which included:

1. The Rio Declaration on Environment and Development and the statement of principles for a global consensus on the management, conservation and sustainable development of all types of forests;
2. The Framework Convention on Climate Change; and
3. The Convention on Biological Diversity.

Importantly, the Rio Summit witnessed the globalization of the concept of *Sustainability*. However, in the process there have evolved many interpretations of what is meant by Sustainability. Some of these have become diverse and often being reinterpreted by the media and political groups to accommodate particular intersubjectivities.

UNCTAD'S Definition of Sustainability

According to UNCTAD (2012, para. 5-11) Sustainability is:

- Carefully managing scarce resources: the extent to which a human activity can be continued without relying upon limited resources, such as fossil fuels, or leaving waste behind; and giving nature the chance to replenish itself;

- [Improving] working conditions: this is both a concept and a strategy by which communities seek economic development approaches that benefit local social conditions and quality of life for all;
- Ensuring that environmental protection and social and economic development are complementary – rather than antagonistic – processes: it is an economic state in which the demands placed upon natural and human resources by people and commerce can be met without reducing the capacity of those resources to provide for future generations;
- Working towards an equitable future and fair outcomes in a just, inclusive society for all, and creating equal opportunities for all;
- The simultaneous pursuit of economic prosperity, environmental quality and social equity;
- Planning with integrated environmental, social, human and economic goals. This means that sustainable planning should have three overarching objectives: eradicating poverty; protecting natural and human resources; and changing unsustainable production and consumption patterns;
- Focused on the development of programmes that promote social interaction and cultural enrichment; and
- Not only about retaining industries, jobs, and local services, but also sustaining our human values and protecting the vulnerable in society.

The researcher has endeavoured to utilise themes associated with, or compatible with the above definition, in designing her data collection instruments.

The Decade of Education for Sustainable Development

For over 30 years the popular term *Sustainability* has been associated with the environment movement (R. Wright, 2004). In 1997, UNESCO specifically noted that *ecological Sustainability* included the following interconnected systems that cannot be considered in isolation: *Natural; Social and Cultural; Economic; and Political Spheres*. Increasingly, the role of social Sustainability crossed over from the rhetoric of the environmental and scientific discourse to the context of the perceptions of relationships within the sociocultural, as well as the political and economic processes in both communities and organisations. It is this intersubjectivity that is driving ACARA to develop a broader inclusive notion of Sustainability, rather than the previously biophysically centred environmental education. The more inclusive descriptor positions

the intersubjectivities of the anthropocentric realm within the ecological realm as a metacognitive factor. It is this scope that is reflected in Australian Curriculum (ACARA, 2012).

In December 2002, the General Assembly declared the years from 2005 to 2014 the Decade of Education for Sustainable Development (DESD). According to UNESCO (2002) sustainable development seeks to accommodate the needs of the present generations, without compromising those of the future. The policy is centred in the continuum of a safe and fair global community. The policy emphasises the need to develop learning strategies to find effective ways out of current social and environmental problems as part of this notion of Sustainability praxis.

The approach to education for sustainable development encompasses an important, but complex interdisciplinary perspective. DESD's scope includes populations, animal and plant species, ecosystems and natural resources. At the human level, it fosters a global education that integrates anxieties such as the conflict against poverty, gender equality and human rights. DESD represents education across the planet covering, health, human security and the essentialness of intercultural dialogue. DESD is importantly being accommodated through ACARA, where the explicit educational agenda for sustainable development, depends upon Australian teachers' capacity to help develop appropriate attitudes, skills and knowledge. Both DESD's and ACARA's intent is to facilitate informed decisions for the benefit of the collective, now and in the future, and to provide the means for individuals and groups to act upon these decisions (UNESCO 2002).

The United Nations Decade of Education for Sustainable Development (2005-2014), for which UNESCO is the lead agency, seeks to:

[Integrate] the principles, values, and practices of sustainable development into all aspects of education and learning, in order to address the social, economic, cultural and environmental problems we face in the 21st century (UNESCO, 2002).

Within the sociocultural dimension of the UN Declaration, the researcher underscores the importance of understanding a university student's lifeworld (Habermas, 1984) in terms of perceptions of social Sustainability (UNESCO, 2002). The following figure underscores the interdisciplinary assumptions involved with the DESD. By extension,

the tripartite model (Figure 2) underscores the challenges that Australian teachers face in facilitating Sustainability as cross-curriculum priority (ACARA, 2010): for example, contextualising language in primary science in the Academy’s *PrimaryConnections* project (“Australian Academy of Science,” 2005). However, by accommodating a crowded curriculum there is a risk of lost specialised content knowledge to support pedagogical integration or cross-curriculum initiatives, such as Sustainability (ARIES, 2012).

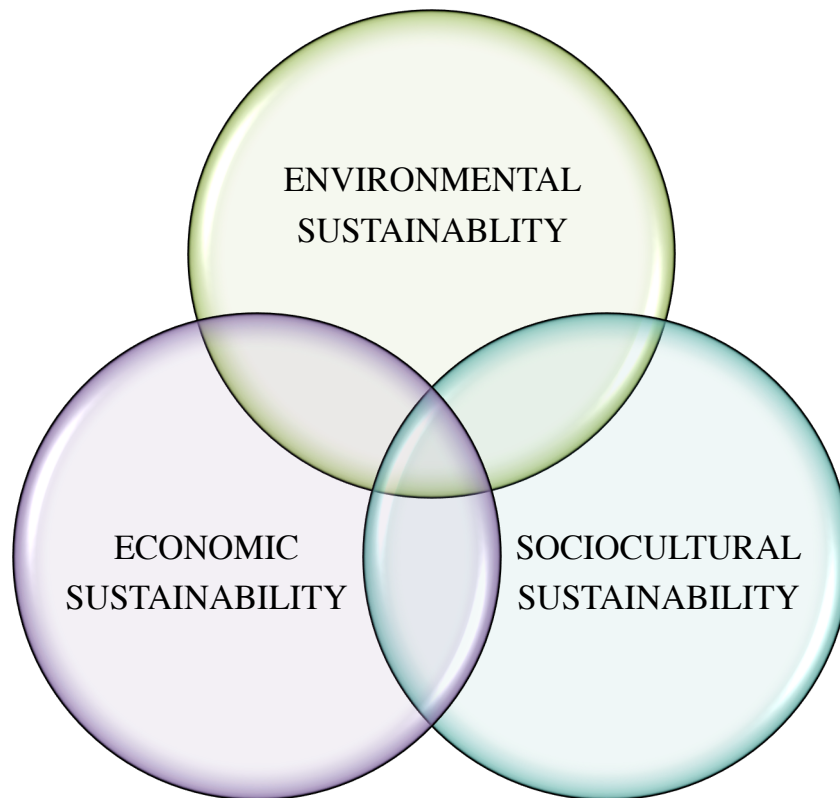


Figure 2. *A Tripartite Model of the Factors Linked to UNESCO’s Notion of Sustainability.*

The Australian Research Institution in Education for Sustainability

Education for Sustainability initiatives developed within the United Nations has migrated into Commonwealth policy through the Department of the Environment, Water, Heritage and the Arts. The Commonwealth has commissioned the Australian Research Institute in Education for Sustainability (ARIES) at Macquarie University to conduct research into how to facilitate meaningful change. This notion underscores the necessity to achieve attitudinal and behavioural changes. However, to move

operationally towards reaching outcomes of lived-Sustainability, a great deal more research has to be initiated. According to ARIES (2009):

The research program aims to identify key factors and impediments influencing education for Sustainability, evaluate existing approaches, and develop effective educational materials and programs to promote behaviour change towards the sustainable practices (para. 3).

ARIES also has a network of Australian Universities and corporations that have engaged in this research project. It would be an expected step for any Australian university to initiate appropriate partnerships within the ARIES community. In addition, the work of ARIES has flowed into Sustainability as a cross-curriculum priority for the new Australian Curriculum (ACARA, 2012). ARIES is the research mechanism that has moved into strategic policy areas as seen by extension with the Melbourne Declaration (2008) and the initiation of ACARA. Through ARIES, Sustainability policies have flowed into the teaching and learning sphere of faculties, as well as schools of education responsible for the pre-service primary teacher education courses.

Sustainable Communities within Universities and Schools

Consistent with (ARIES, 2009; AITSL, 2010; AQF, 2012) the broad objectives accommodating Sustainability include:

1. Developing a heightened awareness and practice of social and environmental Sustainability amongst its staff, students through to the local and global communities.
2. Establishing a vision that embeds social and environmental Sustainability and well-being values, knowledge and skills into the university faculties, schools through curriculum and research initiatives.
3. Continuous improvement in reducing a university's and/or a school's environmental footprint in areas of: energy; water; materials; waste; biodiversity and transport, as an exemplar to the broader community, as well as other partners.

According to ARIES (2009), Australian universities need to set goals, objectives, targets, programs and a person responsible for Sustainability. Such social Sustainability programs could include (ARIES, 2009):

- Taking responsibility for Sustainability service offerings in degrees and units;

- Linking social Sustainability with occupational health and safety and wellness practices;
- Integrating social Sustainability as a core part of any training and education;
- Promoting social Sustainability into diversity and equal opportunity policies and initiatives; and
- Supporting social Sustainability interaction with the wider community, as well as internationally.

Following the election of the Rudd Labor Government at the end of November 2007, one of the first initiatives was the establishment of an Australian Curriculum commencing with the Melbourne Declaration (2008). Subsequently, ACARA was commissioned to oversee this process. Together with other Rudd initiatives such as signing the Kyoto Protocol and participating in the Bali conference, Sustainability as a cross-curriculum priority became a feature of the Australian Curriculum.

Summary of Part One and Links to Research Questions

In reviewing the literature on what constitutes an adequate definition of Sustainability, the researcher presents the complexity of intersubjectivities involved for any informed understanding of the topic. Part One introduced the complexity of the sociocultural dimension of the anthropocentric link into the ancient biophysical domain. The literature underscored the need for a high level of interdisciplinary knowledge required in order to drive the continuum. It reinforced the importance of Sustainability as a cross-curriculum priority necessary to drive change and to provide a broad vision to the Australian community, as identified by (ACARA, 2012; ARIES, 2012; UNCTAD, 2012; UNESCO, 2002). It reinforced the degree of specialised knowledge required by graduating primary teachers. Finally, the intersubjectivities of social Sustainability were introduced with particular references to the role universities play to adequately educate primary school teachers within the graduate one-year GDE-P course.

The study investigated students' perceptions regarding four interconnected factors associated with Sustainability including: sources of information on Sustainability; lifestyle, attitudes and behaviours towards Sustainability; awareness of economic and political issues linked to Sustainability; and attitudes towards Sustainability population policy. These factors informed the construction of the research questions. The following questions links into the generality of the interdisciplinary nature of the theme reviewed:

- *Who and/or what influence GDE-P students' perceptions of Sustainability?*
- *What are GDE-P students' perceptions of economic and political factors regarding Sustainability?*

Part Two: Key Sustainability Issues Impacting Lifestyle, Attitudes and Behaviours

Part Two of the literature review outlines a number of key issues on Sustainability as an integrated dynamic of social-cultural factors intersecting with the biophysical sphere. In 1991, *Caring for the Earth: A strategy for sustainable living* (1991) was published by the World Conservation Union, United Nations Environment Programme and the World Wide Fund for Nature, in which the definition of Sustainability had been refined to be as below (Figure 3):

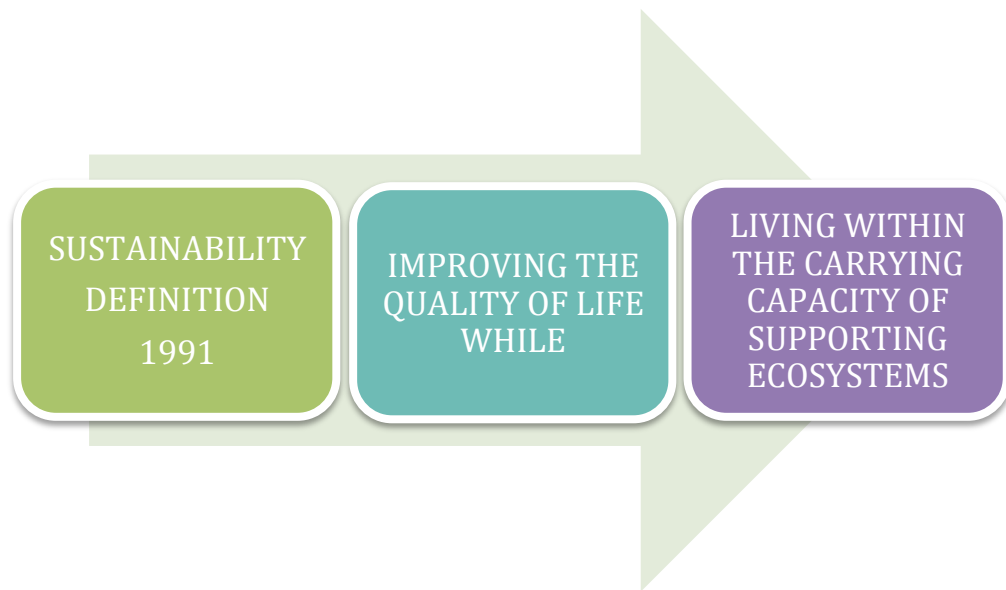


Figure 3. *1991 Definition of Sustainability (adapted from UNESCO, 2006).*

The key notion in this definition is the fact that supporting ecosystems have a *carrying capacity*, a limit; a very distinctive and far more rigorous proposition from the previous definition quoted. However, though not stated, the implication is that this carrying capacity should not be surpassed. For an example of carrying capacity being exceeded and leading to population crash is that of 31 reindeer being placed in 1944 on St. Matthew's Island in the Bering Sea; by summer 1963 there were 6000 animals suffering body weight loss and after the following winter 48 remained alive (D. Klein, 1969). Lovelock (2006) considered the Earth's sustainable capacity to have already been far exceeded.

Anthropogenic Global Warming: Climate Change

Sustainability was described in the 1987 Brundland World Commission on Environment and Development's report *Our common future* as: "development that

meets the needs of the present without compromising the ability of future generations to meet their own needs” (UNESCO, 2006, p. 10).

The St. James’s Palace Noble Laureate Symposium (2009) claimed that global Climate Change represents a similar threat posed to civilisation as thermonuclear weapons, and as such, should be addressed in a similar manner to the Pugwash gathering in 1957. In the second component of the literature review the science of Climate Change is introduced, as well as the issues of particular anthropocentric behaviours (e.g. ranging from lifestyle choices through to government policy).

Gore (2006) presented Climate Change as an ethical issue. Wang (2010), citing Gore at Duke University, stated that Climate Change was a political, market, national security, employment issue, and more importantly, a moral issue.

NASA climate scientist Hansen described the extreme consequences of human-caused Climate Change as a moral issue on a scale with world slavery (cited in Carrell, 2012). The consequences will provide a legacy of injustice for future generations. Markowitz and Shariff (2012) offer the following reasons why Climate Change is an ethical issue:

- Those least responsible will suffer the most (future generations, poorer populations and non-humans);
- A minority have abused a finite resource; and
- The atmospheric absorption of greenhouse gases is a failure of the present generation to seriously tackle the problem now.

Rotman (2013) and Broome (2012) claim that ethicists are seriously questioning present lack of actions regard to mitigating the effects of Climate Change on future generations. Twomey (2013) states that the risk of violence will increase with extreme weather, suggesting that in the United States the chance of violent crime will increase 2-4 per cent with a rise of three degrees Celsius.

Towards a Tipping Point

Scientists claim that the Earth is heading towards another significant and disruptive climatic age (A. D. Brown, 2003). This time it is an anthropogenic generated *tipping point*, a point or set of conditions at which science has predicted that climatic and ecological systems will no longer continue in their present state (A. D. Brown, 2003).

Many environmentalists, climatologists and scientists use the term *tipping point*, implying a point of *no-return* to previous conditions within that system has been reached, triggering the commencement of a positive feedback system with chaotic outcomes (Foley, 2005; Garnaut, 2008; Lovelock, 2006; Lynas, 2007; Pittock 2009; Spratt & Sutton, 2009).

Diverse and essential ecological systems could break down, possibly with unpredictable chaos, in the transition to another age that may or may not be able to support human habitation and the complex agricultural and technological nexus. According to Nobel Prize winning scientist, Callaghan (personal communication, November 21, 2012), the chance of holding the average global temperature increase down to 2°C has already passed.

Lynas (2007) methodically detailed the progress of calamitous events that will occur as the average global temperature continues to rise, and Gilding (2011), states that as such events start to occur, “... denial ends, and the reality that we face a global, civilization-threatening risk will become accepted wisdom, virtually overnight ... [Described as] the Great Awakening” (p.106).

Anthropogenic Carbon Dioxide: The Positive Feedback Loop

Since the 1970s atmospheric carbon dioxide emissions and methane has been increasing to perilous levels (A. D. Brown, 2003; L. R. Brown, 2006; Diamond, 2005; Leggett, 2000; Lovelock, 2006; Lowe, 2005a, 2005b; Lynas, 2007; O’Connor & Lines, 2008; Parenti, 2011). Carbon dioxide has risen from nearly 280 parts per million (ppm) in 1760 to 345ppm in the first decade of the twenty-first century and a milestone of 400 ppm was passed on May 9th 2013 at the Mauna Loa Observatory (“Carbon Dioxide at NOAA’s,” 2013). Global warming is causally linked to increased amounts of infrared energy being trapped by carbon dioxide (CO₂), methane and other gases (Lovelock, 2006; Salmon, 2007).

With increased global warming, the oceans will take in less CO₂ and according to science more CO₂ will go into the atmosphere, thus increasing the global temperature (Spratt & Sutton, 2009). This process is described as a classic positive feedback loop. As a result of this feedback process, the Arctic ice shelf will retreat and the greater the

loss of Arctic ice cover, the greater the *albedo effect* (less energy being reflected back into space from the white sea ice) contributing to the enhanced chance of disruption of the North Atlantic *thermohaline circulation* or Gulf Stream, potentially freezing parts of Britain and Western Europe, with possibly the near cessation of this convection current in the Greenland Sea. Leggett (2000) places considerable emphasis on the drastic prospect of methane hydrates being released from (at the moment) vast frozen areas. Given that methane is 21 times more efficient at trapping infrared energy when compared with CO₂, the thawing out of these frozen areas will accelerate global warming.

Scientists predict that as global warming proceeds, and as trees replace the tundra, the once barren frozen soils will become disturbed and release stored carbon to the extent that it will exceed that which can be stored by the new forest (Cubby, 2012). Similar outcomes of carbon decomposition occurred in forest soils of Wisconsin and North Carolina when, in 2012, they were experimentally heated by 5.5 to 11 degrees Celsius (“Global warming threat”, 2012). Callaghan (personal communication, November 21, 2012), stated the ALT (active layer thickness) of permafrost, melting from the top down, has increased dramatically over the last several years; this continues to enable the stored methane to be released into the atmosphere. These conditions form the classic positive feedback loops the type of which A.D. Brown (2003) warned: the warmer it gets the more carbon gets put out into the atmosphere, which then warms the atmosphere even further. In far warmer climates, such as Indonesia, carbon is being released into the atmosphere as peat bogs of Kampar dry out after canals are being dug. These canals have a dual purpose and deleterious effect. They act as a means of transporting out logs from the previously inaccessible rain forest and draining the swamp in preparation of establishing acacia plantations (Pearce, 2012c).

The flow and exchange of carbon in its various forms between the Earth’s large reservoirs, the atmosphere, oceans, fossil organic carbon and land surface biosphere, is known as the carbon cycle (Spratt & Sutton, 2009). Since the Industrial Revolution the carbon cycle has been disrupted from its 700,000-year balanced state, during which time *Homo sapiens* evolved and thrived (Salmon, 2007).

Politics, Sustainability and Climate Change Refugees

British Prime Minister Margaret Thatcher, a scientist, expressed public recognition of Climate Change at the May 1990 gathering's press conference noting that:

There would surely be a great immigration of population away from areas of the world liable to flooding, and from areas of declining rainfall and therefore of spreading deserts. Those people will be crying out not for oil but for water. (Cited in Leggett, 2000, p. 4)

The complexity of the issue of Sustainability is found in the tripartite relationship between the biophysical environment, economics and sociocultural values. Globally, organisations are pushing for solutions to the pending Climate Change crisis: for example, the Climate Action Network (CAN), which is a global network organisation accommodating both government and individual action to limit anthropogenic induced Climate Change (CAN. n.d.). In Australia, the Climate Change Institute (CCI) is part of the CAN network and notes that:

Without decisive action, the economic and environmental threat that Climate Change represents will increasingly affect us all. Decisive action, however, cannot only significantly boost clean energy and low carbon jobs and industries, it can create societies better in touch with natural and regional communities.

The Climate Institute ... is solely focused on the issue of Climate Change, integrating both national and international dimensions.

[As well as] critical research and analysis of climate impacts, community attitudes and economic risks and opportunities, has clearly contributed to significant developments in policy and practice ... and targeted to educate and influence community, business and political leaders who have the power to effect positive change. (CCI 2008-2009, p. 8)

At the Rio+20 climate conference, June 2012, the United Nations High Commissioner for Refugees (UNHCR) released the report *Climate Change, Vulnerability and Human Mobility*. This report was based on 150 testimonies of climate related refugees from Ethiopia and Uganda, confirming previous speculation. Although the UNHCR has not yet a definition of a *climate refugee*, they considered that Climate Change would produce much more dislocation of people driven from their previous land (Ortiz, 2012).

According to activist McKibben, founder of the online blog *350.org*, 350ppm of CO₂ is the level to which it is imperative the Earth must return from its May 2009 level of

387ppm (cited in Fegan, 2009). Salmon (2007) claims the CO₂ levels “are the highest in 700, 000 years” (p. 207), yet the current international push is for 450ppm (Kerr & Taylor, 2009). The growth of carbon dioxide concentration in the atmosphere as observed at the Australian observatory, Cape Grim Tasmania, shows the inexorable rise that is occurring here and around the world. The impact on sea levels around the planet is of great concern. Porritt (2006) noted that scientists claim in 20 years the Greenland ice cap could melt, causing a one-metre rise in the sea level. He also noted that most of the work undertaken on this topic has been on possible physical adaptations to such outcomes, but research on how communities or individuals will adjust psychologically has not been carried out.

Australia, as the world’s largest exporter of coal in 2009-2010 (“Exports,” n.d.) has to consider how coal use will impact directly on the people living on the Pacific islands, as the associated Climate Change gradually floods these nations.

Factors Feeding into Climate Change

The factors feeding into Climate Change are many and varied, both on a global and local level; issues in Australia include heat and water.

Heat

Other than heat given off by power generation, refrigeration and all the accoutrements of twenty-first century city living, during the day sunlight heats the roofs, roads and parking areas all of which increase the temperature in the surrounding area. Peng et al. (2012) measured *Surface Urban Heat Island Intensity* (SUHI) across 419 global big cities finding it to be one of the most obvious impacts of population on the earth system. The greener (more vegetation) the built environment, the cooler it was. It has been estimated that green roofs (those covered with vegetation) and cool roofs (white), could save Californian consumers in excess of \$211 million in power bills; equating to taking 91,000 cars off the road per year. In addition, if only 50 per cent of the roofs were green, stormwater runoff, by absorption and evaporation of rainfall, would be reduced by 136 billion litres leading to an immense reduction in pollution of waterways. The Los Angeles Times reported that research from the Lawrence Berkeley National Laboratory claimed that 25 per cent of the surface of most cities was made up of roofs, with paving being a further 35 per cent. If reflective surfaces were added to 100 large

urban areas of reflective surfaces, an estimated 44 giga tonnes of greenhouse gases would be offset (Akbari, Menon & Rosenfeld, 2008).

Water

A. D. Brown (2003) stated that to supply the world's need for water, there has to be 45,000 dams built on the planet by the end of the twenty-first century. These dams will probably cause considerable disruption to the Earth's surface (Pearce, 2012b, 2012c) and surrounding environment and systems with the propensity to silt up: for example, the Aral Sea (Pearce, 2012a). Many dams would be constructed in areas of decreasing rainfall, put with the associated use of flood irrigation also leading to the problem of salinity. Therefore, the long-term benefit of thousands of more dams is questionable. Worldwide, water tables are dropping as increasing numbers of people draw on the supplies for their own direct needs, as well as indirect ones of agriculture and industry (Trompiz, 2012).

A Vulnerable Australia

Due to its geographic location Australia is, "the most vulnerable developed nation to Climate Change" (Lindenmayer, 2007, p. 60). Much of Australia's agricultural land is in marginal rainfall areas and projections are that there will be a significant reduction in these latitudes (Lowe, 2005a). Australian's rainfall patterns are being completely disrupted with much of the South-East coast receiving less rain, the North-West of Western Australia getting much more; while Perth's average run off over the last 30 years has been one third of that recorded between 1900-75 and the sea level has risen 10cms (Lowe, 2005a). Howden and Jones (cited in Lowe, 2005a) indicate there is a one in three chance the rainfall decline could be up to 25 per cent. The sea level has a further impact on the Murray-Darling basin, an area that has not only suffered drought for a number of years but has been devastated by the over allocation of water rights to irrigators. The amount that can be legally taken in dry years is greater than the total flow of the system (Lowe 2005a). After several days of temperatures in excess of 35 degrees, the protein in wheat commences to deteriorate, reducing its suitability for bread and pasta making (Lowe 2005a), while a one degree Celsius rise in temperature above the norm drops the yield of wheat, rice and corn by 10 per cent and that of soybeans declines by 17 per cent (L. R. Brown, 2006). If the change were at a slower pace, there would be a chance of an evolutionary response allowing some species to adapt. Taking the Intergovernmental Panel on Climate Change (IPCC)'s second worse scenario of

Climate Change, the Consultative Group on International Agricultural Research established that even a slightly shorter growing time could result in a crop failing completely (Jarvis, 2011). In addition to this vulnerability, an increasing Australian population growth will amplify the crisis.

Agriculture and its Environmental Effects

In the Australian context, A. D. Brown (2003) claims, “there is a finite limit to the total biomass that can be sustained in any ecosystem” (p. 249), while many other researchers consider the Australian limit of satisfactory Sustainability has already been surpassed (Beresford, Bekle, Phillips & Mulcock, 2001; Diamond, 2005; Chittleborough, 2006; Cribb, 2010; Flannery, 2005, 2010; Linder Mayer, 2007; Lowe, 2005a; O’Connor & Lines, 2008). Reinforcing the crisis, Flannery (1994) states that of the 22 million hectares of Australia’s arable land currently in use, 70 per cent is degraded and requires restoration, a situation that has occurred in less than 250 years after the British arrived. In fact, O’Connor (1998) contends that the impact colonisation has had on the Australian environment has resulted in so much damage (irreparable damage in many cases) that many systems are on the verge of collapse: for example, the Murray-Darling River system (A. D. Brown, 2003; Kingsford, 2008; Lindenmayer, 2007; Lowe, 2005a; O’Connor & Lines, 2008). Scientific knowledge and technical inventions over the last two to three hundred years have dramatically improved global agricultural production though some are now incurring negative unanticipated outcomes and consequences (Bandarage, 1997; A. D. Brown 2003).

From British colonisation (1788) until the contemporary period, Australians expended much time and resources trying to force the ancient lands to conform to northern hemisphere agricultural practices, rather than being flexible enough to allow some other form to evolve (Rolls, 1969). They were “terribly maladapted” (Flannery, 1994, p. 355). In particular, the devastating effects of the radical land clearing policies cannot be overestimated. Most of the South West of Western Australia is covered by “highly infertile sand sheets” (Flannery, 1994, p. 93) and over the millennium plants have adapted to cope with these conditions, but it has been in an interlocking, dependent manner. Temperate lowland wood and grasslands have suffered most in the radical clearing policies of bureaucrats (Revkin, 2003b). This clearing and its associated extinctions cannot be blamed on the unenlightened past as, “approximately 50 per cent of all clearing for agriculture has taken place since the 1970s” (Linder Mayer, 2007, p.

42); often known as *conditional purchase*, where it was compulsory for the purchaser to clear the land within a set number of years (Revkin, 2003b). The scheme destroyed much of Australia, and the resultant dry land salinity it caused is still continuing to spread, rendering vast tracts of land useless for cereal crop production (Revkin, 2003b).

Incalculable Loss of Biodiversity

Major changes in climate also accommodate the loss of biodiversity (A. D. Brown, 2003), because many species have and are disappearing before their identification, classification and knowledge of any symbiotic relationships have been established. As A. D. Brown (2003) explains when writing of *mycorrhizae* they: “can establish symbiotic relations ... of trees of different species and transfer nutrients between or amongst those trees” (p. 213), pointing out that this is, “... not a benefit available to the odd [saved] isolated tree” (A. D. Brown, 2003, p. 213). In Western Australia’s wheat belt approximately 450 vascular plant endemic species are, “under threat of extinction from salinity” (Beresford et al, 2001, p. 200), while dispersion of Sandalwood tree nuts is challenged due to decline in Boodie (a small marsupial) numbers because of habitat loss.

Australian biota is unique and hence losses here are global losses (Beresford et al., 2001; Lindermayer, 2007; Lowe, 2005a, 2005b; O’Connor & Lines, 2008; Revkin, 2003b; Rogerson, 2004), while losses elsewhere in the world are lamented (Mies & Shiva, 1993; Diamond, 2005; D. Klein, 1969). Lindermayer (2007) claims attention to the monitoring of Australia’s biodiversity is poor. Similarly the clearing within forests has been a contentious issue, with the harvesting of native forests a considerable problem, because the poorly considered manner in which it is carried out: for example, the loss of old trees and their hollows is not only unsustainable, but has a major negative impact on over 300 vertebrate species. Further more, Lindenmayer said in a radio interview that from new work coming out of the Fenner School, it has been found that over 2000 tonnes of carbon per hectare is being stored in the above ground timber of the wet forests of Victoria (Fisher, 2008). This would equal, in carbon trading approximately \$80 billion in comparison with about half a billion in timber royalties to the Victorian Government.

Depletion of Soil Quality

To some extent depletion of soil quality has been alleviated with the use of fertilisers. Within Australia, introduced pastures required a fair fertility in the soil, the lack of which has been ‘corrected’ by the application of superphosphate. In many cases when these soils are disturbed, on exposure to the air, the sulphate compounds convert into sulphuric acid and the soil releases manganese and aluminium that can be toxic to plants (Yencken & Wilkinson, 2000). After some 30 years of fertiliser application the soils have, in some areas, become so acidified that a number of temperate pasture species now find it difficult to grow (G. W. King, 1988). Also now with most produce, be it plants or animals, being consumed some considerable distance from the area of production, little (if any) of the organic material coming from these living things returns to the soil that produced or sustained them. Feed lots, abattoirs and the consumption of cereal crops and animal products have become centralised near city and urban areas, away from the productive horticultural and agricultural lands. Disposal of sewage via outlets into the ocean has a detrimental effect on marine life (Yule cited in O’Connor, 1998). Lack of the organic matter affects soil structure (A. D. Brown, 2003).

The best organic fertiliser was mined from islands that previously had enormous guano deposits, reducing them to hostile landscapes. The synthetic fertiliser is a chemically produced by-product from fossil fuels production. *Eutrophication* occurs in many waterways now due to increased amounts of phosphorus and nitrogen from fertiliser run off entering the system (A. D. Brown, 2003). Most of these systems are already under stress due to decreased rainfall and greater volumes of water being held back and/or withdrawn from rivers, decreasing their flow.

Sustainable Wild Harvest

The wild harvest of kangaroos for human consumption is a sustainable industry (Chittleborough, 2006; Diamond, 2005; Lindermayer, 2007). Professional shooters slaughter the animals in their natural habitat, avoiding both transport stress for the animals and ‘food miles’ (Isaac, 2008). The facts that kangaroos are not hard cloven hoofed, and consume less food and water than sheep and cattle are very valid reasons to encourage their farming (Lindermayer, 2007). A cow emits 600 times more methane than a kangaroo (Trivedi, 2008). Unlike the ruminants, it seems that kangaroos use reductive *acetogenesis* as the major hydrogen utilisation reaction in the fore-stomach and hence they are basically not methane admitters (Wilson & Edwards, 2008). These

authors referred to the Intergovernmental Panel on Climate Change's 2002 report stating that Earth's atmosphere is unable to remove the amount of methane, a far more dangerous gas than carbon dioxide, now being discharged into it. Other than the fact kangaroo hides make superior leather, their meat is high in protein, low in fat and cholesterol free.

Fossil Fuels

However, possibly the resource depletion that gets the most publicity in daily media, is the fossil fuel, oil. Coined by M. King Hubbert, the term *peak oil* was originally used to predict when oil production in the U.S. would, in the 1970s, peak (Cribb, 2010). The term now appears to have entered the Lingua Franca referring to a worldwide situation or more accurately, though largely ignored, a global crisis of the near future. As to how the present Western Civilisation will handle this remains to be seen, but many appear unaware that such depletion will not merely effect transportation and prices, but all things ranging from agricultural production to health services and medical equipment such as syringes and plastic tubing extensively used in Intensive Care wards.

L. R. Brown (2006) devoted a chapter, *Beyond the Oil Peak* to this situation, in which he outlined what could be the implosion of the way of life, as we know it. Mills (2008) in his *The Myth of the Oil Crisis* furiously attacked Heinberg (2004, 2011) and those who recommend decreasing world population and a rejection of the capitalism. These he calls Neo-Luddites, accusing them of wanting “... to make unimaginable changes in our society and way of life ...” (Mills, 2008, p. 236). However, L. R. Brown (2006) made a prediction that future historians may even “... distinguish between before peak oil (BPO) and after peak oil (APO) ...” (p. 21). He wrote “... some CEO's sound very bullish about the growth of future product ...” (L. R. Brown, 2006, p. 23), but as the firms were buying up their own stock that may not hold true. With increasing prices and improved technology tar sands or shale oil has now become viable: for example, the Alberta fields of Canada supplies U.S. with up to five per cent of its oil perhaps appearing to dissipate the urgency of the situation. It is an expensive form of extracting oil, using great quantities of natural gas and water and in the process decimates the environment (Cubby, 2011b).

Writing in the *Business Spectator*, Kohler (2012) stated declining oil should be dismissed because there is currently an international oil rush. This would include tar

sands, shale oil and gas (not coal seam gas) that are accessed by fracking. Though large reserves have been found across the Northern Hemisphere they are not financially viable, so Kohler claims the American finds will undermine the energy dominance of the Middle East allowing it to become energy self-sufficient, not needing to pursue renewable or nuclear energy and for it to again become an economic superpower. Several weeks later, writing in the 'Climate Spectator', Mushalik (2012) mounted an argument as to why shale oil will not overcome the deficiency of USA oil. He quoted Hansen's, NASA climatologist, claim that CO₂ concentration will increase by 250 ppm if even only half of this 'unconventional oil' and gas is burnt. By 2020, offshore oil will have peaked and as shale oil wells only produce small amounts, it means thousands of wells have to be drilled.

Monbiot (2012) wrote, whereas the general public, business and governments had not responded to the moral issue of cutting fossil fuel use as a means of reducing emissions, with the approach of peak oil possibly the economics associated with the shortage would have a desired effect. But now there are "... monstrous deposits located in the United States ... the Bakken shales in North Dakota contain as much oil as Saudi Arabia" (Monbiot, 2012, para. 9). Even ignoring the ethical side of the massive environmental destruction of oil/tar sands extraction, it will not, according to Aleklett (2012), negate Peak Oil.

Claims are surfacing that coal reserves are nowhere near what had been previously estimated. Madrigal (2008) writes of Rutledge's estimation that a total of 662 billion tons of coal, including that which has already been mined, will be available to man. This is in sharp contrast to the World Energy council's prediction of some 850 billion tons still available. Similarly Stubborn mule (2010) writes that the Australian Bureau of Agriculture and Resource Economics (ABARE), when claiming that at 2008 production rates, there is approximately 90 years of coal production available, does not understand exponential growth ("When will," n.d.). According to University of Newcastle researchers, with the development of a model designed to project production of mineral resources, the ultimate recoverable resources (URR) of coal production, worldwide, will peak between 2010 and 2048, with Australia's declining after 2050 (Mohr & Evans, 2009). As Zabarenko (2011) wrote, the switch from coal to gas is not of any benefit from the Climate Change perspective. Parenti (2011) considers it a "bridging fuel" (p. 238). Burning coal emits sulphates, other particles and far more carbon dioxide than

methane, but methane is 20 times more potent than carbon dioxide. Zabarenko (2011) quotes Romm of the *Center for American Progress* as saying "... the way people think about natural gas is just wrong ... from a climate perspective ... get off all fossil fuels as quickly as possible" (p. 15).

Food Security

With the increase in population food can no longer be sourced locally, but is transported, sometimes from great distances, thus using more fossil fuels and hence pushing more carbon dioxide and other pollutants into the atmosphere (A. D. Brown, 2003; Cribb, 2010).

According to Boycott (2008), the head of Britain's Countryside Agency first coined the expression 'nine meals to anarchy' to describe the country's urban food situation. In 2008, Britain's Whitehall ministers and civil servants were warned by supermarket managers that there was only three days supply of food left, in other words 'Nine Meals to Anarchy' by Simms (2010). The crisis was largely brought on by a narrow cost saving, just-in-time market system that does not allow for fuel disruptions, as was the case here. He claimed that the country's capability of feeding itself has been deteriorating for some time and during cold spells food prices rise (Simms, 2010). The food crisis of 2008, resulting in riots in many of the 37 affected countries was due to the shortage of global grain supplies, of which Australian drought was a contributing factor.

This crisis was, according to Simms (2010), the catalyst for what is now the land-grab (buying up swaths of agricultural land in other countries) by a number of both developed and developing nations. Hodgson (2010) quoted the World Bank's claim, that between 2005-2008 the price of food rose by 80 per cent and resulted in 100 million people falling below the poverty line. Simms (2010) questioned whether the change in growing crops for food to their production for biofuels is acceptable, while the need for more food often causes more marginal land to be brought into production with present areas, already being stressed, resulting in deterioration of good country. Cribb (2010) cited a Rabobank report that stated in the 1960s, 0.43 hectares of food production was available per person. By the present it had fallen to 0.23 and with the predicted rise in population, in 2050 it will have decreased to 0.18 of a hectare. Racher (2007) who described, "... farming as a smash and grab industry ..." (p. 10), has written that there is 5.27 acres (approximately 2.39 hectares) of the planet for every person, but

this includes desert, frozen or hot, urban and mountain. For nations that wish not to have starving millions at their borders, a defence policy is a food policy.

Pearce (2012c) considered the spike in food prices in 2008 was due to both the restriction on food exports by food producing nations and the activity of market speculators. He extensively documented this current global land-grabbing activity stating the greatest participants are individuals or semi-government entities from China, India or Middle East Countries, as has been experienced in Australia. Usually the recipients of such attention are the underdeveloped countries within Africa and South America even entailing the possible loss of sovereignty. Barbour (2012) quoted an American agribusiness adviser as saying the fundamental concern is actually sourcing sufficient farmland to produce the necessary increase in production, hence the push into developing countries.

The fact that Australia has an annual profit of \$14 billion from food exports implies the country grows more than sufficient food for itself, but most of that profit derives from meat and wheat. *Growcom*, a peak Queensland horticultural organisation, claims Australia's food security is under threat with a quarter of fruit and vegetables being imported. Challenges not only come from the future shortage of water, land and fertilisers, but at the moment the industry is weighted down under some 130,000 individual laws dealing with horticultural production (Woolley, 2011).

Bornman (2012), in her opening address to the *Food Security and Healthy Food in Western Australia Workshop*, stated that with Climate Change, world economics and trade, many of the disparities that had previously separated developed from developing nations were being removed and "we are all moving towards similar Sustainability risks" (p. 4). It was becoming imperative that a secure and reliable chain of supply from producer to customer be continued. The appalling waste of food that occurred in Australia (Elsworth, 2012) and globally had to change. Thomas (2011) had previously written that food loss occurred within the supply chain at production, harvest, and processing while it was at the retailer and consumer level that food waste occurs. He noted the continuing corruption in developing countries such as Somalia and Cambodia where in the 2005 drought those working for the World Food Programme purloined food from the supply chain.

Hoffman (2012) wrote that one of the main topics at Rio+20 would be the link between Climate Change, its effect on food production leading to food insecurity, population growth, price volatility and undernourishment. At present in the developing world, half a million women and children are undernourished. The figure is predicted to rise by 20 per cent within a decade. Female under nutrition does not just produce poor maternal reproductive health but can affect up to the next three generations.

Renewable Energy

One of the main arguments used in the debunking of renewable energy is that it is incapable of a satisfactory base load, a reliable supply of energy irrespective of weather conditions. In 2007, an experiment funded by the German Economics Ministry showed “... that distributed power can indeed produce base load in a secure and reliable manner ...” (Leggett, 2009, p. 50). This was achieved by using detailed weather data and linking wind, solar, biogas and hydro plants nationally via a central computer controlling a national network. Drexel University’s College of Engineering claimed to have developed a new fast and reliable method of storing electrical energy. A combination of flow batteries and super capacitors have been formed into an electrochemical storage system capable of integrating with present grid distribution (“Making ‘renewable’ viable”, n.d.).

The main renewable energy sources (L. R. Brown, 2006, 2011; Flannery, 2010; Leggett, 2009; Pearce 2012c) are biomass/biofuels, geo-engineering, geothermal, hydroelectric, hydrogen, marine power, solar, wind and nuclear (though not considered by most as renewable). These topics are expanded upon in Appendix B.

Adaptations

Across the world, business and government authorities at either local or national levels have recognised, despite the cost, the necessity for adaption planning. The following notes several differing responses from various countries. The UK Department of Environment, Food and Rural Affairs commissioned a report in 2011 to establish how resilient businesses in that country were to the effects of Climate Change (“Insights into climate,” 2012). It found a significant difference in attitude between technically orientated businesses that saw direct risk, particularly mining companies with international interests, and those of consumer supply, even where they relied on overseas supply chains. Business opportunities connected to Climate Change are present

now while the actual physical impact will be felt in the future. Only half the authorities had factored Climate Change in to their future business strategies. As those companies that had had involvement with the Adaption Reporting Power had a far greater awareness of the situation, it was recommended the Government improve communication with the private sector to increase climate adaption awareness in businesses. It was also noted that for a third of the businesses, the risks were unknown, both in probability and impact. A common language and a standard framework for dealing with the subject of Climate Change adaptations would have a positive consequence.

Malawi, a small landlocked country in southern Africa already suffering from decades of swings from drought to floods along with overpopulation, is vulnerable to Climate Change. In 2006, the country published its National Adaption Programme of Action prioritising five actions, none of which included any attempt at birth control or stabilising the population. Nor does such appear any where in the Global Facility for Disaster Reduction and Recovery's fourteen page document ("Climate risk", 2011). It is stated however, that over half of the population live below the poverty line and food insecurity is the norm for one in five people; topping the list of major reasons for these conditions is the increasing human population. Certainly restoring forests, improving rain-fed agriculture and Lake Malawi's resources are all desirable preparedness for extreme weather conditions, but with a birth rate of 40.8 /births/1000 population, ranked 10th highest in the world the prognosis is not good (Indexmundi, 2011). Global Facility for Disaster Reduction and Recovery has Malawi 5th on its list of priority countries ("Country programs", n.d.).

Climate Change for Adaption Actions for Local Government is Australian Government's policy developed to help local government initiate risk assessment and recommendations for adaption action (WALGA, Climate Change 2012). Within Western Australia there are a number of action plans ranging from Broome in the north, through pastoral country in the Shire of Murchison, central wheat belt of Wongan-Ballidu, both Eastern and Southern Metropolitan Regional and to tourist and residential Mandurah, south of Perth. Recommendations are future planning needs to be cognisant of not only sea level rise, but also storm surge and flooding in extreme weather events. Due to the likelihood of these conditions occurring, foreshore setbacks, relocation of recreational areas, caravan parks and the like; implementation of engineering controls

such as sea walls and levees and upgrade of infrastructures including roads, water pipes and drains will possibly be required. Economic planning should be developed to handle the assumed reduction in tourism in conjunction with community awareness and education. Similarly, recognising ecosystems that will need extra protection and instigating projects to retain water, not only within rural areas with the likes of detention basins but also in urban design (“Adaption responses,” n.d.).

Though moving away from the more localised response planning, the research of Potgleter, Doherty, Crimp, Rodriguez, Hammer, Meinke, and Fearweather (2008) used a shire approach across the main winter crop growing areas of Australia to establish regional areas sensitive to Climate Change. Working with both low and high CO₂ emission scenarios, it was found that without any form of adaption, a slight decline in production would occur by 2020 continuing on until 2050. By altering planting times, along with the increased temperature and CO₂ fertilisation, early flowering and maturing may negate the decreasing winter and spring rainfall.

Summary of Part Two and Links to Research Questions

This section of the literature review explored key Sustainability issues linked to the science of Climate Change, the potential for a global tipping point and the interlocking complexity of environment issues, such as biodiversity. The final section includes specific references to the carrying capacity of the Australian context. The issues discussed are easily accessible to the broad public.

The study investigated students’ perceptions regarding four interconnected factors associated with Sustainability including: sources of information on Sustainability; lifestyle, attitudes and behaviours towards Sustainability; awareness of economic and political issues linked to Sustainability; and attitudes towards Sustainability population policy. These factors informed the construction of the research questions; however, the following questions link into the next dimension of the interdisciplinary nature of the theme, this time with an emphasis on the causal links specifically associated with anthropogenic Climate Change (human behaviour). The first research question extends and specifically covers the science and human activity. The following relates:

- *Sources of information on Sustainability.*
 - (a) What personal actions do GDE-P students undertake?
 - (b) What behavioural choices do they report?

- *What are GDE-P students' perceptions of Sustainability linked to population?*

Part Three: Awareness of Economic and Political Issues Linked to Sustainability

Part Three of the literature review links Sustainability specifically to: economics; politics; big business; resource depletion, as well as alternative energy sources to fossil fuels. Several interconnected Sustainability themes are discussed, with the first consideration being the political-historical and environmental-economic context of contemporary Australia within the global economy. The second context is a global economy with a population moving towards an unsustainable nine billion during the middle of the twenty-first century (Diamond, 2005; Lovelock, 2006; Stern, 2006).

Australia: A Self-Supporting British Convict Colony

The settlement of Australia by the transportation of British convicts in the late-eighteenth century was initially conceived from an economic perspective. For the *free settler* who followed the convicts, it was to be given the chance of financial and social betterment, as well as the fulfilment of the British Government's desire for a self-supporting convict colony (O'Connor, 1998). In Australia, economic development would be the driving force to give way to economic growth (O'Connor, 1998). The distinction between 'economic development' and 'economic growth' is important. Economic development is seen as the growth in average income, and is associated with the betterment in welfare for members of the society, usually expressed as per capita income. Economic growth in contrast, is the accumulation wealth of the country without reference to the number of persons in that population (Weeks, 1989). However, a *sustainable future for Australia* is not achievable while there is this paradigm of continuing economic growth (Lindenmayer, 2007; Lowe, 2005b; O'Connor & Lines, 2008). An obsession with economic growth is driven by business groups who are in a position to exert enormous pressure on the government of the day (Pearse, 2007). According to economist Saul (2005) today's governments have abandoned control of their nations to multi-national corporations and civilisation is seen "... as a whole through an economic prism" (p. 20).

According to Tham & Campbell (2011), at the behest of the business community in 1997, 30,880 temporary business immigration entrants were admitted to Australia on

what is known as a 457 visa specifically to fill alleged deficiencies in the number of skilled workers. By June 2009 this had risen to 142,669 immigrants (Tham & Campbell, 2011). This employer-sponsored scheme, heavily weighs in the employers' favour, negating the responsibility of training staff, paying the lowest possible wages and according to union officials, in some cases, with working conditions that would not be tolerated by locals.

There is the right for repeated renewals and for many it leads on to permanent residency. Owers (2006) wrote that world-wide skilled immigration saved \$552 billion from associated costs of training, and at the time of writing, there was not one Australian trained doctor at Mersey Hospital in Latrobe (Victoria), with half the doctors at Launceston General Hospital (Tasmania) having been trained overseas. Owers (2006) also noted that Washington DC had more Ethiopian doctors there than there were in Ethiopia. Jakubowicz (2012) states that the issues of a nation's capacity to train skilled people, or to invite them from a developing country at the social and intellectual cost to that country is an important moral question that crosses over in to the principles of Sustainability associated with wellbeing and fairness.

Australia's Production of Carbon

Despite being common place for Australian politicians to claim that Australia produces a mere fraction of the world's carbon emissions and it is, therefore, of little use for us to make cut backs, Australia has the largest per capita production of all nations ("Pollies fiddle", 2007). At a conceptual level, Australians can only be responsible for their own laws and behaviours. Therefore, it follows that by curtailing the current carbon output, as well as population growth there would be reduction in the acceleration of Climate Change.

Economics and Growth

Thirty-six years ago, Daly (1973) was claiming that the present economic growth model had outlived its usefulness, "the current neoclassic *growthmania* must give way to a new paradigm" (p. 152), that is to a steady-state economy [Italics added]. Economic growth without consideration of the environment (C. C. Hamilton, 2010) or costs of externalities has been, in one form or another, rampant for centuries. As long as the addiction of continual economic growth persists, Daly (1973) claimed a sustainable future will be unachievable and described this addiction as the, "malady of

growthmania” (p. 149). Thirty five years later he was still berating the fact that economists are fixated on economic growth claiming a steady state economy was not the same thing as a failed economy (Daly, 2008). He contended that GDP accounting does not allow for the subtraction of bad undesirable things (Daly, 2010). The example he gave was the cost of pollution, it’s not subtracted, and the cost of the clean up is added as value; applying to the depletion of resources, aquifers, forests and much more, claiming that it is time for a new accounting and financial system. Daly (2010) states (on his blog) “... economists and psychologists are now discovering ... the positive correlation between GDP and self-evaluated happiness [decline]” (para. 5).

The Stern Review (2006)

According to Stern (2006), the Earth is starting to call in the accumulating debt. Stern reviewed the Economics of Climate Change, announced by the UK Chancellor of the Exchequer in July 2005. The Stern Review set out to provide a report to the UK Prime Minister and Chancellor with the world’s most comprehensive review ever carried out on the economics of Climate Change, assessed the nature of the future economic challenges faced by the world and how at a global level the challenges could be met. Lomborg (2006a) challenged the Stern Review’s figures claiming some entertained was scaremongering (2006d). Stern (2006) emphasised actions taken now and in the immediate future will determine whether economic and social conditions of major disruption will occur later in the twenty-first century. He estimates a disruption similar to the First and Second World Wars in combination with the Great Depression.

Political Power

Singer (2002) states that the majority of Western nations have been lead by some form of democracy since the demise of sovereign power. However, he claims that today’s world leaders no longer lead, but are manipulated in the global markets by transnational corporations. Singer attributes this to when the World Trade Organisation removed the sovereignty of a people within a state, to the power of the multinational corporations. He states this power is usually manifested by means of lobbyists who strategically place delegates on boards and commissions. The Australian coal industry is an example of a powerful group that continually lobbies the Federal Government (Pearse, 2007). *New Economy Foundation* policy director Andrew Simms (2010) claimed that economic growth has been considered natural, whilst in nature, things only grow to maturity.

The 1944 Bretton Woods Conference

Responsibility for much of the present attitude and critical situation in economic areas can be laid on the philosophy and outcome (perhaps unintended) of the 1944 Bretton Woods Conference (Goldsmith, 1996; Korten, 1996). Korten (1996) claims Bretton Woods created "... new institutions that have shaped and controlled the world's economic activity since that time ..." (p. 61) and this vision became a world economically "... dominated by U.S. corporate interests ..." (Korten, 1996, p. 61). Australian Liberal Party member Pearse (2007) observed the influence of the fossil fuel industries in Australia, to the extent that selective information was put forward to those who would be making the decisions. Such decisions involve power to those who have a capacity to sway due process on behalf of selective interests worth billions of dollars, that is, to be advantageous to those within the fossil fuel and building industries, property development and/or the commerce of consumerism.

These new power plays did not occur because the colonial powers decided to end formal colonisation, rather colonisation ceased to be because they found the economic advantages could be continued by more politically acceptable and effective methods: for example, those that evolved out of the U.S. Council on Foreign Relations and culminated in the Bretton Woods Conference (Goldsmith 1996). Barlow (cited in Suzuki & Dressel, 2002), claims John Maynard Keynes set Bretton Woods up to be democratically overseen by the UN as the World Bank, the International Monetary Fund, as well as the International Trade Organisation, "... to regulate trade while incorporating all the basic UN covenants" (p. 72).

However, Korten (1996) claimed Bretton Woods had evolved out of the previous decade's U.S. Council on Foreign Relations whose vision was U.S world domination by economic means. Korten (1996) continued quoting the then U.S. Secretary of the Treasury, Morgenthau, as saying he looked forward to where all in the world would enjoy a dynamic economy resulting from, "... the fruits of material progress on an Earth infinitely blessed with natural riches ... prosperity had no fixed limits ..." (p. 21). In the above, two major flaws exist: the assumption that everyone would benefit from such economic growth and the more devastating, that the limit of the planet's finite resources would not retard economic growth. There also is an absence of any acknowledgement, or inclusion of the costs of the externalities that he chose to call *natural riches*. Possibly because it was meant to be under the auspices of the United

Nations, it does not seem to have elicited criticism at the time, but Suzuki and Dressel (2002) wrote that:

... without a General Assembly vote, says Barlow, “the USA killed off the International Trade Organisation in a single Council vote, creating the GATT (General Agreement on Tariffs and Trade) ... then removed all three [ITO, the World Bank and the International Monetary Fund] from UN control, basically making them arms of the US Treasury Board (p. 73).

Globalisation: China and India

The issue of industrial development and population becomes critical when the food and energy needs of the two largest countries are considered in the second decade of globalisation since the end of the Cold War. These countries will eventually dwarf the combined impact of Europe and the USA if they accommodate the same consumer patterns as the West. Currently, China (and in the future, India) will continue to drive Australia’s prosperity linked to resource exports, including minerals, fossil fuels and potentially uranium.

Political Stalling

The IPCC was formed in 1988 as a subsidiary of the UN’s environmental work and the World Meteorological Organisation. It was not meant to be an industrial body, but it has government appointees from those countries that have vested interests in the fossil fuel industries and runs on consensus not majority, with the result that stalling and obfuscation by those delegates is the norm (Flannery, 2005; Leggett, 2000). The Kyoto Protocol (1997) was the first international treaty under which rules of conduct for an international market dealing with GHG emission trading was set (O’Brien, Meizlish & Hawn, 2008). The theory is that polluters will pay per tonne of carbon they release into the atmosphere and hence will be encouraged to reduce their emissions. Companies stated as preparing for the carbon price, including Shell that started its planning in 1997 working on a price of \$40, and Wesfarmers that has invested heavily over the last four years in energy efficient technology (Adam, 2012). With former Prime Minister Howard refusing to put Australia’s economic interests behind that of the approaching environmental crisis, and with America continuing to stall, not only was the wording of Kyoto reworked, but also the targets shifted, so that America gained an emission increase of 12 per cent (Leggett, 2000). However, during 2006 Howard tasked Dr Shergold to enquire into the feasibility of emissions trading (Tillett, 2010).

In September 2009 the US Senate declined to pass its climate laws prior to the Climate Change Conference in Copenhagen (Flannery, 2010). Without global cooperation, the impact of Australia opting out of the global solution would provide minimal impact and probably political sanctions from other global states if vital resources were needed. Hypothetically, major political conflict could see powerful states taking control, and denying sovereignty, of small or even middle states such as Australia if resources were needed to support the interests of super states. In cognisance of this hypothetical scenario, Australia continues to play a role within United Nation's forums, regional summits and contributed to the December 2009 Climate Change Conference in Copenhagen in Denmark and the outcome of the contentious Copenhagen Accord.

Underscoring the Copenhagen Accord is the realisation that it is in both Australia's interests, as well as its international partners to reach an international agreement or consensus regarding policies and actions that will stabilise and then reduce carbon emissions and to move towards sustainable populations and technologies. However, unless the major economies of the world agree on an emissions trading scheme or international price on carbon trading small, but rich nations like Australia will not be in a position to political commit to any self-limited policies because fear of such a move inviting major economic uncertainty. The former Leader of the Australian opposition Malcolm Turnbull lost his leadership in 2010 over this particular issue (B. Keane, 2010, July 12).

Despite the Australian Liberal/National Party Coalition going to the 1990 election with the promise of reducing greenhouse gasses, from the time John Howard took over the leadership a *quarry mentality* reigned supreme (Pearse, 2007). Allied to this was the fact that the fossil-fuel industries have, over the years, manoeuvred themselves into the position of funding many advisory groups and lobbyists; making it impossible for views, contrary to the self serving interests of this power group, to even get a hearing at any responsible level of government. Historian Paul Kennedy claimed that people who succeeded in democratic political systems are usually those who avoided antagonising powerful interest groups (cited in Lowe, 2005b). Attempts are being made to implement environmental policies in a capitalist market system “... that is simply too powerful ...” (Else, 2008, p. 49). Politicians and big business, be in Australia or overseas, have too many undesirable vested interests in obstructing the transition to a sustainable

population, a steady-state, non-rapacious economy and use of renewable energy resources (Leggett, 2000; O'Connor & Lines, 2008; Pearse, 2007). Callaghan (personal communication, November 21, 2012), when discussing his work as head of one of the 17 different international research stations now in the Arctic, made it very clear that politicians' claims of not knowing enough relevant information is totally false. They have been made aware of the climatic crisis of many years and that the underlying international interest in the Arctic is all geopolitical, readying for resource raiding.

In 2008, Australian Prime Minister Rudd did carry out his election promise and signed Kyoto while his emissions trading plan angered both environmentalists and industry (Grattan & Colebatch, 2008). Be that as it may, at the end of the same year, Rudd ignored the science in his appointee Professor Ross Garnaut's report and announced in his White Paper only a target five per cent cut in emissions, \$500 million to renewable energy, \$4 billion to coal and the biggest polluters compensated (Grattan & Colebatch, 2008). Therefore, it is not the polluter who pays, but rather it is a situation of the taxpayer paying the polluter. In a commitment given by the Government, money raised by the carbon tax will be put to the advancement of cutting emissions and compensating those detrimentally affected (Pears, 2011). However, by June 2011 analysis by the Climate Institute found that protection of the heavy emitting, trade-exposed industries till 2030 would cost households \$2.7 billion ("Shielding big polluters", 2011). The intransigence of many politicians and economists held (and hold) back on the necessary change to renewable energies, sending us to an inevitable tipping point (O'Connor & Lines, 2008).

The Carbon Pollution Reduction Scheme (CPRS), the pricing of carbon emissions, or *the carbon tax* as it is at present known, was the centre-point of the Australian Government's policy on Climate Change. From early 2009 increasing criticism of Rudd's Carbon Emissions Reduction Scheme had been growing with Garnaut eventually calling for its scrapping and a fresh start being made ("Wong is wrong on ETS", 2009). In May 2009, Rudd reduced the initial price of carbon from \$40 per tonne to \$10 and delayed the commencement by 12 months (Kerr & Taylor, 2009). After a change of leader and prior to the 2010 election, Gillard though speaking of challenging Climate Change, stated she would not have a carbon tax, reiterating only nine days before going to the vote that the tax had been ruled out (Akerman, 2011, February 27). Three days later the Treasurer labelled the claim they were returning to the proposition

of a carbon tax as hysterical. Within a very short timeframe after a successful election (August, 2010), Gillard reversed a previous promise and proposed the prospect of a carbon tax, rather than an emissions trading scheme (Tillett, 2010). February 2011 saw the Labor Party introduce a carbon tax (Combet, 2011).

The Australian Government set an initial price of \$23 per tonne, starting on 1st July 2012 and increasing until 2015, when it is planned to shift to a trading scheme wherein the market will set the price. The cost of externalities and environmental damage is at last to be factored into the cost of a product. Deatherage (2011) considers emission trading to be a means of bridging the space between the economy and the environment; claiming, “ ... economics and economists could not put a value on ecosystems ... ecologists could not comprehend economics ... ” (p. 17).

After 2015, it is intended to phase out the tax with the introduction of an emission-trading scheme. Emission trading or cap and trading schemes allow a company to offset its pollution by purchasing ‘polluting permits’ that have been issued, many of which have been given free, to another firm that has not used them. However, by May 2012 Europe was suffering from a surplus of permits that was choking its emission-trading scheme (Coelho, 2012). Similarly, Carbon Offsets or Carbon Credits may be purchased, whereby a company pays another to take actions that will absorb or reduce emissions. The intended outcome would see the first company's carbon emissions indirectly being reduced. In a report for the Australian Industry Greenhouse research it was found that the price of Australia’s carbon may fall by 2020 to \$A4 after the domestic floor price is removed in 2018 (Maher, 2012a).

This low price does nothing to drive a shift from coal or encourage investment in renewable energy. As O’Brien, Meizlish and Hawn (2008) found in their analysis of the CPRS, a strong carbon price will be needed to produce incentive for investors to enter the bio-energy industry. Such schemes do not actually necessitate the consuming public to, in any way, change their practices. However, Stern considers Australia is leading by example in regard to the carbon tax, and that it is not ahead of the rest of the world as California, China, the EU and New Zealand all have some form of emission trading schemes (Maher, 2012b). Andrew Macintosh, Associate Director of the ANU Centre for Climate Law and Policy, and Hugh, Saddler and Sherry Consultants claimed that analysis shows within the next 20 years or so there will be little change in our electricity

or energy systems (Palmer, 2012a). Crabb (cited in Palmer, 2012b) stated the talk about the carbon tax is no longer about the climate, but about the cash. This is not to argue as to whether this method is considered to be the least costly and most effective way to contribute to lessening of Climate Change, is in fact so. Yet, to allow the forces of the capital market to have an additional area of influence on Sustainability for the future is not beneficial, as it could provide another opportunity to churn the ground and burn ancient fossil fuels. As Garnaut (2011) wrote:

... there will be no success in mitigation, at a national or international level, without good governance ... circumstances in which it is easy, indeed more natural, for interests to capture policy, and for the ultimate reasons for policy to be forgotten (pp. 74-75).

It was revealed in Sydney that a local company, regarded as being amongst the world's largest conductors of offset deals, was not genuine, but was shuffling certificates and not saving forests as part of the Reducing Emissions from Deforestation and Degradation (REDD) scheme (Cubby, 2011a). A further negative outcome is that in some areas the introduction of a REDD scheme has resulted in crucial resource access being denied to local communities. Some six months later a Government appointed advisor was warning of fraud (Wroe, 2011).

Countries of the developed world that report diminished or stabilised emissions may in fact not have achieved such, but can make that claim as a result of United Nations Framework Convention on Climate Change's (UNFCCC) accounting rules that allow countries to report territorial emissions. This actually means that production processes are allocated to the producing country, not the consuming country, so Australia that is manufacturing less and less, can therefore increase its carbon footprint without increasing reported emissions.

On June 20-22, 2012, world leaders gathered for what was known as Rio+20 for the continuation and hopefully strengthening of targets, particularly those of the United Nations Environment Programme (UNEP) that had been set at the now ended Kyoto Agreement. Formulated at the 1972 Stockholm Conference on the Human Environment it was envisaged to show leadership and facilitate global environmental policies for the benefit of future generations. Unfortunately, that has not been the case due, among other things, lack of funds, authority and political power.

Politics and power play were emphasised at Rio + 21. Dr J. Castro of Global Health Population and Environment Alliance wrote that, though the Vatican had only a permanent observer state at Rio, it opposed 80 amendments dealing with education, health and gender. A few developing states from the UN's Group of 77 then joined with the Holy See (Stewart, 2012). This was not dissimilar to the 1992 Earth Summit in Rio where the Vatican had had removed any reference to overpopulation and the Bush administration had vetoed any reference to overconsumption (R. Smith, 1993). As the UN works on consensus this resulted in anything connected to reproductive rights being erased from the draft document. At one of the side events at Rio was that of the Aspen Institute. It was here that Roger Martin, Chair of UK's Population Matters, called upon the Leaders Council to see that the UN silences the Holy See to its rightful status of observer and to cease participating as a full member (O'Sullivan, 2012). After examination of the UNEP, Ivanova, Assistant Professor of Global Governance at University of Massachusetts, found it impossible for one body to effectively resolve global environmental issues and contends that by not focusing on the symptoms, success may be achieved by tackling the source of the problem (Editor, 2012).

Vested Interests in Maintaining BAU

Politicians and big business have too many undesirable self-serving interests in obstructing the transition to a sustainable population, a steady state, non-rapacious economy and use of renewable energy resources (Flannery, 2010; Leggett, 2000; O'Connor & Lines, 2008; Parenti, 2011; Pearse, 2007). For ten years Leggett (2000) battled the system and tried to pressure government bodies and authorities to turn to energy production from renewable energy resources, particularly solar. These sustainable technologies would prevent the waste of millions of dollars of taxpayer's money on such things as carbon capture, and storage or carbon sequestration. Australian politicians are reluctant to admit there is no certainty that carbon sequestration will even work (Jackson, 2008). In October 2008, one of the world's leading authorities on clean coal warned Prime Minister Rudd, who had backed clean coal (C. Johnson, 2007), that his Global Carbon Capture and Storage Institute's \$315 million investment up until 2017 was a mistake (Atkin, 2012). At point of writing, \$37 million has been spent and without any positive outcomes. In addition, three American co-research projects have been scrapped or deferred, after the work was regarded as irrelevant. The former Premier of Queensland, Bligh, promised to give the clean coal company, ZeroGen, to the coal industry so the taxpayers' near \$160 million, the Commonwealth's \$43 million

and the coal industry's approximate \$50 million would not be totally wasted. In October 2011, the company went into liquidation (Lion, 2011). However China, that on average fires up a new coal fired power station each week, has started up GreenGen, a new low-carbon coal gasification power plant to test commercial potential of the technology ("China leads" 2012).

Sceptics, Commercial Media and Anti-Scientific Rhetoric

Shared agreement on what constitutes and is required to achieve Sustainability is both complex, contested and faces aggressive opposition from vested interests and some commentators. Lewandowsky (2011) claimed that though recent economic climate conditions may have caused people to become worry weary, "public doubts about climate science have demonstrably been fostered by vested interests and political groups" (p. 3).

The Fairness Doctrine was developed in the USA during the mid-twentieth century under which broadcasting licensees were compelled to give controversial topics balanced coverage (Gill, 2012). Though there does not appear to be an equivalent rule for broadcasting in Australia, 4.3.1 of the Commercial Television Industry Code of Practice states licensees, "... must ... represent viewpoints fairly ..." (Commercial Television Industry Code of Practice, 2004, p. 32) while the updated 2010 edition has an added 4.3.1.1 "... an assessment of whether the factual material is accurate is to be determined in the context of the segment in its entirety ..." (Commercial Television Industry Code of Practice, 2010, p. 21). Similarly radio is required under 2.2(a) to present material that is supportably accurate with 2.2(b) stating that "... errors of fact are corrected at the earliest possible opportunity" (Commercial Radio Codes of Practise & Guide Lines, 2011, p.7) In the case of interest groups with wealth, the adherence, or lack of, to this additional clause offers an opinion based on equal time and balance. This could be seen as a flawed practice: for example, Radio 2GB's Alan Jones (Edis, 2012). Jones' anti-Sustainability and anti-Climate Change rhetoric is hence assumed by the consumer to be equal to peer reviewed science, even though it is not testable scientific evidence. Therefore, in the case of extreme commercial rhetoric, the listeners receive a negative narrative towards Climate Change theory, which usually drowns the evidence-based narrative.

One of the most targeted scientists by Climate Change sceptics is the Director of the Earth System Science Centre, at Pennsylvania State University climatologist Michael Mann. Contemporary science only had access to approximately 100-150 years of temperature measurements using thermometers (Bruce, 2012). In order to investigate climate beyond the 150-year range, Mann and his colleagues measured atmospheric chemistry from ice and coral cores, as well as the growth rings of trees. This collection of indirect scientific evidence allowed Mann to interpret the world's climatic conditions over 1,000-year period. Anti-Climate Change campaigners seized upon Mann's methods as being fraudulent, when Gore cited Mann's research in his *An Inconvenient Truth* (David, Burns, Bender, & Guggenheim 2006). Since then other researchers using different data and methods have not only drawn the same conclusions but have extended the timeline. The only way the scientist can explain the recent warming conditions is to factor in the human effect (Bruce, 2012).

McCright and Dunlap (2011) found that amongst conservative white males (CWM) in the USA, denial of Climate Change was significantly higher than that within the general population. This demographic became associated with the CWM Effect. Readfearn (2011a) identified an Australian CWM group including: Andrew Bolt, Alan Jones, Cardinal Pell, as well as Christopher Monckton (UK), "the 'high priest' of climate scepticism" (C. Hamilton, 2010, para. 2). This coalition of 'organised climate denial' is now in Australia. Ashley, Professor of Astrophysics at University of NSW, claimed that the solid science behind anthropogenic Climate Change is real and that the chance to alleviate what it entails has been set back several decades by the Murdoch press ("Murdoch medias battle", 2011). Therefore, tertiary students, in the construction of their perception of Sustainability, are confronted by what appears to be an array of information, yet from a narrow negatively biased perspective (see Appendix C). This section acknowledges a number of these outspoken opponents, as it is important to reflect upon those who underscore the conceptual framework for interpreting Sustainability.

Adjunct Professor at the Copenhagen Business School and acknowledged Climate Change sceptic Björn Lomborg held attitudes to climatic and resource conditions that had elevated him to a spokesperson position for Climate Change deniers. Describing it as *no problems* could largely sum up his philosophy and *technology will fix it*. Lomborg's *The Skepticle Environmentalist* (2001) was later dismissed by a panel of

Scandinavian scientists as not a work of science (Revkin, 2003). Lomborg claimed "... the Green Revolution has been victorious ..." (p. 67) accrediting it with the negation of the prophecies of L.R. Brown, Ehrlich, Hardin and others. Many negative consequences of the Green Revolution, as discussed by Mies and Shiva (1993), are now only starting to be recognised. Lomborg (2001) calculated how much the world's worth would be, should we concentrate on economic development and how much we stood to lose were we to concentrate on environmental issues. He contended we are sufficiently well resourced to be able to do both. Singer (2002) cited an article of Lomborg's in the *Economist* stating that the cost of seriously reducing carbon emissions would be far greater than the cost of adapting to the higher temperatures. Yet as late as 2006 Lomborg wrote, in *Fragile Earth* (2006c), "... the jury was still out ..." (p. 248) in regard to Climate Change.

In 2010, Oreskes and Conway published *Merchants of doubt: how a handful of scientist obscured the truth on issues from tobacco smoke to global warming*. These researchers questioned claims in their attempt to find the truth on global warming. They documented in great detail the intricate patterns of wilful deception carried out by a small number of corporate financed scientists who had moved from the pro-tobacco industry's spin to that of the fossil fuels' anti-anthropogenic induced Climate Change deception.

In *The Lomborg deception: setting the record straight about global warming*, Friel (2010) systematically deconstructed Lomborg's statements and claims, by returning to original sources of information. It was reported in September 2011, that the incoming Danish government was no longer prepared to fund Lomborg's Copenhagen Consensus Centre (Lewis, 2011). However, this did not deter his ability to (two months later) publish a scathing article in *The Australian*, one of this nation's leading papers (Lomborg, 2011b). In the article, he did concede there was a definite correlation between growth rates and CO₂ emissions. Lomborg is shifting his stance on Climate Change with it being reported in a November ABC AM interview that he considers Climate Change "... is real, man-made and a major problem the world needs to confront ..." (Eastly, 2011).

Frequently published geologist Professor Ian Plimer, and Lomborg claimed there was not a concern over rising sea levels and melting icecaps and the more extreme weather

and financial damage from hurricanes, came from increasing numbers of large cities in prone areas. Plimer (2009) contended not only the world climate has always been in a state of change, but also any temperature increase was due to solar irradiation and not anthropogenic causes. Many conservative politicians reinforce the denial position. Former Prime Minister Howard, during his speech launching Plimer's latest book *How to get expelled from school: A guide to Climate Change for pupils, parents and punters* (2011), alienated himself with Plimer's distaste for the "environmental propaganda" (para. 2) being taught on Climate Change stating that "the progressive left has got their grip on the commanding heights of education instruction in this country" (Readfearn, 2011c, para. 15). Science reporter Peddie (2011) stated that University of Adelaide's climate scientist Professor Bruce Brook claimed that Professor Plimer was perpetuating contradictions, inaccuracies and misrepresentations of the science. Ian Lowe (2011), Emeritus Professor, School of Science at Griffith University, stated that the Institute of Public Affairs (IPA) business funded propaganda unit that pushes an extreme free-market ideology and unrestrained capitalism, promoted the book. The Science Teachers' Association had taken exception to the book. Lowe claimed both the Institute and author are working in conjunction to spread misinformation regarding Climate Change. According to Quinn (2012), the IPA reinforced this practise of sending books to schools. This time it was Jeff Bennett's book *Little Green Lies: An expose of twelve environmental myths* (2012) in which the author cited Plimer, Monckton and the Heartland Institute's conferences to back up his claim that the science was not settled in regard to Climate Change.

Accompanied by Plimer, Lord Monckton, on an anti-Climate Change speaking tour of Australia, was purported to be a mathematician, though his degree is in the Classics, also contended any increase in temperature was due to the sun, (J. Cook, 2010, Abraham, 2011). This claim was previously negated by Professor Stephen Schneider, Biological Sciences, Stanford (Williams, 2008) who stated while the surface of the Earth has warmed, the stratosphere has actually cooled, which would not have been possible if there had been increased heat from the Sun. Garnaut (2011) also noted that with both modelling and actual observations the stratosphere is cooling while simultaneously the troposphere, the atmospheric layer adjacent to the Earth is warming. Monckton called for Gore and other environmental extremists to be incarcerated for crimes against humanity and described the diversion of food crops to biofuel as

genocide (Wallace, 2010). This goes unchallenged, as does his claims to being a member of the House of Lords and a Noble laureate (C. Hamilton, 2010).

Monckton's 2011 tour of Australia was blighted before it even started, when in America, standing alongside a large display of a swastika under Ross Garnaut's name, he called him a fascist (Readfearn, 2012). This was followed by the release of the 'under cover' video of Monckton in the Mannukal Economic Education Foundation's boardroom, WA mining magnate Ron Manner's free-market think tank. Here was Monckton stating a good method of getting free-market, climate science-denying ideology out to the public. The media merely had to find some 'super- rich' backers to buy the mainstream media. Shortly after, Gina Rinehart, a Monckton backer bought a sizeable share in one of Australia's largest media outlets (Readfearn, 2012)

Lewandowsky, Ecker, Seifert, Schwarz and E. R. Cook (2012) stated that strong support for an idea rarely arose from ignorance, but was the result of a firmly held belief, albeit false. Those who most vehemently denied Climate Change science were found to be those who considered they were the best informed on the topic. The authors explored dissemination of misinformation in four categories. Firstly, rumours passed on by people to others where an emotional response stimulated further dissemination, irrespective of any validity of that information and fiction, giving as an example Crichton's *State of Fear* that was submitted to a US Senate committee as scientific work. Secondly, politicians and governments, wilfully or otherwise, pass on inaccurate information. In addition, the next wave of misinformation came from vested interests, including corporate and NGO groups. Bedford (2010) has coined the term *agnogenesis* to describe this practice of misinformation. Finally, it was the media's function to disseminate a diverse range of misinformation regarding Climate Change. The most recent shift in the discourse can be found in the plethora of new social networks. The new media has added to what the writers referred to as "... the fractionation of the information landscape ... an important contributor to misinformation's particular resilience to correction ..." (Lewandowsky et al, 2012).

The literature raises the question of who funds anti-Climate Change advocates and campaigns. Expositions by Independent Australia's environmental editor revealed astroturfing, propaganda and "... socially engineered forms of brain washing ... (S. Keane 2012, para. 1) by PR firms to achieve sacrifices from the general public in the

interests of their clients, mostly the fossil fuel industry. Bill McKibben of *TomDispatch* wrote that due to their large fossil fuel reserves these companies battle against Climate Change action and sponsor global warming denial with, for example, erroneous information appearing in *The Wall Street Journal* (McKibben, 2012). At the beginning of 2012, a whistle blower leaked names of sponsors of The Heartland Institute, an American think tank that campaigns on the benefits and safety of fracking for coal seam gas and spreads doubt about Climate Change science including undermining science lessons for school children. This has triggered financial scrutiny of its tax status and donors (Goldenberg, 2012), as well as the admission by Professor Bob Carter of James Cook University, an outspoken critic of Climate Change science, that he has received monthly payments from Heartland (Cubby, 2012a). Similarly another charitable body, UK's Global Warming Policy Foundation that funds Climate Change sceptics, is being investigated. This is chaired by Lord Lawson who, when in Australia participating in *The Spectator's* 2011 Climate Change debate, criticised British Prime Minister Cameron's support of Gillard's actions regarding Climate Change. He stated there was also in the UK a completely erroneous plan to handle Climate Change (Lloyd, 2011).

Cardinal Pell's address at the London Climate Change denial think tank received extensive criticism from research scientists. Descriptions ranged from dreadful, utter rubbish, flawed (Readfearn, 2011b) and "... embarrassing ..." (Stephens, 2011, para. 9). This performance followed several weeks after Professors Muller and Curry (two leading sceptics) recanted their previous position of denial and were in agreement with NASA and the Hadley Centre work on land temperature records of the last 60 years that showed a significant rise of one degree Celsius (Stephens, 2011).

Philippe Legrain is a strong advocate of immigration for Australia. The words ecology, Climate Change, environment, externalities or Sustainability, would not be found in his writings (2006) or public speaking tour in 2007. Missing also was any reference to the Australian Bureau of Statistics, which was a pity as it may have prevented him for making gross errors in regards to growth through both immigration and births. This well published economist casually claimed that rises and falls in unemployment had nothing to do with migrants but were due to "... the economic cycle of boom and bust ..."

(Legrain, 2006, p. 66).

Ethical and Political Engagement

If Australia were to move towards a pro-Sustainability position, it would have to confront the dominant business practices (Flannery, 2010; Lowe 2012). In particular, Australia would have to reduce its lucrative carbon exports. Even more confronting would be the consideration of a stable population policy: for example, crossing over into sensitive policy settings associated with immigration (“Let’s talk,” 2010, “Kevin Rudd’s”, 2010). It is assumed that environmentalists would support the above policy shifts as being pro-biodiversity. However, the new policy settings would also have political and national security implications at the global level, contrary established socio-economic and polity established by Bretton Woods (1944). In this scenario, questions of social Sustainability interconnected with political realities have to be balanced in respect to the tripartite Sustainability equation (Brundtland, 1987 cited in UNTAD, 2012).

The influence of big corporations and national security are consistently brought into focus: for example, in September 2009, when the US Senate declined to pass its climate laws prior to the Climate Change Conference in Copenhagen. According to Flannery (2010) business wanted an operational deal reached at Copenhagen. Without global cooperation, the impact of Australia opting out any global carbon reduction solution would provide only minimal impact. Australia’s coal and gas would be sourced elsewhere (“Coal Trends,” 2012). Major political conflict could see powerful states taking control, and denying a nation’s sovereignty (Parenti, 2011): for a hypothetical example, small or even middle states such as Australia if resources were need to support the interests of super states. In cognisance of this hypothetical scenario, Australia continues to play a role within United Nation’s forums, regional summits.

Within the broader issue of this research proposal, Australia is seen as a stakeholder within globalisation. Scientific and political/economic theories and research will be sighted to support assertions of Sustainability as predictions, or warning of a pending ecological, social and economic crisis as reported by Stern (2006). The discourse presented is inclusive of an intersubjectivity of values on a backdrop of scientific predictions and popular perceptions, some of which are often generated by the popular media. In addition, the notion of sustainable development is often viewed as an oxymoron because the common discourse underscores development as a process of depleting and degrading the natural environment.

This theme of development continually surfaces within the proposal, specifically to Australia's low population (circa 22 million) and its economic links to countries such as China and India (> 2.6 billion combined). Australia is a wealthy per capita nation due to its huge carbon exports of coal and natural gas to China and iron ore. However, Australia's large land mass is extremely vulnerable and has a limited capacity to support populations of countries with a similar area such as China, Brazil, USA and the European Union. In addition, Australia faces a moral dilemma because the material privileges enjoyed by its relatively smaller population are directly linked to its exports to countries with huge populations all contributing to anthropogenic carbonisation and Climate Change by the burning of Australian coal and gas.

Unsustainable Use of Resources

As nothing can live without water, the depletion of suitable water is of the greatest resource calamity. Parenti, (2011) states that water shortages should not be viewed just from an agricultural perspective, but from a national security perspective as a trigger for conflict. This risk, precipitated by either or a combination of overpopulation and climate warming (Solomon, Hsiang, Meng, & Cane, 2011), could be at a tribal level or between large nations (Parenti, 2011). He claimed that water security is a dominant factor in the ongoing tension between India and Pakistan, whether it is over control of glacial areas or the damming, and possible diverting, of rivers. In addition to rising population numbers drawing on underground water levels, there is a decrease in agricultural production and natural vegetation cover, all contributing factors to Climate Change. L. R. Brown (2011) underscored the crisis of the Yemen aquifers being pumped out at a faster rate than that of recharge. He describes it as an already failing state, a hydrological basket case with one of the world's fastest growing populations. Heinberg (2011) reinforced the economic impacts that water shortages could have on industry, agriculture and energy production. He noted research has estimated that between 1960 and 2000 worldwide groundwater depletion had risen from approximately 123 cubic kilometres to 229 cubic kilometres. Pearce (2012c), discloses the futility of a Saudi prince's 30,000 housed (in sheds) Holstein cows being kept cool with misted water and feed from 3000 hectares of irrigated crops, as "... the madness of farming in the desert ..." (p. 38).

Summary of Part Three and Links to Research Questions

Under Australia's present political system, globalised corporations carry the established momentum of business as usual (Pearse, 2007; O'Connor & Lines, 2008). From a scientific view the economic costs of mitigation or adaptation to ongoing Climate Change is traded off for political priorities and power (R. J. T. Klein, Huq, Downing, Richels, Robinson & Toth, 2007). This process of trading the science for political gain is best demonstrated with the introduction of the Carbon Tax by Gillard after her 2010 election, as well as the subsequent change of policy with the fast tracking of an emission trading scheme with the return of Rudd as Prime Minister in June 2013 (Combet, 2011; Tillett, 2010). Behind a political manoeuvring centred on securing power, long term sustainable economic, social and biophysical Sustainability are being marginalised. The factors of Climate Change and the explained tipping points (Foley, 2005; Garnaut, 2008; Gilding, 2011; Lovelock, 2006; Lynas, 2007; Pittock 2009; Spratt & Sutton, 2009) are continually increasing and therefore, it is mere speculation as to what catastrophic situation has to arise to precipitate the necessary radical change needed for a sustainable future. It is also unlikely for a bottom-up movement to succeed in this scenario, as there are so many interlocking factors that the archetypal environmental warrior groups can neither be across, nor have the financial clout required to counteract the transnationals.

The four interrelated factors were investigated with an emphasis on sources of information on Sustainability, and an awareness of economic and political issues linked to Sustainability. The media coverage leading up to the study was a major consideration in the design of the questioning process. The context of the post Global Financial Crisis was a major backdrop to the study. This crisis was linked into much of the rhetoric of the Australian political discourse at the time and therefore, this awareness shaped the interview questions. The following open questions apply:

- *Who and/or what influence GDE-P students' perceptions of Sustainability?*
- *What are GDE-P students' perceptions of economic and political factors regarding Sustainability?*

Part Four: Attitudes towards Sustainability Population Policy

The fourth component of the literature review explores the issue of population as a prime factor of Sustainability. The balance between population size, earlier attitudes to and policies of continual population growth are discussed including notion of a sustainable population is reviewed from the Australian post-World War II perspective. Part four explores the collapse of developing nations linked to unsustainable populations, as well as the moral issue associated with the exploitation of these nations intellectual capital by developed nations.

Population as a Socio-Political Problem

Knowledge of, as well as the practical need to action behaviours to balance the size of a human population to the carrying capacity of the biophysical environment has been part of many cultures for thousands of years. Today, population has to be considered a major global risk management consideration (Diamond, 2005; Lovelock, 2006; Meadows, D. H., Meadows, D. L. & Randers, 1992; Stern, 2006).

deMenocal and Cook (2005) emphasise the potential for global societies to collapse still exists, noting:

Disquieting parallels are evident between ... cultural collapses and the state of global societies today, and this is perhaps the most compelling ... Most people ... view that population growth coupled with increasing resource use eventually leads to loss of environmental quality as the carrying capacity of the land is diminished. There is no shortage of examples in the modern world in which geopolitical tensions and population growth have led to widespread human suffering through restrictions on the availability of food and water (Rwanda, Darfur, the Middle East). These socially destabilizing factors are those that cultures can hope to have some measure of control over. Societies can and do adopt better and more sustainable practices given sufficient incentive to do so. This Malthusian thread runs through nearly every example of ancient cultural collapse ... (p. 1).

There are many sociocultural positions held when investigating the history of population policies and attitudes, some sensitive to biophysical Sustainability and others threatening the planet. Again the complexity and intersubjectivity of Sustainability is underscored, in the anticipation for Earth to carry 10-11 billion of humans by the end of the twenty-first century (United Nations, 2011). In Diamond's (2005) *Collapse*, he

discusses the causes that lead to the disintegration of many ancient cultures. According to deMenocal and Cook (2005) this ‘collapse’ can be traced to:

[Two] fundamental vulnerabilities of urban societies. Internal sociopolitical factors affect the way societies use, regulate, and protect resources such as water or land, whereas external climatic variability introduces uncertainty and vulnerability that can limit the availability of those resources (p. 1).

Throughout history, a civilisation’s population size and cultural values have determined its success, longevity, and/or failure (A. D. Brown, 2003; Diamond, 2005; Malthus, 1973; Meadows, D. H., Meadows, D. L. & Randers, 1992; Ponting, 1992). The logical extension of overpopulation of any species in a closed system is not sustainable and historically this is resolved by the species’ collapse. Many researchers (Diamond, 2005; Lovelock, 2006; N. Stern, 2006) see population linked to consumption as the critical factor in a finite ecosphere. Like any construct of a plague as imbalance, population is the biggest multiplier effect, especially human generated carbon emissions associated with increasing energy demand (Sustainable Population Australia (SPA), UNFCCC Party Submission, (2009).

For a considerable span of time the Earth could cope with the increasing numbers of humans, but now humanity has reached a stage where, due to the excessive growth within a world of finite resources, the situation becomes extremely problematic as such conditions give rise to: more people; more food/resources required; more Climate Change and more people required to produce food/resources. Lindermayer (2007) explained this in 1961, when humanity was consuming at the rate 0.5 Earths to sustain itself, by 1981 the consumption was one Earth, and the equation had blown out to 1.5 Earths by 2001.

The above consumption linked increasing populations trends underscore the likely outcome of what is known as a positive feedback loop. A. D. Brown (2003) explains, “... a system in a positive feedback will destroy itself...” (p. 27), or as Lovelock (2006) states “... deviations of the climate are amplified not suppressed, so that greater heat leads to greater heat ...” (p. 164). If one of the previous conditions is not curtailed, the system will keep on feeding back into it and once established, there is little prospect of escape from a *runaway positive feed back loop*. The international scientific community is unequivocal in emphasising the unsustainable anthropogenic carbonisation of the

planet's atmosphere due to rapid population and this is threatening biodiversity and global civilisation (Lovelock, 2006; Stern, 2006).

After the Second World War, the Green (agricultural) Revolution saw a transformation of agriculture that utilised the science of new crops, mechanisation and artificial fertilisers. For several decades this largely negated or perhaps delayed the doomsday prophecies of L. R. Brown (2006), Ehrlich (1978, 1986), Hardin (1973, 1993, 1998) and others. However, Lovelock (2006) says it is a matter of time before the limits are found: “... in the end ... Gaia will do the culling ...” (p. 141).

Population a Historical Perspective

From the time upper Palaeolithic humanity ceased to lead an existence as a hunter-gatherer and moved into the Neolithic period of agriculture, some aspects for an increasing population were regarded as desirable (Galton, 2001); the main reasons being: more labour to help produce surplus crops, fishing, and the domestication of animals. The concerns of both sustainable population and city size also occupied Plato (428/427 BC – 348/347 BC) and Aristotle (384 BC – 322 BC). However, Caesar Augustus (63 BC – AD 14) considered it necessary to adopt pro-natal legislation to counter the population decline following the Punic Wars, a series of three wars fought between Rome and Carthage from 264 to 146 BC (Kile, 1995).

In non-agricultural societies early hunter-gatherers, for example the Inuits (until the 1930s), attempted to control their numbers largely by infanticide and abandonment of ill or old members (Ponting, 1992). Diamond (2005) and Douglas (1982), also describe the culling of populations associated with Kenyan camel herders' methods and document practices used by island communities of the Pacific area, for whom the opportunity to expand to new areas or for a satisfactory percentage to migrate to other countries, was not an option to maintain their stable populations. Abernethy (2005) cites Wynne-Edwards's observation “... numbers grow to the point of filling a habitat with respect to its food supplies ...” (p. 17). However, this is not the case in today's global market because as long as a nation can afford it, it is possible to import food supplies from elsewhere; but as the planet's population grows past its seven billion, Sustainability is pushed even further and the potential for over access to a range of limited resources increases (Cribb, 2010; R. King, 2011; O'Connor, 1988; J.W. Smith, 1991).

In Western Australia, Professor James Martin (a computer scientist, a Pulitzer prize nominee, and British Information Technology consultant) at a public meeting claimed that no country with a large expanding birth rate has ever pulled itself out of poverty (Perth, December 2, 2008). He explained that the genocide in Rwanda was as much about overpopulation and lack of land for young males. Similarly Parenti (2011) writes, "... poverty fuels the sense of grievance ... destitute farm hands – unable to afford a bride price ... or even find work ... drift into the ranks of the Taliban ..." (p. 107). The prediction is with Climate Change the situation will only be exacerbated by more frequent droughts and floods.

Other hypothetical population control measures have been considered: for example, obstetrician Walters proposed, in a letter to the *Medical Journal of Australia*, a "... baby levy ... [or a] carbon tax for larger families ..." (Walters, 2007, p. 668). His argument was that each baby born represents approximately 80 years of carbon emissions so for those families having more than a recommended number of two, a \$5000 levy and annual fee of between \$400-\$800 should be charged for land acquisition, tree planting and maintenance. This would follow the polluter-pays principle, but instead new mothers are showered "... with financial booty ..." (Walters, 2007, p. 668). Walters cites Attenborough's statement of: "Instead of controlling the environment for the benefit of the population, we should control the population to ensure the survival of the environment" (2007, p. 668). Sample (2008) reported on the British Medical Journal's editorial of doctors, for the sake of the planet, advising parents to limit families to two children.

In contrast to Walters' proposal, the Howard Government introduced a baby bonus for every woman who had a baby after July 1, 2004. Each would receive \$3, 000 (R. Buchanan, 2004) because the government wanted to stimulate Australia's population growth with an incentive.

From Genesis 1.28 to the Radical Reductionism of Nature

Even in an increasingly secular age, it is important to trace the values and attitudes implicit in contemporary Australia's philosophical position of population derived from religious beliefs associated with birth control and perceptions of family and community. Australia has traditionally placed the masculine hegemony firmly at centre of its culture and by extension, the Earth, as a feminine symbol as nature, is also dominated (Hallen,

2001). The dominance of the feminine is linked to two thousand years of Judeo-Christian values promoted in Western institutions (Hallen, 2001).

When the Bible exhorted one to "... subdue it..." (Genesis 1.28, p.8) it became tragic for the biosphere that the next phrase *and replenish the country* was not the one that was followed. With the further pronouncement that *every moving thing that liveth shall be meat for you; even as the green herb have I given you all things* (Genesis 9.3, p. 13) it is of little wonder that *God fearing people* (usually men) took this as a licence to plunder the Earth's resources.

The early Greek mythology proposes that the Earth is a 'living entity', Gaia (Lummis, 2001). The hypothesis of Gaia was written by Francis Bacon some five centuries ago in his attempt to explain the Greeks' understanding of the Earth, but this concept was met with strong objection from the Christian Church that saw Gaia as a pagan god (Flannery, 2010). Lovelock (2006) and others applied this concept, whether they are dealing with changes in human values (Meadows, Meadows, Randers & Behrens III, 1972), overpopulation and resource use (Ophlus, 1973; J. W. Smith, 1991); population growth (Weeks, 1989); Climate Change (Lynas, 2007); or "... the world's common resources like the oceans and the atmosphere ..." (O'Connor & Lines, 2008, p. 71).

Throughout the Renaissance a paternal and anthropocentric concept of the world held sway and continued on into the Enlightenment (Hale, 1977). However, the Church's teachings and authority were being challenged by the *new arts* or sciences: for example Galileo and Copernicus. The enormity of a theory that saw the Earth rotating around the Sun rendering *humanity* peripheral in the scheme of things caused Copernicus (Hale, 1977) to be subjected to extreme pressure by the church. The emergence of early science would provide the start of a radical reductionism with both benefits, as well as negatives with the objectification of nature. Newton and in particular Descartes, in the seventeenth century claimed mathematics was the only way to express ideas of a scientific nature and all could be rationally examined and explained (Hale, 1977; Nicolson, 1960).

Throughout the eighteenth century a ruling class of intellectuals and colonialist emerged increasingly behaving like predictors and controllers of the world's future (Nicolson, 1960). From this political intersubjectivity emerged a separatist ideology that split the

biosphere from narrow human intellectual pursuits and evolved into the forerunner of today's philosophy of *technology will fix it* (Lomborg, 2001, 2006b): for example, today many countries such as France, Russia, UK, USA, India, China and others use nuclear power to supplement fossil fuel usage. However, as demonstrated in Japan March 11 2011, there are inherent risks of failure (Inajima & Song, 2012).

The reaction to the Enlightenment's over analysis of the world to reduce nature to virtual meaninglessness, radical reductionism was redressed during the Romantic period with a new redemptive value of wilderness (Blanning, 1996; Carolan, 2006). By this stage the resultant European political power and wealth structures had become an integral matrix of Western Culture. These eras of Western culture's development saw rapid colonisation and from an environmental-cultural perspective, the world became consumed. However, Petty and Malthus would see the expansionary endeavours as mathematically unsustainable (Kile, 1995).

Petty and Malthus

Other intellectuals during the late seventeenth century anticipated the *un-Sustainability* of Western expansionism. A writer of population, Sir William Petty, despite believing economic benefits would be derived through population growth by means of greater labour productivity, questioned the Sustainability of expanding populations. Petty claimed that because population grew at a geometric rate it would "... increase to give one Head for every two Acres of Land ... there must be Wars and great Slaughter" (cited in Kile, 1995 p. 29).

Since Petty, some have cautioned against the alleged wisdom of perpetual population growth, with the name of one such writer, Malthus (1766–1834), evolving into an adjective, *Malthusian* to describe this school of thought. His philosophy recognises the real condition underscoring non-Sustainability linked to an ever-expanding population. Malthus was the first to link the causes and results of population growth (Weeks, 1989) proposing that there was a geometric progression in population growth, while the production of food was only extended by an arithmetic progression, thereby leading to catastrophe (Wattenberg, 2004).

This issue of *un-Sustainability* is even more alarming when rates of consumptions of finite resources are added to the equation, especially in the second half of the twentieth

century (Weeks, 1989). Population until the end of the eighteenth century, had largely been limited by what Malthus called "... preventive and positive checks ..." (1973, p. 15) such as malnutrition leading to starvation, disease, epidemics and war.

The Sierra Club and the Club of Rome

The Sierra Club was possibly the first formal body to be concerned with the Earth's ecosystems and population. By the 1980s the Sierra Club entered into debate on population stabilisation, arguing that much environmental damage was the result of overpopulation. It lobbied to cut America's immigration, forming in 1988 the Population Committee and Conservation Coordinating Committee. Recently, the Sierra Club has now completely moved away from the topic of population growth in America (Watson, 2004). Dr Coulter, Vice President of SPA, claims there are powerful forces within both America and Australia that ensue the topic of population limits/reduction does not gain credence (personal communication June 8, 2009).

In 1968, the Club of Rome, founded mainly by the work of Aurelio Peccei (Moll, 1991) as a think tank, brought together an international collection of people from varying backgrounds of science, academia, policy making and society. The early 1970s saw the Club commission *Limits to growth: A report for the Club of Rome's project on the predicament of mankind* (Meadows, Meadows, Randers & Behrens III, 1972) that proved to be highly contentious due to its criticism of population growth. Weeks (1989) considered the book is the "... most elaborate and well-known empirical investigation of an optimum population size for the world ..." (p. 377).

In 1968, Ehrlich's book *The Population Bomb* argued for a limit to human population in view of future inadequate food supplies. It is not a confidence-building picture of the future, bearing in mind that this was written when Climate Change was barely recognised. Ehrlich (1978), in an attempt to quantify this claim, proposed the formula of $I = P \times A \times T$ with I representing environmental impact, P population size, A affluence and T technology.

The various stresses and ills that overpopulation causes is a continuing theme with many authors and researchers predicting a return of Malthus's positive checks. Ehrlich's previously mentioned formula is criticised by Bandarage (1997) because it doesn't indicate who or what is responsible for the damage. As the conditions mount, political

tensions between groups and or nations increase and can lead to one version of what Ehrlich calls the death rate solutions (1968, p. 45). However, Bandarage (1997) claims Ehrlich has a primordial *fear of the other* and it is this overwhelming fear and self interest that are “the guiding forces of Malthusianism” (p. 51).

The Correlation Between Poverty and a Large Population

Diamond (2005), Greenhalgh (2008), Hardin (1998), Malthus (1973), Martin (2006), Ophuls (1973) and Weeks (1998) all note the correlation between poverty and large population.

In examining the association between population and food, Weeks (1998) contends the recently developed high yield varieties of wheat and rice, which were major components of the Green Revolution in the mid-twentieth century, when introduced into such countries as India, Pakistan and Mexico doubled, almost tripled the yield in some areas. However, despite these advances, today India has now become an importer of wheat (Weeks, 1998). According to Martin (2006), between 1960 and 1995, India managed to increase its average food per person by 17 per cent, but the population in that time grew by half a billion, not only putting an enormous strain on the economy, but the water table dropped resulting in future major water shortages crises. The demand for more water necessitated the need to dig or drill to greater depths, and in some areas serious subsidence of the land is being experienced.

As past populations numerically increased they have basically either physically expanded into new territory, or imported the necessary foodstuffs from conquered, colonised lands or collapsed (Diamond, 2005). However, growth was always accompanied with the threat of starvation should there be crop failures over consecutive years, and according to R. Wright (2004) much of the world still has this concern. Over population, increased energy consumption results in unsustainable anthropogenic carbonisation of the planet’s atmosphere, threatening biodiversity and global civilisation (L. A. Brown, 2006, 2011; Cribb, 2010; Kellman, 1987; Lovelock, 2006; Stern, 2006).

Chinese and Indian Trade with Australia

In Chapter One the researcher described the significance of China, and the potential of India, to Australia’s economic prosperity as massive urban and industrial infrastructure

projects result in the purchase of hundreds of billions of dollars worth of Australian commodities.

During the late twentieth century, China's ruling powers' desire for modernisation, the alleviation of poverty, as well as the restoration of the country's standing on the international stage was to be achieved by instigating a *one child policy* (Greenhalgh, 2008) that over a period of 30-years, reportedly, prevented a population increase of 400 million. Ironically, China's pursuit of its one child policy was established to counter the earlier push for population growth for national security as decreed by Mao (Greenhalgh, 2008).

As Rosenberg (2008) emphasises, Indian and Chinese population trends are serious concerns for food security, as well as commodity and energy consumption:

As recently as 1950, China's population was ... 563 million. ... [and reached] one billion in the early 1980s.

China's total fertility rate is 1.7, which means that, on average, each woman gives birth to 1.7 children throughout her life. The necessary total fertility rate for a stable population is 2.1; nonetheless, China's population is expected to grow over the next few decades. This can be attributed to immigration and a decrease in infant mortality and a decrease in death rate as national health improves.

By the late 2010s, China's population is expected to reach 1.4 billion. Around 2030, China's population is anticipated to peak and then slowly start dropping.

In ... India, the world's second most populous country is expected to surpass China in population. By 2040, India's population is expected to be 1.52 billion; that same year, China's will be 1.45 billion and India will become the world's most populous country. As of 2005, India has a total fertility rate of 2.8, well above replacement value, so it is growing much more quickly than China [together this population is circa 3 billion people] (Rosenberg, 2008, para. 4-7)).

However, in terms of Sustainability (Lovelock, 2006; Stern, 2006) the comprehension of this so-called benefit to Australia is far more complex and far-reaching on a global scale: for example, selling iron ore, coal and gas to China and India. Trade may accommodate massive short term profits for Australia, but the extreme flooding, decreasing rainfall and more intense bush fires linked to global Climate Change come at a real cost.

Australia: Populate or Perish

Competition for resources and agricultural land over history has led to a countless number of wars between tribes, city-states, as well as coalitions of industrialised nations during the twentieth century. The potential for conflict is enhanced when starvation and hardship are amplified. However, today many industrialised nations have weapons of mass destruction, as well as biological weapons (Diamond, 2005; Lovelock, 2006; Stern, 2006).

Flannery (1994) explains that today, large human populations are not a requirement for military protection, as large armies are now redundant with modern warfare offering "... the ability of the state-of-the-art technology to neutralise a vast superiority in numbers ..." (p. 370). This was observed during the atomic attack on Japan, the first Gulf War, as well as in the Balkans campaign of the 1990s. Yet, contrary to Flannery (1994), the Australian political psychology is still holding fast to the large population thesis for war-based security.

The Australian political theme of *populate or perish* was born in early 1942, when Australia realised an inability to defend itself against the Japanese, during the Labor Governments of both Curtin and Chifley. In 2004, the Howard government introduced the baby bonus and more recently Rudd ("Rudd welcomes," n.d.) re-introduced the *Big Australia*, prior to the commencement of this study.

The issue of population in Australia is still politically and psychologically hypersensitive within the notion of Sustainability for a large Australia being linked to security. However, the final solution for the allied forces in the Pacific in August 1945 saw the destructive capacity of atomic weapons exercised upon two Japanese cities. The human and economic cost is on the historical record for both the Japanese and the global community and from a global Sustainability position major high technology wars provide an irrational outcome (Mason & Caiger, 1997).

Hiroshima (August 6, 1945) still symbolises the nothingness of war on a fragile planet and according to Mason and Caiger (1997):

The war effort had strained Japan's capacity from the beginning of the conflict... it reduced the country to exhaustion. ... By early 1945, factories often stood idle or operated below capacity because of shortage of materials, even before the allied bombing raids destroyed

them ... raids inflicted death and homelessness on a people already suffering from food shortages. By the war's end about a quarter of ... dwellings in the cities had been destroyed, and perhaps four million people had left Tokyo. (p. 353)

The potential for war due to population pressures is still a real global threat (Stern, 2006).

The Curtin Government

During the war (WWII) years, the Curtin Government decided a larger post-war Australian population was essential. The then Department of Information Minister Calwell, began to develop policies to populate Australia. Both sides of Australian politics supported the rhetoric and tacit assumptions of a *White Australia*: for example, Britain and northern European countries were seen as having *appropriate people*. By late 1944, Calwell had negotiated assisted immigration from Britain for the anticipated post war years. Hansard recalls:

Mr Calwell (Melbourne - Minister for Immigration and Minister for Information) - by leave – If Australians have learned one lesson from the Pacific war now moving to a successful conclusion, it is surely that we cannot continue to hold our island continent for ourselves and our descendants unless we greatly increase our numbers (Australian Federal Parliament, House of Representatives, Record of Proceedings, August 2, 1945, pp. 4911- 4915).

Curtin did not live to witness the massive post-war immigration/immigration that would see Australia's population grow from 7-million plus during the 1940s to 23-million in 2012. It was during the Chifley years that:

[The] first migrants to arrive in Western Australia after the war came on the 'Asturias' in September 1947. Britons nominated by industry and individuals, including child migrants and Polish Allied ex-servicemen were the first to arrive. In February 1948, they were joined by displaced persons from Europe. Most non-British migrants, however, arrived from 1952, the main source countries being Italy, the Netherlands, Germany and the former Yugoslavia ("Populate or perish," n.d.).

Rudd: Big Australia

In the context of this study it can be assumed that contemporary demographic information from the Australian Bureau of Statistics (2012) will see some of the GDE-P students involved in this study as having family links to the early Curtin/Chifley/Calwell immigration policies, if they studied history and politics. During

the three years leading up to the study's survey and interviews, the Australian media was actively engaged in the population debate linked to the then Prime Minister Rudd's pro-population rhetoric. In March 2008 Rudd delivered a speech expounding his new agenda for economic growth based by him on the three Ps: productivity, workforce participation and population growth ("Economic growth," 2008) while in May that year his Minister for Immigration still had not mastered the terminology of Net Overseas Migration ("Confusion reigns," 2008). Healy (2009) claimed Rudd's policy, to counteract an ageing population, of bringing in thousands of overseas workers was ill-founded. Previously, Lattimore & Pobke (2008) stated "... increases from present fertility levels are ineffectual antidotes for population ageing ..." (p. 99).

According ABC NEWS Online (2009, October 23)

The Federal Government is under pressure to spell out how it plans for Australia to sustain more than 35 million people by 2050.

Yesterday, Treasury head Ken Henry expressed concern that Australia would not be able to sustain a predicted 60 per cent growth in population over the next four decades.

Prime Minister Kevin Rudd says he believes in a *"big Australia"* and that the population forecast is good news for the country, but he does concede that it poses complex challenges.

"That is why we're taking a leading position on Climate Change but also the long-term Sustainability of the Murray-Darling and the proper provision of water supplies for the future."

"This Government is building for the future - we call it nation-building for the future. But let's be optimistic about the fact this country's growing, so many around the world are heading the other way."

Mr Rudd says the Government is developing long-term plans for health, the environment and infrastructure.

"I actually believe in a big Australia I make no apology for that. I actually think it's good news that our population is growing," he said. [Emphasis added] ("Rudd welcomes," n.d. para. 1-7):

Gillard Did Not Believe in a Big Australia

Former Prime Minister Julia Gillard declared she does not believe in a *Big Australia*, which was a significant policy shift on population growth. She said:

I don't support the idea of a big Australia with arbitrary targets of, say, a 40 million-strong Australia or a 36 million-strong Australia. We need to stop, take a breath and develop policies for a sustainable

Australia.

I support a population that our environment, our water, our soil, our roads and freeways, our busses, our trains and our services can sustain. (Gordan, *The Age*, June 27 2010, p. 1)

Today, Australia's large cities are straining under inadequate infrastructure. According to *The 2010 Intergenerational Report* (Treasury, n. d.) Australia's population will increase from circa 22 million, to 35.9 million in 2050 using current immigration trends. Melbourne is predicted to reach seven million people, and Sydney over 7.5 million. The statistics cited see Australia's population growing (Goldie, 2009) faster than developing countries, such as the Philippines, Malaysia, India, Indonesia and Vietnam (Indexmundi, 2011). As reported by Gordan (2010), Gillard saw many complexities associated with population policy:

It is a debate about planning affected by many factors, water supply, open space, infrastructure, ensuring the appropriate tax base to support our ageing population ... the need for skills and the need to preserve a good quality of life, the new PM said. ...

Australia has this very difficult problem - parts of Australia are desperate for workers, but other parts are desperate for jobs...

Having a smart and sustainable population, coupled with the right skills strategy, will help improve this imbalance (Gordan, *The Age*, June 27 2010, p. 1)

Population and immigration is an extremely sensitive and controversial subject in Australian politics. Some sectors of the community are hostile to immigration and some business sectors are demanding more flexibility for skilled immigration (Nader & Dowling, 2008). Refugees, in particular the boat people entering Australia through Christmas Island, continue to be a polemic issue throughout the study. The media also covered the hypothetical prediction of Climate Change refugees associated with predicted outcomes of rising sea levels. According the ABC NEWS (2009, December 11):

Former government Climate Change adviser Ross Garnaut says it is inevitable that South Pacific countries will end up having their populations relocated to Australia or New Zealand.

Several small Pacific nations are pushing the delegates at the Copenhagen climate talks to sign up to a tougher international agreement than the Kyoto protocol.

But Professor Garnaut says the future of the Pacific islands is only a small part of the world's Climate Change problem. ("Climate

refugees”, n.d., para. 1-3).

Therefore, the Australian Government, which is on the public record as supporting one of the world’s largest coal exports, faces a moral dilemma associated with rising sea levels within its own Pacific neighbourhood.

Population, Climate Change and Natural Disasters

During December 2010, Queensland was hit with severe flooding that impacted three quarters of Queensland including 70 towns and cities. It was estimated that an area equivalent of Germany and France was flooded. Brisbane saw major flooding and destruction. According to the Queensland Government office of the Queensland Chief Scientist (n.d.):

In Australia, floods are the most expensive type of natural disaster with direct costs estimated over the period 1967-2005 averaging at \$377 million per year (calculated in 2008 Australian dollars).

Until recently, the most costly year for floods in Australia was 1974, when floods affecting New South Wales, Victoria and Queensland resulted in a total cost of \$2.9 billion. The Queensland Government estimates costs for the 2011 floods will exceed this figure for Queensland alone; with the damage to local government infrastructure estimated at \$2 billion, and the total damage to public infrastructure across the state at between \$5 and \$6 billion. (p. 1)

The financial cost of the flood wiped \$30-billion off Australia’s GDP (“Flood cost tipped”, n.d.). If Australia had established large cities of several million plus, as is common in Asia, or extremely dense cities as found in Europe, the floods could have been as catastrophic as the Japanese tsunami (Easdown, 2011).

Fukushima 2011

If the unpredictability of natural geophysical forces impact with a nuclear power plant surrounded by large populations, the costs are nearly incomprehensible and ongoing: for example, the tsunami devastation of Fukushima March 11, 2011. The impact upon large populations and the carrying capacity of a nation to deal with damaged nuclear power plants, and the impact upon fisheries, agricultural lands, health costs and insurance premiums, superannuation losses let alone energy shortages is a global exposure.

According to Inajima and Song (2012) the:

Tokyo Electric Power Co. (9501) asked the government for more aid after estimating it may need at least 11 trillion yen (\$137 billion) to

cover costs from last year's nuclear disaster at its Fukushima Dai-Ichi power plant.

The utility, which has lost 94 percent in Tokyo trading since the March 2011 disaster, may have to pay more than 10 trillion yen to decontaminate areas around the plant and compensate those affected by the disaster, it said in a two-year business plan through March 2015

...
Decommissioning the four damaged reactors [according to Tepco] is forecast to be an "enormous cost," exceeding its earlier projection of "less than 1 trillion yen . . ." (para. 1-3)

Summary of Part Four and Links to Research Questions

The possibility of a *global collapse* still exists today (Diamond, 2005), with any significant increase in population, economic, environmental and sociocultural dimensions become even more sensitive to shifts in normative climate patterns, geophysical events, or regional political tensions including war. This reinforces the role of the interlocking factors of Sustainability including: human population, the finitude of the environment and unprecedented Climate Change and the increasing probability of chaotic outcomes.

According to the literature, unfettered population and economic growth will result in environmental damage (A. D. Brown, 2003; L. R. Brown 2006; Chittleborough, 2006; Diamond, 2005; Ehrlich, 1968; Ehrlich & Ehrlich, 1983; Hardin, 1973, 1993, 1998; Lindenmayer, 2007; Lowe, 2005a, 2005b; O'Connor & Lines, 2008; Weeks, 1998), and some state the scientific consensus says environmental damage has already occurred (Garnaut, 2008; Lovelock, 2006).

The study investigated students' perceptions regarding four interconnected factors associated with Sustainability including: sources of information on Sustainability; lifestyle, attitudes and behaviours towards Sustainability; awareness of economic and political issues linked to Sustainability; and attitudes towards Sustainability population policy. The following question link into the generality of the interdisciplinary nature of the theme reviewed associate with unsustainable human population growth together with the notion of finite planetary resources. The following applies:

- *What are GDE-P students' perceptions of Sustainability linked to population?*

Part Five: Other Sustainability Studies

In the final part of the literature review, the researcher summarises several case studies across both the general public, as well as tertiary students' perceptions of Sustainability or environmental ethics. The studies are summarised under the four interconnected factors of Sustainability:

1. Sources of information on Sustainability;
2. Lifestyle, attitudes and behaviours towards Sustainability;
3. Awareness of economic and political issues linked to Sustainability; and
4. Attitudes towards Sustainability population policy.

Factor One: Sources of Information on Sustainability

In this section, the source information links constructions of Sustainability with: the power of the media, education as an agent for change through Sustainability literacy and selective curriculum, as well as misconceptions regarding Sustainability.

Hawkins (2005)

Hawkins (2005) investigated whether participating in a Public Affairs Issues Course focusing on environmental Sustainability, affected University of Arkansas graduates' attitudes, motivation and actions. The mixed methodology incorporated survey, discussions and interviews. Participants were of five general education classes with courses delivered both face-to-face and online by three different professors using the same text. Hawkins (2005) found knowledge and classroom experiences did assist a change in attitude amongst students and documented some beneficial environmental and societal actions.

Wall (2007)

Wall (2007) sought to establish if environmental ethics and environmental journalism were likely to influence the development of a philosophy of environmental citizenship. He noted that though the Society for Environmental Journalism had been devoted to enhancing the reporting of science and environmental issues, it had been a struggle with main stream media covering responses to events rather than underlying issues and causes. Wall juxtaposed the effect of Rachel Carson, Aldo Leopold and Al Gore alongside Three Mile Island and Hurricane Katrina. Wall (2007) contended that the power of words could induce a sense of environmental citizenship.

Kagawa (2007)

Kagawa (2007) conducted research into dissonance in University of Plymouth students' attitudes to Sustainability and sustainable development with view to developing changes in curriculum. This was carried out via an online questionnaire survey with both closed-category statements and open-ended questions. Kagawa (2007) identified the following four points:

1. That "a majority of student respondents think Sustainability is a good thing ... their positive response not particularly correlating with their degree of familiarity with either of the concepts of sustainable development or Sustainability" (para. 3).
2. Students strongly related these concepts of Sustainability within their environment, as opposed to economic and social aspects.
3. Actions such as recycling, saving energy, water and responsible purchasing practises were often mentioned.
4. An attitude of uncertainty regarding the future for society.

The study highlighted the importance of: inclusion of Sustainability development within the curriculum supported by deploying suitable pedagogies. He stated that these steps facilitated pro-Sustainability actions (Kagawa, 2007).

Leiserowitz, N. Smith and Marlon (2011)

Leiserowitz, N. Smith and Marlon (2011) conducted their research during the US summer, consisting of a national American survey comparing middle and high school teenagers' (n = 517) knowledge and understanding of climatic system/global warming against American adults (n = 1,513). Those sampled were individually weighted to conform to the demographic parameters of the US Census Bureau. Answers were coded as correct or incorrect, with don't know or refusals being handled in the latter category, and then graded. Though some schools had included Climate Change in their teaching, only a few students had been involved in such a topic. The research found three important outcomes noting that:

1. The respondents' knowledge overall, had been acquired through the general media, family influences or the like.
2. Except for several key issues (such as, global warming being mostly caused by humans, the greenhouse effect, fossil fuels producing CO₂ and that it this

molecule traps in the Earth's heat), the students had similar or slightly less understanding than the adults.

3. There were serious gaps in knowledge, along with misconceptions, accounted for doubt regarding Climate Change amongst the student participants. Importantly, it was concluded this would render them, as adult citizens, incapable of making informed decisions on Climate Change, its impacts and possible solutions.

National Earth Science Teachers Association K-12 Climate Change Education Survey (2011)

With not too dissimilar results to Leiserowitz, N. Smith and Marlon (2011), teachers in the National Earth Science Teachers Association K-12 Climate Change Education Survey (2011) found two important considerations noting:

1. That 38 per cent of the students had firmly held misconceptions about Climate Change.
2. Approximately 25-30 per cent reported that students, parents, school administrators and community members had argued that Climate Change was not happening and that Climate Change was not the result of human activity (Johnson & Holzer, 2011).

Nielsen's 2011 Global Online Environment & Sustainability

The Nielsen's 2011 Sustainability Survey ("Sustainability Survey," n. d.), research concluded: the decline in concern with Climate Change could have been due to the drop off in the media's coverage of the same, with its preference given to financial and economic issues associate with the Global Financial Crisis. Therefore, as the media reflected the fear of unemployment, this narrative reinforced the respondents' concerns for job security and well being over issues such as Climate Change.

Weber and P. C. Stern (2011)

Weber and P. C. Stern (2011) attempted to not only ascertain the US public's understanding of Climate Change, but to make constructive suggestions as to how such understanding, could possibly be brought more accurately into line with current and future scenarios. The researchers considered risk management to be an understood framework, and if Climate Change were to be presented in that context, risk profiles

could aid the making of practical decisions. They cited the work of Gober et al. (2009) involving Phoenix's possible future unavailability of water due to unsustainable use. Working with scenarios derived from various policy decisions as a result of climate models, the policies of those engaged were such that if action were taken, reasonable domestic water reduction now would allow for use into the future. The researchers also considered that if the public, through the media, became aware that corporate leaders and the US intelligence and security were taking Climate Change seriously as a threat to their viability and security, attitudes and understanding would change. The researchers concluded that:

1. The effects of education on behavioural change to be weak as previous evidence has shown that trying to alter understanding produces little in the way of people altering their behaviour to mitigate against Climate Change.
2. Psychologists should be engaged to assist with designing what could be called real world/virtual realities as a form of learning environments. These simulations should include possible catastrophic events, uncertainty and probable socioeconomic conditions in the light of progressing Climate Change.

L. C. Hamilton (2012)

L. C. Hamilton (2012), from a US national survey, found education predicted correct answers regarding Climate Change. However, beliefs of the public were largely along political party lines that he considered a biased assimilation effect.

1. College students, in non-experimental conditions, were subject to this bias if received information was inline with their beliefs.
2. More disconcerting, he reported that with the public having the Internet and television, even well formed opinions could be negated by less disturbing claims.

Effeney and Davis (2013)

Effeney and Davis (2013) conducted a study of pre-service primary teachers' Sustainability knowledge and efficacy. Though much emphasis has recently been placed on Sustainability education and the participants considered they were knowledgeable and capable of teaching such, it was found that

1. "No relationship was found between perceived knowledge and actual knowledge which suggests that the participants either did not feel constrained by their lack

of knowledge, or are perhaps unaware of their actual knowledge of Sustainability issues” (p. 32).

2. The researchers contend that the efficacy and knowledge on the participants’ part could have been due to the compulsory first year first semester unit of environmental Sustainability.

This study did not seek to establish from where the students had developed their perceptions of Sustainability, or their life style endeavours to achieve a more sustainable future.

Factor Two: Lifestyle, Attitudes and Behaviours Towards Sustainability

This second area is concerned with problems associated with changing life style choices including: consumption criteria, lack of willingness to take personal responsibility for Sustainability options, fear of the future linked to unsustainable practises, judgement avoidance, as well as world Sustainability values (UNESCO), versus dominant American and pro-Western values that accommodate an economic-centred worldview.

Wong (2001)

Wong (2001) conducted a study of 345 National Taiwan University students’ perceptions of resource Sustainability, environment and green consumerism. As it was considered that university students were the future elite decision-makers of society, their attitudes and behaviours would have significant impact on the future course of development for that country. This study, using a survey questionnaire, discussed the students’ perceptions of the environment, resource Sustainability, and green consumerism in Taiwan. Most students were aware of environmental conditions, resource Sustainability, consumption patterns and the priority of development options. They also recognised that a fundamental change in present wasteful lifestyles was required if a sustainable future were to be achieved.

Popken (2007)

Popken (2007) considered the question whether experience with green buildings influenced people’s lifestyle behaviour, and if this resulted in support for pro-environmental policies. The study involved 33 participants who were anonymous employees, including administrative assistants and managers from four offices within buildings in Dallas and surroundings areas. It was conducted via addressed envelopes. The researcher found that:

1. People were uncomfortable with the prospect of changing life styles.
2. Changing attitudes was not necessarily sufficient to translate into taking action.
3. Popken (2007, p. 33) cited Savage (1993) who claimed that within the urban fabric “ ... the only public spaces are those orchestrating consumption and tourism ...” (p. 125). She proposed first hand experiences and more familiarity with green buildings could have removed some uncertainty by exhibited economic as well as environmental benefits.

Nielsen’s 2011 Global Online Environment & Sustainability Survey

The Nielsen 2011 Sustainability Survey, conducted across 51 countries with 25,000 Internet respondents, found that concern regarding Climate Change or warming was:

- 2011 (69 per cent);
- 2009 (66 per cent); and
- 2007 (72 per cent),

Other environmental issues such as air and water pollution had overtaken it, with the United States of America accounting for the greatest decline. Americans (21%) “ ... were decidedly not concerned, [with] 63% indicated they believe natural variation – and not people – causes Climate Change/global warming ... ” (“Sustainability Survey,” n. d., para. 5). As previously noted, the decline in Climate Change concern could have been due to the media’s preference in giving coverage to financial/economic issues, putting job security and well being to the fore.

Bezbatchenko (2011) Doctoral Thesis

Bezbatchenko (2011) investigated, the space between people’s perception of Sustainability and their actual active involvement. The methodology was to interview 12 students twice and four administrators. She considered it valid to examine students’ perceptions as it was from this age group that would come business and political leaders. Bezbatchenko found that:

1. Most young people regarded Sustainability to be of a major legislative priority but were unwilling to take personal responsibility.
2. The scepticism with which sociologists and social psychologists have, since the 1960s, regarded the relationship between attitudes and behaviours with the Cognitive Dissonance Theory the only one in which behaviour can affect attitudes (this because students did not wish to be judged, they tend to withdraw from commitment to Sustainability).

3. Within the campus setting, removal of judgement based language, clear signage and public display of positive environmentally desirable actions can increase social capital.

Bezbatchenko (2011) considered social capital the best manner in which to examine the attitude-behaviour relationship.

Factor Three: Awareness of Economic and Political Issues Linked to Sustainability

This section examines economic and political studies linked to the topic of Sustainability.

O'Toole, Wallis and Mitchell (2006)

O'Toole, Wallis and Mitchell's (2006) research investigated the impact people's perception of Sustainability had on sustainable development. Such perceptions shaped their environment and how people adjusted to immediate special facts. These held perceptions contained aspects of Sustainability across environmental and sociocultural spheres. Attitudes varied across these rural catchments with environmental and economic values often in conflict and in cases in conflict with those outside the local realm. What was most valued and desired by the communities for present and future generations was dependent on their interlocking social, economic and environmental values. However, as variance was found within perceptions of Sustainability across the geographic areas, perceptions held by regions may not be that of specific localities.

Mission Australia's 2012 Youth Survey

In Mission Australia's 2012 Youth Survey 15,000 individuals between the ages of 15 and 19 years of age participated. Their three main concerns were handling stress, school and study issues, and body image, with their main source of information coming via the Internet. It was money and not the environment that was their big worry. The leading issues were the economy for 30.8 per cent, population for 27.6 per cent followed by drugs and alcohol for 21.8 per cent. Seven out of ten respondents had a positive outlook for the future while one in 20 held a negative view ("Mission Australia Youth Survey", 2012). In 2010, the environment for 38 per cent had been the major issue, followed next year with 37 per cent and this year it was down to 17.5 per cent regarded it as the country's biggest problem. Such a fall off is of major concern to challenging Climate Change according to Dalton, the Research Manager (Twomey, 2012).

Factor Four: Attitudes Towards Sustainability Population Policy

The final section reviews research covering global human population growth projects.

Swinburne University of Technology Study (2010)

In 2010, Banyard proposed a research project to be conducted by Swinburne University of Technology postgraduate students, to explore students' attitudes towards population (Dr Banyard, personal communication, September, 2010). Banyard had expected the research would have been taken up by at least one Honours candidate. No postgraduate student was prepared to take on the research theme. Banyard's initial project offer was subsequently downgraded to a 6000-word report by the end of a 12-week semester with a third year group. However, there was still a great deal of reluctance from students to conduct the survey. In addition, there was a great deal of difficulty in recruiting participants. Two focus groups were asked the following questions.

1. How informed are young people about population growth as a global Sustainability issue?
2. To what extent do young people perceive a link between population growth and each of the following?
 - (a) Environmental degradation;
 - (b) Biodiversity;
 - (c) Human health; and
 - (d) Decreased quality of life opportunities for future generations.
3. What strategies might be useful in educating and raising awareness among young people about the issues associated with population growth?

A summary of the study concluded:

1. Students had some awareness of the consequences of population growth, but seemed to see it as an individual issue.
2. The impacts of population growth were perceived as being only linked to situations in developing nations.
3. Population growth in Australia was perceived as having a positive benefit.
4. Students had problems discussing these issues, because of the social connotations and the related issues of immigration and racism (Tongamp, Chin & E. Watson, 2010).

Unfortunately, any attempt at furthering the research was abandoned (Dr Banyard, personal communication, November, 2010)

Summary of Part Five

The reviewed studies found that initiatives in fostering Sustainability needed to be continually visible. In addition, the studies emphasise Sustainability communication was dependent on visible structural changes in order to be effective. Environmental philosophers, policy makers and planners need to collaborate, in order to promote and discuss Sustainability awareness within the general public and across universities (Kagawa, 2007). Finally, the required catalyst to initiate the necessary actions towards Sustainability that needs to be implemented has not been forthcoming. The reviewed studies underscores the essentialness of education across all levels, but reinforces the current situation as a slow process of education.

Socio-political mechanisms have a link to formal and indirect forms of education as factors in accommodating Sustainability literacy. This broad notion of literacy in tertiary education assumes to engage all faculties ranging from the sciences through to the creative arts. Therefore, two interconnected dimensions of Sustainability emerge as being essential to Sustainability. This dimension being the importance of reliable knowledge specifically associated with the global and national Climate Change debates, and the anthropocentric lifeworld, as an extension of the notion of ecology. As to how deep this education should be will be confined by both time and financial considerations, but the limitations of a finite planet and the science of the natural systems will eventually force a critical realisation that human survival is at stake.

Importantly, the United Nations has devoted ten years to the interrelated issues of Sustainability and education. Nonetheless, a cross faculty foundational unit incorporating the philosophy of Naess and Fox would be most advantageous; for example: Fox (1995) considers transpersonal ecology as a deeper appreciation ecology and is the acknowledgement/appreciation of the fundamental existence of things in nature, while shallow ecology is the mere valuing of nature's elements for their 'extractive financial' value/worth to humankind. He contends if one could develop an ability to distinguish between deep and shallow ecology, an enlightened world-view for life would be achieved. It must be remembered that humanity is an evolutionary

outcome of the planet's ecology, not a separate phenomenon. Sustainability is a human response to reposition the *original connection* (UNESCO, 2005).

Summary of Chapter Two

The literature review investigated the interrelated dimensions of the notion of Sustainability. In examining the detail of the discourse, as positioned by the United Nations, the researcher reviewed the interdisciplinary complexity and challenges required of primary teachers to implement one of ACARA's three priority areas. The literature review was structured in five parts.

The first four parts were linked to the research questions presented in Chapter One covering four factors:

- Sources of information on Sustainability;
- Lifestyle, attitudes and behaviours towards Sustainability;
- Awareness of economic and political issues linked to Sustainability; and
- Attitudes towards Sustainability population policy.

These factors informed the construction of the research questions. The researcher investigated the following questions:

- *Who and/or what influence GDE-P students' perceptions of Sustainability?*
- *What are the GDE-P students' attitudes regarding Sustainability?*
 - (a) *What personal actions do GDE-P students undertake?*
 - (b) *What behavioural choices do they report?*
- *What are GDE-P students' perceptions of economic and political factors regarding Sustainability?*
- *What are GDE-P students' perceptions of Sustainability linked to population?*

The first four parts underscored the interrelated nature of Sustainability including: economics, the environment (i.e., the planet's biophysical domain), and sociocultural attributes (anthropocentric domain). The summary of the four parts provided a link into the questions that the researcher used during her interviews with the GDE-Primary students. The questions were presented in a manner that underscored the interrelated nature of investigating perceptions of sustainability.

The fifth part of the literature review examined recent research covering similar themes associated with the researcher's investigation. The studies claimed that Sustainability

needed to be continually visible, and that its success was dependent on visible structural changes that need to be continually communicated throughout society.

CHAPTER THREE: CONCEPTUAL AND THEORETICAL FRAMEWORK

Introduction

The chapter introduces a number of theoretical perspectives that provide a matrix within which research could be conducted. In addition to backgrounding the historical development of some theoretical and conceptual frameworks, the process of selecting an appropriate framework for the research is discussed. The researcher positions her research under the broad notion of an interpretivist framework as depicted below (Figure 4). As such, the theory of social constructivism supports this overarching model for understanding the formation of the GDE-P students' perception of Sustainability. Neuman (2007) claims that a theoretical framework provides the structure, the approach, general rules and procedures by which to position research. According to Punch (2000) a conceptual framework is a collection of interrelated concepts that underscores the important themes or topics associated with the research, as well as describing key concepts and variables, and the relationships that they present.

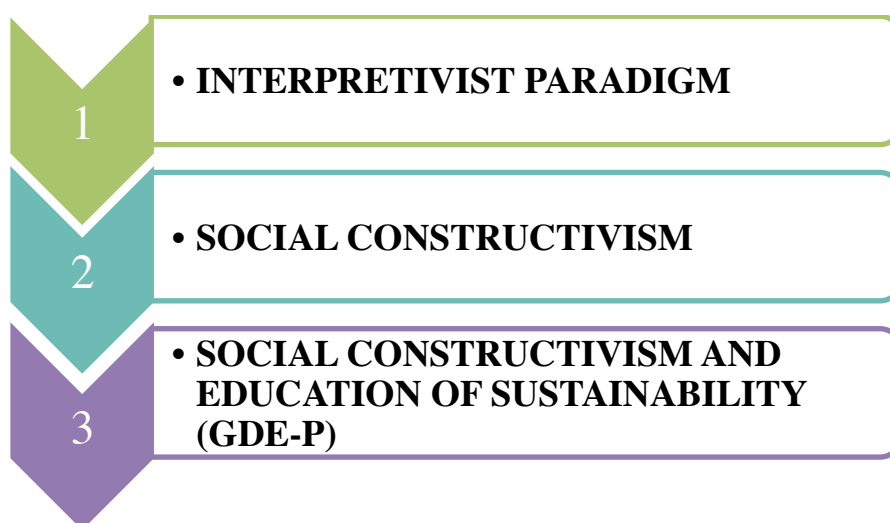


Figure 4. *Framework for the Research Project.*

The Interpretive Paradigm

Traditionally, in educational research there have been two major theoretical research positions, namely positivism and interpretivism/constructivism (Ellis, 2012; Hittleman & Simon, 2006; Howell, 2013; Kukla, 2000; Pass, 2004). Positivism is concerned with realities centred on gathering facts or causes of social phenomena: for example, associated with surveys, experiences and the exploration of correlation in particular studies. Abbott (2010) contends that quantitative methods that measure and identify

social structure should be used for such studies. In contrast, constructivism involves the exploration of realities in human inquiry (Guba & Lincoln, 1989; J. W. Willis, 2007): for example, the realities underpinning GDE-P students' perceptions of Sustainability. Any theoretical perspective offers a worldview or approach towards inquiry or research and within such there is an inherent degree of subjectivity and therefore capacity for interpretation of the data collected (Bell, 2007; Denzin & Lincoln, 1994; Ellis, 2012; Kuhn, 1970; Ratner, 2002). The researcher is required to provide a shared understanding of the multiple realities that she is exploring (Hatch, 2002; Mertens, 2005; Pattern, 1990).

Insights into Complex Social Phenomena

The interpretive paradigm evolved from the biographical research conducted at the Chicago School of Sociology in the first half of the twentieth century in an effort to gain insights into complex social phenomena. It was further developed in Germany in the 1970s into “an open narrative form of interviewing and a procedure of analysing narrative text” (Apitzsch & Siouti, 2007, p. 4). Takaya (2008) cited from Bruner's *Theory of Education* in which he claimed culture embodies “a set of values, skills, and ways of life” (p. 2). He also considered culture was the “toolkit” for sense-making and communicating culture and embraced beliefs, values, knowledge and as such were interpretive processes. Tracy (2013) considered the “... interpretive paradigm [as] a way of seeing both reality and knowledge as constructed and reproduced through communication, interaction, and practice” (p. 62). She wrote of Greertz who viewed “... researchers as ‘cultural interpreters who provide vivid descriptions that unpack values, beliefs, and action in a group, society, or organisation’ ” (p. 50). Morehouse (2012) argues “... interpretive research . . . is the research that seeks to take ... (agency, action and meaning) as the framework for research in education & psychology” (p. 2). Kinash (2010) wrote, “... a paradigm is a matrix of beliefs and perceptions” (p. 1). She continued citing Foucault's (1972) consideration that ages had mindsets that arose from people's actions and communications with one another (for example, the debate about the polemic rhetoric of Alan Jones 2GB and other blogs cited previously) and these are social entities, setting how one interacted with others and evolved from such constant contact. It was this mindset of the time, which was sought in this interpretivist research.

Participants' Interpretations

Wiersma and Jurs (2009) wrote of the interpretive paradigm, “... the researcher depends on the participants’ interpretation ... capture the participants’ language and point of view” (p. 10). Within this approach, the individual participant’s responses would reveal insight into his or her attitudes, perceptions and personal reflections regarding their behaviours. The main objective of the interpretive paradigm is to understand the subjective world of human experience. Littlejohn (2000) said that people find meaning in their experiences embedded in the symbols of their group and the use and context of the language used. An interpretive researcher wants to know how people grasp, understand, and interpret events, as well as artefacts: for example, social and other electronic media. However, it is asserted that sometimes, qualitative research in general, and interpretive research in particular, can provide diverse descriptions, but not absolute explanations as discussed by Packer (2011).

The Subjectivity of Human Experience

Cohen and Manion (1994) view interpretive research as belonging to a non-positivist paradigm “... characterised by a concern for the individual ... the central endeavour ... is to understand the subjective world of human experience ...” (p. 36). It is an attempt to understand another individual from within. By focusing on the internal, interpretive research is future-orientated, and hence the possibility of hypothetical predictions or speculations may arise regarding future behaviour or inclinations. However, Cohen and Manion (1994) reinforce that the interpretive paradigm supports the notion that reality is constructed by subjective perceptions, with no firm predictions ever being guaranteed. It is important to remember, people are free agents, they have their own interests, purposes and desires and will make their own decisions upon which they then act (“Paradigms and communications”, n.d.). Therefore, what a GDE-P student respondent discloses during an interview, may not guarantee to be replicated in a classroom or personal context.

Social Constructivism as a Conceptual Framework for Sustainability

Social constructivism according to Vygotsky (Kozulin, 2003; Langford, 2005; Terrence, 1997) deals with the manner by which an individual’s knowledge is socially constructed from within their cultural knowledge. Vygotsky (1978) proposed that the cognitive constructivism of how people see the world arises from the influential collaborative effect of social interaction and the language dynamic operating within an

individual's community or lifeworld (Habermas, 1984). Hence, social constructivist theory is useful as the basis of any initial interpretive survey: for example, when a respondent is asked about their perception of Sustainability being informed by family, friends, mass media, or online technology. Therefore, the present researcher sees social constructivist theory as an interpretive paradigm for relating specific narratives represented by commercial radio, as discussed in Chapter One and Two. In particular, social constructivist theory is helpful in interpreting the subjectivity developed by socially constructed perceptions: for example, lobbyists endeavouring to influence a preferred political influence or commercial outcome.

Vygotsky (1978) claimed cultural development occurred on two levels: the social or inter-psychological, and within the individual or intra-psychological ("Social Constructivism", n.d.). Within any school or learning situation, the actual development is that level of learning the learner has achieved. However, the potential development, also known as the zone of proximal development, is that level, which the learner could achieve with interaction: for example, scaffolding from teachers, and/or more knowledgeable peers (Axford, 2009; Davis & Miyake, 2004; Ellis, 2012; Klentschy & Thompson, 2008). The situation at universities sees a similar influence of academic teachers and informed adult peers facilitating learning.

Constructivism is a well-founded educational paradigm that is usual linked to early childhood through to secondary education. In this research, the learning context is applied to adult cognition and is inclusive of the social constructivism paradigm where social interaction plays a fundamental role in the development of cognition and where individuals try to find meanings and explanations for the culture and circumstances in which they live (Creswell, 2009; Gredler, 1997; Kim, 2001). The researcher positions this learning model as a contextual framework for her investigation of the GDE-Ps' perceptions of Sustainability. This research did not offer any intervention, but aimed to gather and interpret existing perceptions from the students.

Education and Social Constructivism

A social constructivist view positions knowledge as human-centred that is communicative and socio-culturally formed and reconsidered. With respect to the GDE-P student participants and their anticipated role of a generalist primary school teacher the issue of teaching Sustainability is complex.

Sustainability as discussed in the literature review (ACARA, 2010; ARIES, 2009; UNESCO, 2002; UNESCO, 2005) also intersects with science education. Therefore, one of the problems with Sustainability linked to a science-centred paradigm, is that it limits the social Sustainability dimension that needs to engage human relationships for the important discourse of political change towards issues of Climate Change, development of renewable technologies and population politics. The scope of the research, as discussed in both Chapters One and Two, emphasises a multi-disciplinary context as documented by ACARA (2010), as linked to the Decade of Education for Sustainable Development. The literature reviewed underscores a wide range of sophisticated literacies ranging from both biophysical and climate sciences, through to economics, as well as humanities, linking Sustainability to social justice and personal wellbeing (A. D. Brown, 2003; L. R. Brown, 2006, 2011; Diamond, 2005; Flannery, 1994, 2005; Lindenmayer, 2007; Lovelock, 2006; Lowe, 2005a, 2005b, 2012; O'Connor & Lines, 2008, Stern, 2006; UNESCO, 2002, 2005, 2010).

ARIES (2009) also offers an approach to education for Sustainability that aligns with the social constructivism model, which is inclusive of science. Social constructivism as a learning model is also central to the functioning of university life, as a progressive social enterprise, accommodating particular assumptions about reality, knowledge, and learning. University learning facilitates the construction of new realities through human interpersonal interactions (Kukla, 2000). Academics and students interact to create opportunities for new realities for learning and development through multi-literacies and social engagement opportunities. In this study, the GDE-P students brought with them prior experiences from diverse university disciplines. It is important to underscore the students participated in this research project before any formal science or Sustainability education related studies were engaged. As part of the GDE-P degree the students complete a 30-hour unit in science education; but once in the workplace, they are confronted with the professional expectations of the Australian Curriculum (ACARA, 2010) and Sustainability as a cross-curriculum priority.

Summary

In this chapter the researcher has positioned the theoretical conceptual learning framework under the broad theme of interpretivist theory, inclusive of social constructivism. The historical development of the theories were introduced and linked

to the context of the study accommodating the interpretation of the GDE-P students' perceptions of Sustainability.

CHAPTER FOUR: RESEARCH METHODOLOGY AND PROCESSES

Introduction

This chapter describes a mixed methods approach for the research. The researcher then discusses the specific benefits and limitations of quantitative and qualitative approaches. An outline of the methods undertaken in this research project is then discussed, including: the questionnaire construction linked to a two-phase pilot, and subsequent semi-structured interviews.

Mixed Methods Approach

A mixed methods approach allows the researcher to accommodate both breadth and depth of data, in addition to triangulation of data, and providing comparative data analysis (Cohen, Manion, & Morrison, 2011). In education, "... both [qualitative and quantitative] research strategies have their strengths, and often combining them can combine these strengths" (Punch, 2009, p. 42), which is the case in a mixed methods study. Pragmatism underscores a philosophy for the mixed methods approach (Denscombe, 2007), as a fusion of practices offering multiple lenses for interpretation. There are a number of approaches in mixed methods research (Punch, 2009):

- Triangulation;
- Embedded;
- Explanatory, and
- Exploratory design.

Explanatory and exploratory designs use quantitative and qualitative data to build on each other for in-depth analysis (Punch, 2009). Explanatory designs use quantitative data followed by qualitative approaches, whereas exploratory designs collect qualitative data first, which is then used to form the basis for quantitative investigation. The benefits and limitations of both quantitative and qualitative methods are described below.

Quantitative Methods

Wiersma and Jurs (2009) claimed quantitative research "... has its roots in positivism" (p. 14), from the beginnings of social investigation linked to scientific research and methods. Curtis (2002), when writing of social structures, considered that since the time of Aristotle, much of Western writing had a numerical, quantitative characteristic. Silverman (2001) wrote, "... in research it [quantitative approach] is regarded as 'the gold standard' " (p. 26). Cicourel, cited in Silverman (2001), stated governments preferred quantitative methods because it was perceived as efficient and reliable.

The positivist and the post-positivist paradigms are concerned with behaviours resulting from either external or internal responses to events that have occurred in the past (Creswell, 2005). Positivism refers to research being conducted for the purposes of generalising findings across a large population (Lowe, 2008). Post-positivism is a newer paradigm, which still argues the ability to generalise findings across a population, but more conservatively as it recognises research is socially constructed and unique to the population in which the research is conducted (Lowe, 2008).

Within these normative paradigms, general theories are proposed and the researcher attempts to confirm, validate or negate them (Wiersma & Jurs, 2009). Wiersma and Jurs (2009) list the characteristics of quantitative research:

- Theory based;
- Focused on individual variables;
- Is a deductive inquiry;
- Desirable for seeking relationships;
- Effects and causes, and
- Statistical analysis.

Silverman (2001) argues data collected within quantitative research from surveys, were gained by asking people, despite the researcher having a detached role. He cited Fielding and Fielding (1986) who claimed there exists a probability of difference between respondents in a study and the population in general. Unless the research was of inanimate, non-choice making objects, there is always interpretation, both on the part of the researcher and participants. Therefore, the researcher needs to be considerate of interpretative biases influencing quantitative research.

Qualitative Methods

Creswell (2009) wrote quantitative questions ask why, and qualitative questions ask how and what. Qualitative research is an inductive inquiry, contrasting empirical-analytical inquiry (post-positivism), and aims to describe and understand how the people involved with them experience social phenomena. Flick (2007) wrote, “ ... qualitative research is intended ... to understand, describe and explain social phenomena ‘from the inside’” (p. ix). However, while qualitative methods are holistic with rich researcher-participant interaction, it is a time consuming approach to data collection, and the researcher may be left with more questions due to the complexity of the evolving human perception of the topic under investigation (Flick, 2007).

Qualitative research has been employed in the disciplines of education, nursing, psychology and the social sciences. It evolved out of a number of varying traditions (Flick, 2007):

- Anthropological perspectives;
- Biographical;
- Cognitive studies;
- Conversational studies;
- Ethnography;
- Grounded theory;
- Symbolic interaction, and
- Sociological perspectives.

In the past, qualitative research approaches have often been dismissed by quantitative researchers due to their lack of rigour, as it is unlikely that something as transient as people’s perceptions would be reliably replicated (Silverman, 2001). However, qualitative research is now recognised as a useful approach to data collection for research projects that seek to investigate beliefs or attitudes (Silverman, 2001).

Research Method

After considering the benefits and limitations of both a quantitative and qualitative method, it was decided to undertake an explanatory mixed methods approach. An explanatory mixed methods approach would allow for breadth of students’ perceptions

to be confirmed by the personal narratives shared by GDE-P students, therefore constructing a holistic view of student perceptions linked to Sustainability. Subsequently, a quantitative questionnaire would be conducted first to establish GDE-P students' perceptions of Sustainability and Climate Change, before conducting follow-up semi-structured interviews with volunteer students. The methods undertaken for the research are described in more depth below.

Ethics Clearance

In accordance with University Research Policy and Guidelines, the required ethics clearance was sought. The structure of the survey and the semi-structured interviews were clearly laid out. There was not be any attempt of distributing the questionnaire or interviewing before clearance was received. A copy of all ethics documentation, including consent forms can be found in Appendix D.

Sampling

Purposive sampling was chosen for this research project, as it is “... sampling in a deliberate way, with some purpose or focus in mind” (Punch, 2001, p. 193). In this research, GDE-P students were chosen for their intended implementation of ACARA's cross-curriculum priority of Sustainability. In addition, the GDE-P students represent the most qualified pre-service teacher cohort as they come into the course with established degrees (some with post graduate qualifications). It was the researcher's assumption this sample would represent the strongest pre-requisite cohort with the most informed background in Sustainability and Climate Change linked to the contemporary Australian political discourse.

A sample of 113 students, from diverse Faculties and Schools (e.g., Arts, Business, Computing, Economics, Health, Law and Science), participated in the research. These students participated in the questionnaire, and then volunteers from this group were asked to participate in a follow-up interview. Demographic information obtained from the questionnaire included specific disciplines being studied, age profiles, gender and country of birth.

Quantitative Data

The researcher initially constructed a questionnaire instrument from her interest in Sustainability and significant literature reviewed on these topics. The questionnaire was

then piloted with secondary teachers for comprehension, prior to a Phase Two pilot being conducted with the GDE-P students. The pilot data were then analysed, and resulted in the researcher finding a quantitative approach was inadequate for the scope of the research project. The process undertaken for the quantitative methods is documented in Figure 5, below.

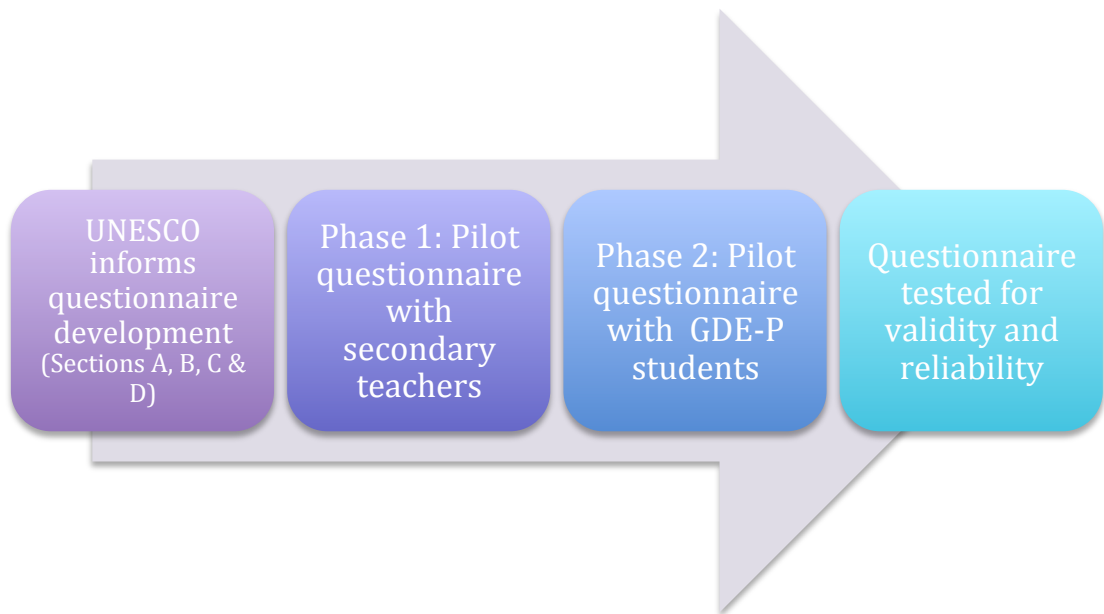


Figure 5. *Quantitative Data Collection Process.*

Construction of the Questionnaire Instrument

The researcher constructed the questionnaire instrument based on the following four questions:

1. Who and/or what influence GDE-P students' perceptions of Sustainability?
2. What are the GDE-P students' attitudes regarding Sustainability?
 - a. What personal actions do GDE-P students undertake?
 - b. What behavioural choices do they report?
3. What are GDE-P students' perceptions of economic and political factors regarding Sustainability?
4. What are GDE-P students' perceptions of Sustainability linked to population?

The instrument also collected demographic information including: specific disciplines being studied, age profiles, gender and country of birth. The questionnaire attempted to capture the complexity of the Sustainability as explained by UNSECO and ARIES, and supporting the expectations of ACARA's cross-curriculum priority of Sustainability.

The researcher used a six-point Likert rating scale with 40 statements/questions dictated by Keypad limitations, with no neutral option. R. Burns (1994) stated that the Likert scale, an efficient procedure to measure paradigms, was desirable as it was based on empirical data derived from the participant's responses rather than subjective opinions of the researcher.

The aim was to engage GDE-P students from across a range of disciplines to gather understandings on Sustainability across the disciplines. The neutral option was removed to force the students to make a decision, either positive or negative. The researcher was aware that many of the questions were complex and were not designed to elicit a right or wrong response: for example, questions regarding nuclear energy could be interpreted both as positive or negative depending upon how the question was analysed against the science or technical evidence available. Nuclear energy is often seen at a superficial level, as providing a solution to carbon linked greenhouse emissions. However, the amount of infrastructure required to establish a nuclear facility sees a massive carbon footprint associated with the use of concrete, steel and transportation, in addition to the mining of the Uranium ore. The other ethical issue associated with nuclear energy is related to the storage of radioactive waste and the potential use of the same in weapons of mass destruction. Therefore, any Likert response would possibly present the extreme of these two positions dependent on how a respondent's knowledge of the nuclear debate was socially constructed.

Piloting the Questionnaire

A two-phase pilot was conducted with the questionnaire instrument. Phase One was conducted with secondary teachers and members of the public and Phase Two was conducted with the GDE-P students. Both Phases are discussed below.

Phase One

Prior to conducting the survey of the GDE-P students, the 10-item questionnaire was disseminated to 13 secondary teachers and two university educated members of the public (see Appendix E). The aim of this pilot was to assess participants' comprehension of the questions and to examine the structure of the instrument. The findings of this small-scale pilot failed to produce a conclusive trend, and exposed confusion on the topic of Sustainability.

Phase Two

After Phase One the questionnaire was reduced in size to fit the Keypad limitations; namely, a 30-minute format, to allow the administration of the questionnaire to GDE-P students within a Science unit at the University (see Appendix F). The comprehensive scope of UNESCO's definition of Sustainability needed to be aligned with particular political contexts of Australia at the time (as discussed in Chapter Two). Therefore, some questions had to be deleted or modified (compound questions), and other questions were negatively worded to ensure the reliability of responses (Creswell, 2005).

Subsequently, Phase Two of the pilot included a test with several classes of GDE-P students (total of 113 students), conducted with an electronic keypad questionnaire that projected their responses onto a screen. As research suggested students' respond according to their instructor's preferred subjectivity if they administer the questionnaire (Mitchell & Jolley, 2004), an independent consultant was employed to conduct Phase Two of the questionnaire pilot. The independent consultant was used to administer the questionnaire and to remove any potential bias associated from either the researcher or her Principal Supervisor, who had participated in the construction of the instrument and who knew the students. In addition, the consultant was well practiced with the technology utilised and this minimised any technical issues.

The researcher and supervisors engaged the University administration to provide a venue accommodating audiences with individual keypad 'wireless' or 'infrared' hand-held tools to complete the pilot questionnaire. The questions were presented to the students in science laboratories on large screens via a computer-projector. Questions were presented on the screen, and the students selected the Likert scale option by clicking on the preferred response using the interactive keypad technology. Data were collected and collated instantly by the software. As the questionnaire was piloted with several classes, Phase Two of the pilot started at 8.30am and lasted until 6pm.

After the questionnaire was completed with the GDE-P students, the consultant processed the data and returned the results in an Excel spreadsheet format to the Principal Supervisor. The researcher and her Supervisors assessed the data from the Excel spreadsheet. Next, the researcher engaged the support of a Research Assistant who entered the data into SPSS 21 and ran a Cronbach's Alpha Coefficient test to

determine the internal reliability of the questionnaire, with a coefficient of above 0.8 deemed reliable (see Appendix G). A Cronbach's alpha test run on the data showed all subscales had a low reliability:

- Section A (What and/or who influences you when it comes to issues regarding Sustainability and Climate Change?) yielded a Cronbach's $\alpha = 0.007$.
- Section B (Sustainability literacy: in regard to the natural environment, economic, lifestyle and Climate Change considerations) yielded a Cronbach's $\alpha = -0.050$.
- Section C (Carbon literacy: in regard to emissions, taxation and renewable energy subsidies) yielded a Cronbach's $\alpha = -0.174$.
- Section D (Sustainable population literacy: in regard to achieving a sustainable population) yielded a Cronbach's $\alpha = 0.167$.

Due to negative average covariance among items emerging during the reliability testing, the coding was re-checked and confirmed as correct. The questionnaire was deemed unreliable for further use. After the analysis, it was decided the instrument required significant refinement prior to a new pilot test. Subsequently, it was decided that the research should use a qualitative approach, informed by an interpretivist paradigm. The quantitative data collection was removed because postponing the quantitative data collection would mean different respondents (a new group of GDE-P students) who may have had different contextual knowledge or course content that could impact their perceptions.

There was also a logistical issue with re-piloting the questionnaire for this project. Phase Two of the pilot was conducted very early in the semester two 2011, during the second week of a 10-week Science Education unit. The unit would cover some content covering Sustainability, so if the questionnaire were re-administered, it would have to wait until second semester 2012, and be conducted with a new cohort of GDE-P students. After considerable reflection it was decided the comprehensive intent of the instrument would prove too challenging, as the researcher became aware of the logistical limitations and personal costs. Therefore, the researcher chose to focus on a qualitative dimension, as discussed in the next section.

Qualitative Data

During Phase Two of the questionnaire pilot, students were invited to volunteer for a follow-up interview with the researcher. Due to the non-compulsive, non-coercive nature of garnering participants for this study, self-selected volunteers most likely held strong views on the topics of Sustainability and Climate Change. Therefore, the outcomes from the self-selecting respondents were anticipated as potentially biased.

The qualitative component consisted of semi-structured interviews with 18 GDE-P students, who had completed Phase Two of the questionnaire pilot. Only four of the participants involved in the interviews had Science degrees; with the majority of students having Arts or Humanities degrees. Through semi-structured interviews, "... the informant's perspective is provided rather than the perspective of the researcher ..." (R. Burns, 1994, p. 279). Denzin and Lincoln (2000) describe how "... social experience is created and given meaning ..." (p. 8), and through interpretive processes can "... explain how people [GDE-P students] attribute meaning to their circumstances and how they develop and make sense of rules which govern their behaviour ..." (Candy, 1989, p. 2). Semi-structured interviews allowed the students to elaborate on their perceptions of Sustainability and Climate Change, covering the Australian context.

The semi-structured interviews consisted of eight questions (see Appendix H), linked to themes measured by the Phase Two questionnaire (and consistent with the four guiding questions as discussed in Chapter Two). Prompt questions were also developed, and engaged for some questions (see Appendix H). However, the nature of the process meant that the students directed the themes discussed in the interview. Three students completed the interview via email, and the remaining 15 completed face-to-face interviews on the university campus, which lasted between 40 and 60 minutes. The interviews were audio recorded, transcribed by a professional typist, and then coded by the researcher using a matrix (see Appendix H).

Coding Processes

The coding of the interviews charted the frequency of each participant's responses to the themes. Subsequently, the researcher could determine key themes and sub-themes using the four interrelated factors outlined in Chapter One.

Limitations of Methods

The researcher encountered a number of issues during the piloting and collection of data:

1. The scope of Sustainability, as derived from UNESCO, was too complex to measure with a quantitative instrument;
2. The Australian political context added to the complexity of the questionnaire design, due to the very intense public debate that transpired during the Rudd/Gillard prime ministerial transition;
3. The Japanese tsunami tragedy occurred (11 March 2011) and the subsequent nuclear catastrophe, as discussed in Chapter Two (Literature Review) added to the subjectivity at the time of the piloting;
4. The need to compress complex questions into an affordable timeframe for an independent consultant to administer was unrealistic (from a financial and university timetabling perspective);
5. Repeating Phase Two of the pilot was logistically unreasonable for the scope of the research; and
6. Retrieval of results from the independent consultant was delayed, which further impacted the researcher's capacity to manage the data analysis within an appropriate timeline.

These circumstances, coupled with the fact the GDE-P students were on practicum placements after the data collection, followed by examination preparation and examinations, meant there was neither the opportunity to further refine the interview questions nor attempt to enlist participants who held a greater cross-section of perceptions within the timeline of the research project.

Summary

The questionnaire of this proposed mixed methods study, proved to be an unreliable measure of students' perceptions of Sustainability and Climate Change. Due to the challenges encountered with the questionnaire, the research project evolved into a qualitative interpretive methodology. The 2011 interpretive study produced rich insights into the individual perceptions of Sustainability for 18 GDE-P students. The following chapter presents the analysis and interpretation of the collected data from the 18 semi-structured interviews.

CHAPTER FIVE: FINDINGS FROM INTERVIEW DATA

Introduction

Following the Phase Two questionnaire pilot with 113 GDE-P students described in the previous chapter, all participants were invited to volunteer for a follow-up interview with the researcher. Twenty (20) students initially responded to the request and 18 participated. This chapter details the researcher's interpretation of the 18 semi-structured interviews. The interviews elicited rich demographic material and students' perceptions regarding the four interconnected factors associated with Sustainability:

1. Sources of information on Sustainability;
2. Lifestyle, attitudes and behaviours towards Sustainability;
3. Awareness of economic and political issues linked to Sustainability; and
4. Attitudes towards Sustainability population policy.

The discussion of key themes from the 18 interviews is organised according to the above four factors. Demographic data is presented prior to the discussion of key themes.

Demographic Profile of the Interviewed Students

The coding of the GDE-P students' demographic profile commenced with the use of pseudonyms to protect students' identities. Male and female alphabetical pseudonyms were used to order the students.

The students interviewed included:

- Six males and 12 females;
- 13 Australian students; and
- Five overseas students, inclusive of three females and two males, all of who had permanent residency.

The specific degree obtained prior to the GDE-P is not used in reporting the interview data, due to the possibility of identifying the participants. Subsequently, the recorded degree has been reduced to either a Science or a Humanities/Arts degree. If a student recorded a Masters or Doctoral degree, then a letter *P* was assigned after the degree (for example: Science P). The students interviewed included:

- 14 (71%) with degrees in the Humanities/Arts,

- Four (29%) with degrees in Science, and
- Four (22%) had higher degrees (three in Humanities/Arts and one in Science).

Table 1. *Demographic Information from the 18 GDE-P Interview Participants.*

Pseudonym	Citizenship	Age	Degree Type
Alan	Australian	35	Humanities/Arts
Ann	Australian	43	Humanities/Arts
Barbara	Overseas	29	Humanities/Arts
Brian	Australian	49	Humanities/Arts
Caddy	Australian	33	Humanities/Arts
Colin	Australian	51	Humanities/Arts
Debra	Overseas	40	Science P
Des	Overseas	33	Science
Edith	Australian	37	Humanities/Arts
Faye	Overseas	34	Humanities/Arts P
Fred	Australian	23	Humanities/Arts
Greg	Overseas	31	Humanities/Arts P
Helen	Australian	33	Science
Irene	Australian	26	Humanities/Arts
Joy	Australian	37	Humanities/Arts
Kerry	Australian	40	Humanities/Arts
Lorna	Australian	38	Science
Mary	Australian	29	Humanities/Arts P

Sources of Information on Sustainability

A number of key sources for information on Sustainability were elicited from the interviews, in addition to sources mistrusted by some GDE-P students:

1. Education, scholarly internet and the scientific community;
2. Non-commercial media;
3. Mistrust of commercial media; and
4. Mistrust of politicians.

Education, Scholarly Internet and the Scientific Community

The GDE-P students spoke of predominantly using education, the Internet and scientific community as sources of reliable information regarding Sustainability and Climate

Change. When using the Internet, students emphasised that they would seek a credible, scientific website.

Seven students (39%) underscored the importance of education across a variety of contexts. Caddy stated:

... I get information ... from what comes home with my kids from school ... Definitely what has been presented at a university level from my unit. Also, just my associated reading from that unit I think. I didn't have much of an understanding before, and now in a very short period of time I have gained quite a lot more knowledge.

Students discussed educational influences and made distinctions about their feelings from the experience, noting: *"It depends on the lecturer, sometimes people have very strong views on Sustainability. If they make a good case, then I'm more than happy to listen ... but I think I ... want to go and find things out for myself"* (Irene). Mary stated how education occurred through *"general discussion with [university] peers"*.

Many of the students said they are educated through family and friends, but that these groups presented polarised views. However, some students said where family or friends had specialised information: for example, parents who are scientists or farmers, or close friends who have tertiary qualifications in relevant disciplines, the GDE-P students would give appropriate attention to specialised knowledge. Barbara saw education linked to her family, *"Both my parents work in science ... so I get a lot of my information from them ..."*

Over half of the students (56%) stated the Internet was their best source of information; however, a number of interviewees implied they were selective and cautious of the sites they used. Helen stated: *"... I look at stuff on the Internet a lot but only if it comes from what I consider to be a reliable source ... I might hear something and then look it up ..."*. Lorna reinforced this opinion, stating: *"... from a reliable source on the Internet, not a .com or blog"*. Only 11 per cent of students cited blogs as a source of information on the topic. Alan stated:

Internet certainly, a lot of professional ... comments ... various papers of what people has discovered, what new information they think they had bought to light, read and evaluate, not one for taking anything for granted. I like to get as much information as I can before I make any decisions about things.

Ann mentioned using the Internet to gather information from a number of sources, including blogs: *“The Internet is a good one for me I suppose. You can look at news, opinion blogs, you name it”*. Colin was interested in the Climate Change debate and goes online, *“onto the climate deniers site and when I go ‘hey, what’s going on here?’ I go onto a scientific one and ask a question. So I guess the internet”*. Joy reinforced the Internet as a source of information saying, *“I would probably start with the Internet”*.

Three students (17%) spoke specifically of the scientific community and research as the most reliable source of information. Brian trusts the scientific community, particularly regarding Climate Change:

I think ... everything is political but they [scientists] have fewer agendas than other players ... they use ... sound methodology, scientific practices ... to make sure ... they are heading ... in the right direction. The other aspect to this is there is a chorus of members of the scientific community (I know there are others that say other things) I think it is the scientific community ... we need to listen to them and I think we ignore them to our peril.

Kerry puts her trust the scientific community but exercises caution: *“I guess agencies, like CSIRO and academic research, although you do tend to wonder if it is not skewed a certain way because of ideology”*. Some students had first-hand experience with the scientific community, with Des stating: *“When I was at university I had a couple of my professors working on research ... It is hard to conclude directly ... but the evidence is there, it pretty strong”*.

Non-Commercial Media

The overwhelming majority of the students (83%) placed their trust in non-commercial media. Programs such as the ABC, television, documentaries or related radio programs provided perceived sources of reliable information. Alan said, *“It would definitely be non-commercial news, I would put some trust in that”*. Caddy stated examples of *“... ABC, radio, [and] documentaries ...”* as non-commercial sources, saying *“... I would say I have more faith in documentary style shows, particularly if they are aired on ABC rather than commercial programs ...”*. Mary also trusted non-commercial media sources, due to their inclusion of local sources of information: *“6PR and other AM stations I listen to at times strongly influence my views, given the local farmers tend to keep us updated”*.

Mistrust of Commercial Media

All the students emphasised a distrust of commercial media. Alan said “ ... *I would not trust commercial news for anything...* ”. Barbara said that commercial, “... *provides no information ...* ”. Colin was emphatic stating: “*Not commercial radio stations, not newspapers*”. Des claimed that newspapers are, “... *partial a lot of the time, they are politicised, I don't really go into the newspaper ... they are more after flashy topics ... whatever is exciting ...* ”. Brian was very critical:

... the shock jocks on the radio could do well to just take a long hard look at themselves. ... I am part of a generation ... used to the 10-second grab on TV or radio. We have to be careful ... I think a lot of the media is distorted and they have their own agendas. ... I am ... pessimistic ... there is a lot of shared and pooled ignorance.

Mistrust of Politicians

Some students expressed concern over the level of political manipulation of Sustainability and related themes. Brian explained that alongside the radio shock jock that “... *leaders in government, community leaders ... could do well to take a look at themselves.*” Helen was emphatic: “... *I would not say government at all ...* ” as a source of reliable information.

Lifestyle, Attitudes and Behaviours Towards Sustainability

A number of key issues impacting on students' lifestyles, attitudes and behaviours towards Sustainability were elicited from the interviews:

1. Climate Change;
2. Resource depletion and population;
3. Renewable energy;
4. Education; and
5. Cost to consumers.

Students noted a number of actions and lifestyle changes supporting Sustainability, in light of the key issues listed above. Key themes were:

1. Sustainable consumption;
2. Education for Sustainability;
3. Sustainable food;
4. Sustainable transport; and
5. Sustainable energy.

The key issues are discussed, followed by students' actions and lifestyle choices supporting Sustainability.

Climate Change

Nine students (50%) explicitly stated issues linked to Climate Change; however, all students interviewed stated Climate Change was occurring. Three students were concerned with the impact Climate Change would have on Sustainability; as evidenced by Ann who said, "... *Climate Change will affect our time on the planet. It will effect where we can live ...*". Carbon emissions were of great concern, with Brian stating: "*The Climate Change side of things really is the amount of carbon we are putting out in the atmosphere, I think that is the big one as a contributor*". Caddy supported Brian's statement, but added the need to approach Climate Change as a community: "*Reduction of greenhouse emissions and how we can do that as a global effort rather than individually*". Throughout the interviews, the various questions elicited concerns directly and indirectly linked to Climate Change. These links will be articulated throughout the interpretation of data.

Resource Depletion and Population

The issue of population increase within the context of the finite system underscores the issue of consumption and the subsequent outcomes of waste and reuse. A second issue emerged with respect to education for Sustainability linked to sustainable resource use and renewable energy. In this section, the issue of resource depletion and population is the focus. Six students (33%) spoke specifically about resource depletion and three students spoke about population (17%).

Alan claimed that population was the first issue, noting:

More people in the world, the more resources we will use, and pollutants we are going to create. We have to reduce carbon emissions ... More ... friendly foods [less chemicals] ... used in our crops ... [and animals too].

Ann reinforced that:

Our resources are running out ... fuel sources ... [we need to change] away from fossil fuels towards sustainable resources, like solar or wind power ... Climate Change will effect our time on the planet. It will effect how we live and where we can live ... Today's waste might be tomorrow's energy.

Barbara noted that, “... *people are not taking [resource depletion linked to Climate Change] very seriously ... You really can't blame them, it's a pretty tricky thing to get your head around*”. Brian was concerned about water depletion linked to a growing population: “*How many people can Australia have? Taking into account water is probably our number one problem ...*”. Helen reinforced the importance of, “... *minimising our impact, changing the way we do things to lessen what our output is*”. Mary stated a link between natural disasters and resource depletion: “*I believe natural disasters [e.g. Queensland floods linked to Climate Change] are a result of overuse of our natural resources*”. Mary also linked the problem to government: “*As a regular citizen, I tend to see local government authorities waste water ... this does not model responsible use [of water]*”.

Renewable Energy

Only one student elaborated on the scope of renewable energies; however, many students implied use of renewable energy and these vignettes are explained in other sub-themes. Ann linked sustainable use of resources and renewable energy with the reduction of Climate Change outcomes that will, “... *affect our time on the planet ... how we live and where we can live*”. She stated there was a “... *massive plastic dump in the middle of the Pacific Ocean ...*”; it was a wasted resource and pollutant. Brian reinforced the issue of “... *finite fuels ... and once they are expended they are gone*”. He emphasised, “... *a collision course with increasing demand on one end ... [and] diminishing resources ...*”.

Education

Education was seen as a key issue for seven GDE-P students (39%). Barbara implied a lack of funding to educate the public about Sustainability and Climate Change was a key issue and resulted in, “*People not taking it very seriously at a general level, I think there are a lot of people out there that cannot be bothered to think about it, and it's huge*”. At a personal level, Barbara said, “*I certainly am not as informed as I could be ... a real issue*”. Kerry reinforced Barbara: “*I would like more information ... a better handle on it ... evidence to support ...*”. Colin expressed a concern for a lack of scientific literacy in education with the general population not being able to combat, “*the false propaganda being put out that Climate Change isn't happening ... or is man-made*”. Debra linked activism and education noting she had a desire to become involved in, “*grass roots movements ... I can do my part*”. Des linked ignorance to a

lack of science education noting: “... *research obviously [needs to counter] ... a lot of misinformation circling, education also ... look into the science behind it [Climate Change], it is pretty obvious*”. Joy claimed one reason “... *a lot of people are ... not taking a stance*” is linked to poor education. Joy continued, “*people are not willing to pay ... to change ... are not convinced of the science behind it*”.

Cost to Consumers

Four students (22%) were concerned with the costs that Climate Change will entail. Fred was the exception to this concern, as he said, “... *another issue is how to implement Climate Change action without a severe effect on the economy ...*”, the students appeared to focus on their personal costs as a projection of Climate Change rehabilitation and lifestyle changes as an outcome of the Australian Government’s Carbon Tax.

The issue of personal cost dealing with Climate Change was an issue for several students, and for Lorna the personal cost was to the exclusion of any other concerns with Climate Change. Joy also spoke of the cost to the consumer. Edith said, “... *at the end of the day, for me personally it is going to come down to how much is it going to cost me financially to change things ...*”. Edith’s response indicated that personal cost would motivate her willingness to rehabilitate her personal behaviour, not a particular ethical position. Lorna and Joy suggested extent of change was a significant consideration, with Lorna saying, “... *[it] needs to be viable, it has to be easy to do ...*” while Joy said, “... *people are not willing to pay for it*”.

Sustainable Consumption

In regards to the above issues stated, students discussed a number of lifestyle changes or attitudes resultant of their opinions. Firstly, six students (33%) mentioned the construction of housing, and in some cases their own housing or what they will/would build. Features such as: additional courses of bricks, solar panels and water saving systems, were discussed as incorporations to make the building more environmentally friendly. Faye said, “*[I want to] ... rebuild our upstairs so that it is more sustainable so that we do not have to use the air-con ... use of double glazing, type of thing so we don’t need to use the air-con type of thing*”.

Colin's main effort was power saving saying, "*Don't use the dishwasher, don't use the dryer, turn plugs off at the wall, don't leave lights on ...*". He also used unleaded premium saying, "*... use premium unleaded to reduce emissions. Do car-pooling, not me, but for my girl when taking her to school*". Edith said she reads, "*... the synergy pamphlets that tell you to turn off all your lights and I do that, I turn off all my power points. ... that's pretty much what I do right now*".

Education for Sustainability

Education as a theme covers several dimensions; however, in this section education relates specifically to lifestyle and attitudes towards key Sustainability issues. Six students spoke about education for Sustainability (33%). Alan talked about education for Sustainability across activism and informal social engagement with friends:

I cannot say that I have done any petitions and things, activity going out trying to convince other people to do things ... I think that if someone doesn't want to do something doesn't matter how much you try to convince them it is not going to change. So just making sure I give my opinion about things where I can, where it is appropriate ... At a social level, ... I do encourage my friends to be ... wiser, thinking about one friend in particular at the moment, about how to do things ... more environmentally friendly, without overtly pushing how I feel. I try and make it clear and help turn people in the right direction ...

Barbara reinforces a social constructivist approach to education for Sustainability, noting:

I talk quite a bit about renewable energies ... because I think a lot of people don't know what renewables are, well not that they don't know what renewables are, because I can hardly say that I knew either but I think people sort of go, oh no well I don't believe in Climate Change and that's it. They are not prepared to enter into any other rationalisation about what they might mean ... I always say to people if even if you don't believe in Climate Change surely you think that moving into a cleaner energy future is a viable option regardless of what your option is ...

Barbara's comment, "*They are not prepared to enter into any other rationalisation about what they might mean ...*" reflects many of the students' lack of technical understandings of Sustainability and Climate Change. Brian talked about education for Sustainability in his family context noting he hasn't, "*... taken a lot of responsibility apart from the family, with the kids ... [I] ... influence friends [about Sustainability] ... [I] start to reflect back ...*". Mary works trying to educate families, "*... about the effects of having more children than they can handle*". Des' positive action is to

become a schoolteacher. Whereas before he used Science in special environmental education centres, he stated “ ... *we need to do environmental education now it really needs to be taken to the general classroom*” and it is this that he will now be doing. Kerry considers her own education will make her more informed so she will have a good base from which to come as a teacher: “*I am looking for areas where I can be more conscientious and use resources efficiently ... I am training to be a teacher so I would like to be more informed*”.

Sustainable Food

Education for Sustainability intersects with personal actions in consciously selecting locally grown, low impact, fresh foods including ethical choices regarding consumption of red meat and other high impact consumerism. Four students (22%) spoke about sustainable food. Ann takes the consumer/consumption lifestyle choice seriously: “... *[I] like clothes, I get second hand stuff and I recycle things ... I send [recycled goods] off to day-care to use them for [activities] ...*”. Ann has also consciously decided to change her eating habits: “ ... *I am just not interested in eating red meat, ... as it turns out it is good for the environment ... there are so many other things you can eat*”. Helen spoke about recycling and reducing, but underscored the importance of: “*Producing our own food sources, and trying to do it in an organic, low impact way*”. Like Helen, Mary tells families about the benefits of using less water and “ ... *growing ... food, and telling others of the benefits ...*”.

Sustainable Transport

Eight students (44%) placed emphasis on improving and use of public transport systems, with two students giving proximity to public transport as a consideration when deciding where to live. Three students (17%) mentioned transport four times, emphasising its importance. Brian claimed there are big and little things regarding transport: “*Big one is transport and that is not just personal transport but where food comes from ... [I only use] the car for when it is really, really needed ... [for] shorter distances ... pushbike or walking*”. Caddy said,

... spending on public transport and even if it's imposing prohibitive cost to make people stop using their vehicles ... have to provide transport ... switching the companies over from using fossil fuels to wind ... same for vehicles to public transport.

Edith emphasised the issues with current public transport: “... *I catch public transport ... [but I] am a shift worker ... [and] cannot catch trains in the morning ... they simple don't run ... should be more access to public transport*”.

Sustainable Energy

Sustainable energy assumes scientific literacy across several areas, including the chemistry of Climate Change and carbon based fossil fuels. It also assumes an understanding of the direct and indirect influences of solar energy. Tidal energy assumes an understanding of gravity and the relationship between the Moon and the Earth. Geothermal energy assumes physics understandings, while the arguments for and against for nuclear energy is premised upon advanced understandings of physics and geology. Four students discussed sustainable energy (22%). Barbara engaged the discussion saying:

I talk quite a bit about renewable energies ... because I think people don't know what renewables are ... I can hardly say I knew either, but I think people sort of go, 'oh ... I don't believe in Climate Change' and that's it. They are not prepared to enter into any rationalisation about what it might mean. I always say to people even if you don't believe in Climate Change, surely you think that moving into a cleaner energy future is a viable option regardless ...

Des sees a link between renewables education and emerging green technologies, “... *when the technologies are available I will be the first one to look into it ... recycling [is] ... important, [and so is] environmental education ...*”. Edith's understanding of renewables is specifically linked to the popular investment in solar energy: for example, she appreciates the need to recycle and limit her carbon footprint, noting:

I recycle, it's a bit lame I know, but I do it ... I catch public transport when I can ... If I could afford it, I would get solar panels ... I read the synergy pamphlets that tell you to turn all your lights off ... All those little things that I have been advised to do I try...

Mary echoed Edith's link to solar energy investments, but underscores a need for financial incentives: “*Investing in solar-power for financial incentives when I purchase a home*”.

Awareness of Economic and Political Issues Linked to Sustainability

Key themes regarding economic and political issues were:

1. Climate Change, carbon footprint and sustainable lifestyle;

2. Taxation, subsidies and trading schemes;
3. Government and business compliance;
4. Ecological protection and water conservation;
5. Educational research for global Sustainability and wellbeing;
6. Nuclear power, pollutants and renewable energy;
7. Ethics and globalisation aid;
8. Globalisation and skilled immigration;
9. Economic compensation to developing nations; and
10. Climate Change refugee relocation.

Climate Change, Carbon Footprint and Sustainable Lifestyle

Climate Change was a significant issue, and was mentioned by all of the students interviewed. Some students discussed their own carbon footprint alongside larger government initiatives to encourage sustainable living. Caddy noted the importance of a collective approach to Climate Change: *“Reduction of greenhouse emissions and how we can do that as a global effort rather than individually ... greenhouse gases and Climate Change as part of our total Sustainability problem ...”*. Alan and Colin also spoke of general emissions and Fred was concerned as how to reduce then stop emissions. Specific measures to combat carbon emissions will be discussed in the next section. However, the students were generally negative towards the Gillard Government’s duplicity approach to Sustainability, with Joy saying:

... the government is governing for a whole nation of people who have different ideas, but I personally cannot see how destroying our environment purely for an economic purpose is plausible. But hey, that’s where we find ourselves.

The GDE-P students reiterated the importance of buying locally grown foods as one way of reducing their carbon footprint. Brian stated his frustration at large corporations importing food:

... eating fresh food ... looking at where they have come from ... [it] frustrates me ... things that are brought from halfway round the world ... [I make a] conscious decision to try and buy local ... [seasonal produce] from the other side of the world will run out of puff eventually.

Water wise behaviours appeared to be a key concern for students, linked to government initiatives to reduce water use in Australia. Personally, Alan stated: *“[I try to] be as*

water wise as possible. Encourage the family and kids to do the same with regards to showers ...”. On a national approach, Alan stated:

So money towards developing new sources of water: for example, desalination, purifying, recycling ... Government making rain tanks essential/compulsory on all new houses would go a long way as well. [I’m] not quite sure why that has not happened yet. When they pushed it before, they could have gone quite a bit further ... [A] little while ago, they were giving rebates and this could have been pushed further. Piping water from other places is a waste of time as you are just going to drain it out from somewhere else.

Brian mentioned some of the government actions and discussion on water use:

I know over East there is the Murray Darling management and that has been ongoing for many years ... In WA I had the privilege of going to Kununnara for work and just seeing some of the vast river systems and water supplies and so on. I think that’s one area that the governments locally can start to look. How we can be good stewards ... I know our current Premier [Colin Barnett] dabbled in the whole topic of the issue of water ...

Fred suggested the government should research incentives for more sustainable water use: “Encourage businesses to research better techniques for farming. Reward households who use less water than their quota”.

Taxation, Subsidies and Trading Schemes

Carbon emissions taxation and trading schemes were a key concern for 12 GDE-P students (67%). Helen was particularly concerned about carbon emissions, stating:

I think they need to certainly stop giving the big carbon emission, big companies that have massive profits, they seem to keep getting let off. I know there are so many different factors that affect in terms of economics and stuff like that. Really I just believe that they need to start making, you know if you are a carbon producer or on a big or large scale you need to pay for that or you need to be doing something to counter that or be given the incentive to look at doing other, getting the energy in other ways ...

Taxation (or tax incentives) was popular among students; Ann stated: “I would introduce a tax ... tax concessions for industries that are sustainable as opposed to those which are not. This is an obvious, logical thing to do”. When commenting as to whether the carbon tax was positive or negative Brian said, “... it is bringing an issue to our hip pockets and to our collective mindset overall ...”.

Some students were concerned about the economic impact of Climate Change initiatives. Fred claimed:

... there is no way to implement a Climate Change model without an adverse effect on the economy ... I would think it unwise to implement any drastic Climate Change measures that may adversely effect the economy.

Faye echoed this sentiment by saying: *“If they can find a way to reduce the cost and increase the power generated by wind farms and things like that it may be useful”*. Joy noted the potential for Climate Change initiatives to escalate socioeconomic division in Australia, stating:

There has to be some degree of user pays ... people would say it has to be fair ... hard to be fair when you have such inequality of wealth ... it is going to cost money, people are not going to like it.

Some students mentioned emissions trading schemes; however, most students echoed Irene’s perspective: *“My answer would be yes [to the Government allowing carbon emissions to be traded on the stock market], but I have to say I really do not know much about that”*.

Similarly, three students (17%) agreed to tax fossil fuel producers, but urged caution in penalising producers too quickly. Des commented, *“... [you] have to look at it on an individual basis ... [fossil fuel producers] should be subsidised to help make that conversion over time”*. Faye echoed a planned conversion by saying, *“... give them [fossil fuel producers] a timeframe to reduce them”*. Kerry acknowledged the need for fossil fuel producers to research alternatives: *“They need to look at the cause of the problem ... if there are alternatives ... what other options [are] available ... I don’t think its clear cut”*.

Students also stated the need for sustainable living to be subsidised by the government. Five students wanted better public transport and infrastructure. Edith supported the government subsidising public transport: *“Absolutely for sure ... I have to pay public transport at a full-time wage earner’s wage ... if it was cheaper for the average working person a lot more [people] would use it”*. Most students supported government subsidies for families to shift to renewable energies. Caddy, *“... was horrified that the solar panels [rebate had been stopped] ... [it] was flawed and obviously people were getting ripped off ... [but] overall the idea was fantastic”*. However, Des noted the

dangers of new technologies: “... *you don't want to give money to people and then in two years their equipment is out-dated*”.

Government and Business Compliance

The students often saw government as being responsible for all the initiatives associated with a more sustainable Australia in the long-term. The major responsibilities being linked to appropriately subsidised public transport and renewable energy infrastructure. Some students (56%) mentioned the issue of compliance, who favoured a market driven solution to Sustainability and Climate Change issues. However, there existed an overall consensus of mistrust associated with commercial motivation and ongoing interests. This mistrust also extended to the relationship between government seeking taxation receipts and accommodating big business interests. Therefore, the students often perceived incongruence with government Sustainability policy and its facilitation of corporate business as usual. Alan noted: “*as far as putting a price on carbon, big business are going to pass on the cost ... if you ... want big business to stop you have to ... make it cost them and they might [change] ...*”. Alan was critical of the way government policies contradicted various public initiatives, “*I think as far as policies go, it is a very grey area. I don't think you can say what would work ... until you give it a go*”. Caddy, commenting on the national initiatives noted: “*The carbon tax [is a good idea] as long as the tax ... is spent on renewable energy sources, replacing and scaling down ... [the] use the fossil fuel[s] ...*”. Fred took a market-based approach to reducing carbon emissions by rewarding businesses that are sustainable:

It ... seems there is no way to implement a Climate Change model without an adverse effect on the economy ... there is an inverse relationship between Climate Change policy and the economy. While the European debt and global financial crisis continues I would think it unwise to implement any drastic Climate Change measures that may adversely affect the economy.

Des was cynical about money and big business, noting:

We live in a world right now where money and generating money is the big priority, it seems like everybody is out for themselves. Whether it is in our direct environment or on a larger global scale, every country out for themselves. We talk about global economy, but it just seems that everybody is trying to get the biggest piece of the pie without really being concerned about what anybody else is doing. So I think as long as we don't realise that we need to function more on a global scale now as far as the economy goes and everything else goes I don't think it is really going to have a good impact on the environment, because whatever someone does on one side, if its not applied on the other side it is not really effective.

Ecological Protection and Water Conservation

Environmental conservation was a concern for 13 students (72%). Brian stated the moral obligation for people to protect the environment, stating:

I think looking at the environmental side, the whole, to my mind, the overarching issue is stewardship, and that is not just for the current generation, but for those that follow.

Ann supported environmental protection, saying:

I personally think that it is a good idea to preserve as much of our untouched environment as we can ... it seems that human development is taking over everywhere and these small pockets should be preserved ... Perhaps you need to look at how we ... reduce, you know like paper, or whatever it is, [and] find more sustainable ways to do things rather than destroy pristine habitats.

Alan noted the challenge of achieving balance between environmental protection and economic drivers:

We need the trees to get rid of the carbon dioxide so we can breath. But once again, as long as it is economic to chop down trees, I really do not see much changing ... Government does [place the economy before the environment], and business does, and as long as government and business are running the country, I think something should happen but cannot see it happening until it costs too much to do it.

Paramount to environmental concerns was water use. Four of the GDE-P students interviewed mentioned the need for policies, planning and management specifically in regard to water use and farming. Ann stated: “*With water, obviously they [governments] need to look at the way planning and infrastructure*”. Barbara echoed the necessity for planning, particularly regarding agriculture: “*... the government should manage what water is available, in terms of what’s viable for us to grow in terms of crops*”. Des also spoke about agriculture:

... they [the government] need to look at what crops they are growing and how much water it needs ... [it is] unrealistic to develop crops that are big water users ... [and] irresponsible to grow massive amounts of crops to feed to cattle.

On the topic of desalination plants Alan reiterated the link between environmental protection and the economy, saying: “*[they] are quite effective but not sure about the costs involved ...*”. However, many of the students were unclear about desalination.

Irene said:

I don’t know if I know much about that. One of the biggest things would be dealing with the salinity, and one of the things would be

taking the salt out of the water or using recycled water. But I do not know much about that.

Educational Research for Global Sustainability and Wellbeing

One of the complex issues found during the interview process was the link between research education for Sustainability and wellbeing for communities and individuals, mentioned by 11 students (61%). Many of the students found it difficult to articulate the interrelatedness of these themes, thus reflecting the same complexity that UNESCO and other global organisations have encountered over many decades. Ann saw a strong link between Sustainability and the Australian Curriculum: *“Seeing that Sustainability is part of the curriculum it is a good thing, I’ve noticed in schools that kids are very knowledgeable and very interested ...”*. Ann saw this approach in school as personal motivation for her to engage in cross-curriculum Sustainability themes. Caddy saw education and Sustainability as a global responsibility for Australia, noting:

Internationally, I think the government should try to educate ... countries that possibly don’t have the knowledge or ... the delivery systems we have ... I don’t think we are delivering the knowledge very well on a national level ... I don’t think ... [developing] countries have those delivery processes, so I think we should assist those countries with that ... We should lead by example...

Faye is an advocate of a strong, independent education program that provides an evidence-based approach, explaining:

Possibly an education program for the general public that isn’t government led or led by western [hegemony] ... One that is completely independent and they would have panels or guests ... from ... various organisations and allow debate to take place.

Mary believes that a more rigorous Sustainability message should be presented through public education, noting the government needs to: *“Educate more about the dangerous effects of overuse in more ways, as opposed to ... pamphlet[s] ... half hidden in your electricity bill envelope!”*

Nuclear Power, Pollutants and Renewable Energy

Nuclear power provided a division of perspective from the students, and was mentioned by 17 students (94%). Many students identified nuclear energy with a non-carbon solution; however, following the very public tragedy of the Fukushima incident, many also appreciated the complexity of risk, waste management of extremely toxic radioactive material as well as serious concerns about weapons of mass destruction. An

overseas student explained that in France nuclear energy was the cornerstone of public energy. What was absent in the nuclear debate from the students was the understanding of the intense link to carbon investment associated with establishing the infrastructure including fossil fuels, associated with mining ore, producing concrete and steel. Debra stated Fukushima changed her opinion of nuclear energy, noting:

... if you had asked before the question before what happened in Japan I would say yes, but – Australia [is] not part of any tectonic plate, it is quite stable country I do believe that's where we should go.

Brian's reply echoed Debra's response:

... risks are huge we have seen some of the results in Japan ... managing nuclear waste which affects generation after generation ... cautious support I would give it on a limited basis

Caddy was very cautious about nuclear power and the risks that it presents:

No, not a priority ... definitely coloured by the sensationalism about the immediate health risk of things going wrong in a nuclear plant ... a 50-100 year plan ... probably see that it has a place ...

However, Lorna thought nuclear energy should be considered: “... it shouldn't be ruled out ... [it shouldn't] be a priority ... honestly, I don't know enough about it, but I know a [bit]”. Des noted some of the dangers of using nuclear energy:

That is a big question [overseas] ... we do a lot of nuclear. Nuclear was looked at for a good solution for a while but in the end it still has by-products that have to be stored and are decaying for ages and again some countries take their nuclear power plant materials and send it to another country where their laws are different and they bury it god knows where ... somewhere they have found that they have been dumping it in the ocean for years now, so no its not a good solution, I think there are other alternatives to it that need to be looked into before.

Fred saw a combination of nuclear and renewable energy sources as being part of a sustainable future. However, Fred was cynical about the motives of big business maintaining that they collectively block new green technologies. He explained:

If it [nuclear power] is proved to be safe, and the waste can be disposed of safely, I think nuclear energy should be the main priority ... Electric cars, they can easily be made and sold, however the oil companies/car manufacturers will not let them proceed ... If things are given a monetary value business will do as much as possible to ensure that supply does not run out.

Lorna, when discussing pollutants, confirmed a majority perspective that carbon is the primary pollutant. She reinforced the public debate covering Climate Change and the

need for incentives and ongoing research and policies that guide market-driven solutions. Lorna said:

I think there should be incentives for ... companies and individuals ... to reduce carbon emissions or ... research ... Overseas, I don't think we should boycott countries ... [but] if we have got the choice of two products that are similar price and you know, and we are importing or we are exporting our goods and they have got two ways they are going to be processed [to determine the] ... carbon footprint, we should go to the other people [who produce goods with the lowest carbon footprint].

Students discussed the importance of developing renewable energies. Des said:

... once the new technologies come out it is important we support it, if electric cars come ... we should start buying them, if solar panels are available ... [it is] important to integrate [sustainable practices, such as] ... water saving systems you can install ...

Helen noted the limitations of electric cars, stating: “*I am not into electric cars because of the whole battery situation*”. However, she acknowledged the need for renewable energies: “*... we should definitely be looking into geothermal ... solar ... harnessing wind and also using wave technology ...*”. Edith underscored the public need incentives to use new technologies based on renewables:

Obviously we have a lot of old technology that is relying on fossil fuels ... old technology needs to be phased out to introduce new technology, whether that be electric cars or whether that be whatever the government and populous choose I think there needs to be some incentives and subsidies ... and use new technology that is safer and more environmentally friendly.

Faye saw the complexity of the transition from traditional fossil fuel towards renewables, explaining:

If they [the government] can find a way to reduce the cost and increase the power generated by wind farms ... it may be useful but I know the cost of all of that produces quite a small amount of power ...

Ethics and Globalisation Aid

The majority of students (61%) understood the ethics and responsibility of a wealthy country, like Australia, contributing to globalisation aid in developing countries. Whilst most were very supportive, other students had conditions attached to the type and amount of aid that should be forthcoming. Alan summarised the critical awareness of the ethics associated with aid:

Yes I do [think we should provide aid]. I think we all have ... a global consciousness ... [I] have come to accept that what one country does effects all the countries ... we have a moral imperative to help ... not just their economies but their environmental standards ... an environmental global organisation of representatives [needs] to come together to try and work out how they can spend the money, but work out in conjunction with each other ways to help the environment ... If you get a lot of politicians together ... nothing happen[s]. [I] cannot think of anything other than that, a global governing body [like United Nations] ... you need all the countries [to] want to work together ...

Joy saw Australia as having a moral obligation to use its wealth and research to help others, “... we are a very rich ... country compared to these developing [countries] and I think we have ... great research, and great resources ... we should share ... with the rest of the world”. Kerry supported Joy’s statement, but said: “... we need to make a contribution based on making sure we have looked after ourselves as well”. Like Kerry, Helen also believed the provision of aid should be conditional:

[We should help] ... if we are responsible [for contributing to Climate Change] ... providing those countries with resources that are contributing to Climate Change ... or if they are our immediate neighbour in our area [geographical location].

Mary and Faye also placed emphasis on Australia supporting its own needs before helping other nations. Mary replied, “... our own country needs to be prioritised before looking at it at a global scale ...”; while Faye said, “... we use a lot of [resources] and we need them [developing countries] as much as they need us”.

However, other students were emphatic about Australia’s moral obligation to help developing countries. Brian stated:

I think a country that has ... the privileges and relative wealth Australia has, I mean it really is a very, very wealthy country, then to partner with [developing] countries ... makes excellent sense. Because we don’t live in a vacuum, we live in a world where we have neighbours near and far, and we share that same world ... Yes. There are huge issues, there cultural and religious, some countries may of course not want that help ... [but] we are willing to lend a hand ... globally.

Globalisation and Skilled Immigration

Fourteen students (78%) were in favour of skilled immigration, but two students said skilled immigration was not beneficial if it were detrimental to the environment. Debra,

an immigrant, spoke in favour of skilled immigration four times and noted the technical knowledge they provide:

... that's how the Australia could increase [its] population ... encourage people ... we cannot just waiting for someone from other country to come and fix it ... go to UK and bring a whole lot of English nurses.

Edith saw the issue of skilled immigration as part of the global market of supply and demand:

... at the end of the day if there is a job to be filled and you cannot fill it from ... [Australia] ... they can get it from overseas with someone that has the qualifications

Ann said: “... there is an argument for training people at home. Skilled [immigration] may be a short time fix ...”. Caddy, like Ann, was in favour of skilled workers in the short term “... but the long term plan would be to spending a lot more money on developing our own scientific and skilled knowledge within”. Irene saw skilled immigration as part of an aid package. She noted:

... yes, but we also need to build our skill base in Australia. I do not have a problem with ... bringing skilled labour ... if that was included as part of an aid package ... Especially if we establish relationships with those countries and build up their skill base ...

Barbara support skilled immigration, but emphasised the associate complexity, including the moral obligation and injustice:

[Skilled immigration is fine] ... but then it is at the expense of the country that they leave ... I don't know how, you ... compensation ... how you would balance that. I ... see ... highly educated people from within their own countries come here ... those qualifications are not valued ... as highly as they might be in their own country ... if you bring a doctor from China and we don't let them be a doctor, then what's the gain there.

Economic Compensation to Developing Nations

Seven students (39%) thought there should be some form of compensation to those countries from which Australia sources professionals, while eight (44%) were opposed to any form of compensation. Edith said:

... No ... it's every man for himself ... If you are an African ... and you have a degree in medical ... you are going to be headhunted by another country, then go for ... more dollars in Australia ... Do I think Africa should be compensated ... hell no, they should pay their own people ... if they want to keep the research there. ... if Australians get poached from America or the UK or Japan we don't get compensated ...

Kerry saw skilled immigration as a personal choice: “No, it is an individuals choice to relocate, we should not be punished for that [compensation].” Debra contended:

I don't think [there should be compensation], they come here, they make money ... but at the same time they will help their parents and families in the country that they come from.

Brian cited the example of a doctor from a developing nation coming to Australia and the obligation of compensation:

... we think it is great when we get a doctor out of Kenya to work here. Well what about the community that they have just left ... there is an obligation [for compensation] ... [that] should be looked at.

Colin expressed a very strong view about doctors trained in developing countries:

No I am dead against that. They seek skilled workforces from countries that cannot afford to lose those people ... rather than educat[ing] our people they [Australia] ...steal theirs and put ... [developing] countries in a worse place. You go all through the wheat belt [and] nearly all the doctors are African ... [they solve our doctor shortage] ... but who cares what happens [in Africa?] ...

Helen saw complexity in the compensation issue and noted:

Yes if we are just taking, but I guess in the long-term you think it would benefit that country ... [Compensation] Only if it is an unfair, like if we are just taking people and nothing is going back to that country ... [for example, increasing their] knowledge base, or ... our own people going, or they are coming here learning something and taking something back.

Climate Change Refugee Relocation

Eleven students (61%) considered Australia should help relocate Pacific Islanders should their communities be threatened by rising sea levels, caused by Climate Change. The majority of students saw a moral responsibility from a fossil fuel exporter, such as Australia, providing relocation as compensation. Colin was emphatic regarding the moral issue: “Of course you should, don't you by law have to go and aid a sinking ship?” Ann's initial response to the issue was a concern for Australia's sustainable population; however, her reflection on the moral issue associated with Australia's contribution to global greenhouse emissions as an exporter resulted in conditional support for relocation. She said:

... I [initially] said that we should not import any people and elevate them to first-world lifestyle because it is not sustainable, but on the other hand, in terms of being a good neighbour, [if] they are about

to sink into the ocean ... we should probably be the ones putting a hand out to help them ... I don't know, does that mean that they come into our society and are assimilated in, or do we find a nice little island that we are not using and we say that you can all move over there.

Brian was unequivocal in underscoring the moral responsibility to relocate Pacific Islanders:

Yes definitely, they are near neighbours and places like Tuvalu we could have walked around in the time we have been chatting and next year in half the time, yes ... In terms of if there is a sustainable future for the Tuvalu's of this world then we may be able to support that, but if ... it is time to abandon ship then we [need to] put our heads together with countries like New Zealand and others and ... help with relocation ... we need to work with our neighbours ... [and other] wealthier countries ...

Des provided a conditional commentary on relocation: “*Is Australia solely responsible - no. Can they afford to - if they can - and maybe it can be done, in partnership with other countries [such as New Zealand] – then yes*”. Two students (11%) did not think Australia should help Pacific Islanders. Faye did not agree that Australia had a moral obligation; however, part of her negative stance linked to her acknowledgment that she did not fully understand the science behind Climate Change, and the cause of rising sea levels. She said:

No. I just think they do not have to come here, they can be, I think it would probably be, help them move in terms of physically moving them in terms of transport, but I do not think that they necessarily need to come to Australia. I think there are other islands and other nations that they could be helped by. I am not sure, I don't know enough about the islands that are being flooded.

Attitudes Toward Sustainability Population Policy

Key themes determined regarding population and population policies were:

1. Population planning and policy;
2. Family size and family support;
3. Equity issues and moral support for overseas refugees; and
4. Immigration.

Population Planning and Policy

Planning for a sustainable Australian population was a primary issue for all of the GDE-P students interviewed. Some students supported a larger population, as long as the

government adequately planned the infrastructure required to support an increasing population. In addition, many of the students were unaware of Australia's current population and in respect to sustainable population they appeared to be estimating figures. Barbara explained her perspective on planning:

I have lived in Melbourne for the last 10 years ... For me, when I think about Melbourne I think 'oh my god, that city could not cope [with population growth]', but then I think well the government is not doing anything so that we could cope. They have weird conflicting arguments about road versus public transport ... I think that we could sustain a huge population really if we put the planning in place now to kind of allow for that in the future, but I just don't think that their perspective is big enough ... the way things are now, I think the cities will go into collapse under a much bigger population. But I would definitely fight for a bigger population with better planning ...

Irene supported Barbara's perspective. She stated: "... [I] think it has more to do with long term planning rather than the number of people ...".

Some students (56%) did not see population planning as an immediate concern, but noted the need to plan in the future. Colin stated: "Not at the moment, I mean I am, but I am not worried about the population now but I am worried about it down the road".

However, Colin also noted the influence of politicians in population growth: "... politicians are pushing for more and more people to be coming in. ... There has to be a [sustainable] level". Like Colin, Ann was not worried about Australia's population increasing, and identified defence as a justification for a *Big Australia*:

... personally it is not something that I am worried about as it is not something that is in my control ... the reason why there is a desire to increase the population in Australia is so that we can protect ourselves in defence reasons then in the global market so that we are actually a player ... Well if we are to stay a country with a population of 20 million indefinitely we are not going to be able to look after our own ... We have a big land mass but a small population, so that would become an issue ... the rest of the world is going to want to move here and they will do it by force, might not be in the next 50 or 100 years, but if there is an imbalance... [we] need to keep up with the world. I am not saying we need a billion people in Australia, but, you know, we might need 100 million ...

Edith was not worried about an increasing population in Australia, but suggested, "... we need to make it sustainable ...". Faye also noted the need to ensure sustainable resource supply for the population: "one [a population size] that can be supported by the land and the economy...".

The students were also concerned about policy affecting population growth. Colin was critical of the baby bonus encouraging population growth, without adequate planning to support an increasing population. He said: “[For example] the baby bonus, they want more and more people. ... you have more people and you are not acting on Climate Change then Climate Change is only going to get worse ...”. Irene was also concerned about increasing demand on public sectors: “ ... make sure it is sustainable for public transport, facilities. ... making sure our health system does not get overloaded ...”.

Caddy suggested education was required to inform people’s choices. She said:

I think have discussions [open debate to educate people] on population growth and [to discuss options for] kerbing population growth. Also, that ties in with that making sure that we solve the [issue of unsustainable population growth].

Debra, who was born overseas, did not see population growth as an issue for Australia and was emphatic about population policy: “I don’t like the Government deciding on too much in peoples’ lives”.

Family Size and Family Support

Most of the students offered a conservative view with respect to providing family bonuses to encourage increased family sizes. They could see a negative impact on Sustainability by encouraging family growth without appropriate education. One student, a parent, also identified the reality of ongoing costs associated with children versus the short-term incentive offered by a baby bonus. Other students explained the complexity by discussing the impact of both immigration and Australia’s responsibility to relocate refugees.

Seven students (39%) wanted policies that limited family size. They were negative towards the baby bonus, with Alan stating:

As far as population control goes, I think getting rid of the parenting payment ... any more than two children you would cut off child support. Would stop all those people that cannot afford to have kids, pumping them out.

Colin was extremely critical regarding who benefitted from the baby bonus:

... reduce that stupid baby bonus so that 16 year olds don’t go out and get pregnant to get \$1000 not realising that it costs a million bucks to raise a baby ...

Mary discussed how the welfare system conflicted with other policies associated with proactive Sustainability. She commented:

Based on more people coming through the welfare system we tend to make rash decisions about giving financial assistance ... that tends to be misused ... [the] Government ... make rash decisions about 'resources' ... [based] on their electoral agenda ...

Several students (39%) recommended a sustainable replacement strategy of two children per family. They did not advocate a *China policy* approach, but reinforced the need to be responsible for the ongoing demand on sustainable resource use. Alan was pointed in his criticism of generous government support for family enhancement:

Obviously cutting off the family support over a certain amount of children ... Two children is fine, that the government would support you with tax incentives and stuff like that they do now and anything over that you pay for it yourself. I think that would cut down a lot of excess population ... There won't be so many people coming through just so they can get money and having kids just to get money, that sort of vicious cycle.

Mary saw a problem in governments providing easy money for families:

If we start taxing families for having more [than two] children then believe me, many 'parents' would perhaps think twice as unfortunately, some families I have worked with are purely driven by money, even when considering having more children!

Similarly Irene was concerned about the demographic of parents accessing parental payments: “... a lot of the people who are in the low socioeconomic status are the ones having the large families”.

Some students made a distinction between education for family size and policy forcing limited population growth. Many students used China as an example for not introducing population policies. Brian said: “... encouraging people about the number of children, I think it is educating and encouraging and not coercion at that level, the Chinese ... of course there was coercion”. Barbara covered some complex issues regarding sustainable population from a global context. She noted:

The thing about it, everyone looks to China, one child policy, is that where we are headed, I am certainly not an advocate for that, but I certainly think that perhaps in general population in terms of having children ourselves perhaps think more than they have in the past about why it is they want to have children and where these children will end up in terms of this global population boom that is going on and how sustainable it is to have ... I mean globally, as in terms of

2050 we will have 9 billion ... I know that a lot of that will be to do with India and China population escalating out of control ... I don't think we have any right to ask them to curb their population when we are not doing anything about ourselves and we are not educating our people in the same way.

Some students encouraged increased family size. Edith was adamant about increasing Australia's population: *"Australia is a very large country ... being able to expand across a really large country ... we should breed and grow"*. Helen also supported pro-population, stating: *"No ... [I] don't think the Government should be able to impose on people so that they are forced to make that decision"*. Be that as it may, later in the interview, both Edith and Helen went on to say increased population resulted in greater use of resources. Joy expressed an incomplete understanding of Sustainability linked to population. She said, *"I am not sure that family size has got a lot to do with Sustainability ... it is absolutely a choice of how many children you should have"*.

Equity Issues and Moral Support for Overseas Refugees

Eight students (44%) discussed equity issues and overseas support. Some students saw the issues of population driving inequality across the planet. In particular, they saw an amplification of the situation in developing countries. They also identified Australia's privileged position as a first-world country and one that should provide generous leadership.

Joy was more concerned with global inequality: *"... there is the wealthy who have everything ... [and] the have-nots ... In an ideal world, not that I want to live in a socialist or communist country, but – there should be some level of equality"*. Kerry supported Joy and noted: *"... they [international organisations] need to look at fair and equitable distribution ... making the most of what we [citizens of the Earth] have"*.

Students' primary concern was the need to educate developing countries on contraception and family planning. Barbara said: *"... masses of research that show that educating women ... dramatically decreases birth rate ... educating women is really where that lies ..."*. Debra agreed with Barbara's response: *"... [it is] part of Sustainability ... education of family planning ... [but ultimately] that's the individual's choice"*. Kerry was undecided on the need to educate women in developing countries. She said: *"Not sure, I am not sure if that is a breach or appropriate or not or a bit of a colonial type act"*.

Helen disagreed with Australia offering education on family size for developing countries: "... [it] is like putting our nose into someone else's business. It is different cultures ... it is their responsibility". Colin was concerned about the moral obligation of religious institutions and their inability to promote scientific-based birth control in developing countries that were under extreme population pressures. He noted:

I was watching Stephen Fry and two Catholics debating on whether the Catholic Church was force for good ... I got on the Internet, and of course they brought up birth control in Africa ... the most positive way to get Africa to get over its situation is to give women control over birth and their bodies, and the second best way is to set up women in small industries, and all the church women said is 'all we hear, we don't let them have contraception'. Well that is the problem...

Immigration

Immigration proved to be a complex issue and was discussed by five students (28%). Some students thought redistribution of the global population as a responsibility of a wealthy Australia. Other students took a self-interest approach, advocating restrictions to immigration and refugees. Brian emphasised the complexity associated with reaching a sustainable population for Australia. He said:

... 40 million is a stretch, but that impacts on immigration policy, how much we encourage people to have children ... how many ... [I] think immigration is the easier one to control ... immigration is a lever that can be swung more easily ...

Lorna saw education about Australia as being central to immigration, and noted: "...immigration people coming in, there needs to be education about how things are done here [in Australia]". Lorna implies a great deal of social infrastructure is required to support diverse populations.

Barbara was pro-population and immigration. She noted:

I know people in Australia are a bit funny about population. We have a big country and a very small population, but you know a small population means ... in terms of infrastructure ... being able to support a larger group of people ... [Australia] should be letting a lot more children in [through immigration]. I don't think they should be encouraging people to have lots more children per family [within Australia] ... I think that Australia could afford to be much larger in terms of population.

Irene supported Barbara. She said:

I think in Australia we are very privileged we do not have a very large population for the area that we have. I think that we need to be able to provide space for people who are refugees or immigrants. That said - I believe it needs to be made sure it is sustainable for public transport, facilities, and bits and pieces about the state. I believe in making sure our health system does not get overloaded. But I think that has more to do with long-term planning rather than the number of people. So as long as we are planning for that amount of people then I think they should get the balance right.

Summary

The interviews uncovered important perceptions associated with the four interconnected factors investigated. In terms of where the students gather their information on Sustainability, most sought educated, scientific and non-commercial media. The majority of students were concerned about biased propaganda and even deliberately sponsored misinformation about Sustainability and Climate Change. Some students did not trust government departments.

In terms of lifestyle, attitudes and behaviours towards Sustainability, the students were emphatic that Climate Change was a scientifically testable phenomenon requiring urgent action to accommodate a sustainable Australia and global society. Resource depletion was a real concern and most students offered an insight into ways of reducing resource use, energy consumption, and offered practical solutions. Renewable energy was also an important consideration. Most of the students were aware of the unsustainable practice of expanding the carbon emissions into the Earth's atmosphere. Most students saw a need to promote renewable non-carbon energy, such as solar, wind, wave, geothermal and other forms. It could be many students were unaware of recent technological developments in generation of nuclear energy.

Students demonstrated a diverse range of personal appreciations of the interplay between economics and politics, linked to Sustainability. Many saw their lifestyle choices as expanding their carbon footprint and thus contributing to Climate Change. Students cited taxation, subsidies and emissions trading schemes as mechanisms that governments could use to enhance a sustainable Australia. Government and business compliance was another tool that could be used to regulate carbon emissions, as well as advocating new green technologies. Ecological and water protection was reinforced by the majority of students as was the essential development of educational research for Sustainability and human wellbeing. The nuclear power debate underscored a great deal

of uncertainty about the science and risks associated with radioactive waste and geophysics for the location for these strategic and controversial plants. Whilst the students perceived renewable energy at a populist level as a proactive investment, the technicalities of green technologies were not fully realised.

Overall, the students had a strong sense of the ethical and moral obligation associated by the ongoing globalisation of the planet and the responsibility of Australia as a wealthy developed nation to lead by example, and appropriate meaningful long-term aid to developing nations to accommodate both biophysical, as well as social Sustainability outcomes. In the globalised context, skilled immigration proved to be a divisive consideration with some students seeing it as part of a free-market approach, while others were hostile to the notion being seen as only a short-term solution to the Australian governments failing to provide adequate education or opportunities to develop their own people's skills. Also economic consideration to developing nations proved to be a contentious topic. Again, some students saw a moral obligation to provide compensation for inequalities perpetuated on vulnerable societies by wealthy parties. The majority of students saw a moral obligation to relocate Pacific Islander refugees to the Australian mainland. Students were aware that the wealth gained from Australia's export of fossil fuels and other minerals were both indirectly and directly contributing to rising sea levels.

Attitudes towards sustainable populations provided an insight into diverse perceptions. Overall, population planning was considered to be a positive initiative, as long as it was educative and democratically promoted. Students found rigid or authoritarian approaches to forcing family planning to be abhorrent. Family size and family support caused a contrast of opinions. The baby bonus was seen as an unfortunate mechanism for encouraging some sectors of the community to rush into pregnancy without fully acknowledging the long-term economic costs of raising a child, let alone several children. Overall, the majority of students provided critical insights into the equity and moral support for overseas populations, and refugees arriving in Australia. Australia's capacity to provide education, material support, diplomatic and institutional leverage, fostering wellbeing and long-term outcomes in developing countries was forthcoming. Immigration was another controversial theme. Students were quick to see a moral obligation to support global immigration into the Australian context as part of its leadership role. The extent of the immigration quantum was an unresolved issue for

many. The need to provide adequate and meaningful social infrastructure to support any immigration program was deemed essential to a sustainable Australian population.

CHAPTER SIX: DISCUSSION

Introduction

In Chapter One, the researcher introduced the scope of UNESCO's education for sustainable development, which includes essential sustainability development issues that are integrated into teaching and learning contexts. The following sustainability issues apply:

- Biodiversity;
- Climate change;
- Disaster risk reduction;
- Poverty reduction; and
- Sustainable consumption.

Proactive teaching and learning has the ability to motivate and empower students to modify their behaviour and initiate meaningful action towards sustainable development. Therefore, an educational approach will enhance the competencies of (UNESCO, 2005) by encouraging:

- Critical thinking;
- Imagining future scenarios; and
- Making collaborative decisions.

As previously discussed, achieving sustainability (both within Australia and globally) is premised on a society that makes active changes regarding sustainability; which is reliant on the workforce, general public and political parties being fully informed regarding the complex notion of sustainability. It also must acknowledge the notion of sustainability for contemporary Australia is inclusive of complex and interpretivist processes as shared human cognitive constructs (Walsham, 1995). Subsequently, achieving an informed society has implications for the way primary and secondary school teachers are initially trained in pre-service teacher education programs. It is also anticipated teachers would need to receive ongoing professional learning to ensure they remain informed and equipped to educate for transformation towards a sustainable society.

The scientific consensus and the United Nations underscore the first 50 years of the twenty-first century as a confronting time of transition for the global community in

education for sustainable development, including for children (Flannery 2010; Garnaut, 2008; N. Stern, 2006). International conditions, and in particular Australia's engagement with Asia, will expand opportunities for Australia to be part of large-scale exports including carbon-based energy commodities to China, India and other major economies. The Australian Curriculum has anticipated the importance of the Asian century to Australia in listing the relationship as a cross-curriculum priority, in addition to Sustainability and Aboriginal and Torres Strait Islander Histories and Cultures (ACARA, 2011).

As discussed by Vygotsky (1978), any collective understandings a society holds involve a complex process of socially negotiated constructions that continue to evolve and develop. In support of the process of complexity it is useful to acknowledge Habermas (1984) and see the Australian dynamic as part of his active paradigm of the lifeworld as a bracketed experience. For Habermas (1984) this includes a series of dynamic interactions of language, symbols and organisations that present diverse ideas and values, some testable through the consensus culture of peer-reviewed science.

The collective Australian lifeworld has an indirect impact on teaching and learning across the three levels of education (K-12). Furthermore, these lifeworld interactions include students who enter pre-service teacher education courses. Therefore, tertiary pre-service teachers bring with them a range of competing narratives and intersubjectivities of the broader cultural experience of Australia. The ontology of the perceptions of sustainability was revealed during the GDE-P students' interviews in this research study. The findings in Chapter Five and the intersubjectivity of the interviews expressed as selected vignettes provide an insight into a group of 18 potential primary school teachers whose collective narratives will impact across years 1-7.

In Chapter Six, the researcher will discuss how her findings are linked to key literature and previous studies on Sustainability. As in the previous chapter, the four interconnected factors associated with Sustainability will scaffold the discussion:

1. Sources of information on sustainability;
2. Lifestyle, attitudes and behaviours towards sustainability;
3. Awareness of economic and political issues linked to sustainability; and
4. Attitudes towards sustainability population policy.

In addition, the researcher will discuss the implications for education linked to: ACARA (2011), ARIES, UNESCO's Decade of Education for Sustainable Development (2005-2014) and tertiary institutions.

The literature review outlined more than half a century of information linking science to United Nations ongoing forums covering sustainability education, inequality and global trade. In addition, historical research emphasised a long understanding of population pressures, resource limits and collapses associated with human groups. The literature also emphasised the warnings of the Stern Report (2006), as well as other scientific consensus explaining the pending crisis of anthropogenic carbon emissions. The scale of the pending climate change was deemed as critical as the Pugwash Conference during the 1950s over the impact of weapons of mass destruction during the Cold War.

From the findings it was evident the students, although representing a highly educated self-selected group, exhibited limited technical and scientific awareness of the interrelated complexities of what the UN describes as Sustainability. None of the students presented any knowledge of nihilistic or doomsday scenarios associated with runaway climate change models. Lummis (2001, 2009) and the United Nations (2005) deemed the internalisation of perceived extinction as an important educational and psychological process in achieving change. Furthermore, the work of Weber and P. C. Stern (2011) emphasised the importance of constructed simulations of climate change outcomes to help students' internalise projected situations centred on their own finitude. Even though four students had post-graduate degrees, it must be appreciated that 71 per cent had a background in Humanities/Arts. Therefore, the responses possibly reflected their prior education. Yet the students with Science degrees (29%) only offered limited insight into the scientific and technical side of sustainability. New instruments would have to be designed to search out any of these particular understandings.

Sources of Information on Sustainability

The literature identified a number of international organisations working to define sustainability, all of which provide reliable information on sustainability: for example, Climate Action Network (CAN) is a global network of over 450 non-governmental organisations working to limit climate change to ecological, sustainable levels. In Australia, the Climate Change Institute (CCI) is an extension of the CAN network. Globally, there is a long history of concern covering sustainability. In 1964 the United

Nations Conference for Trade and Development (UNCTAD) was established for the integration of developing countries into the world economy. The integration happened throughout the Cold War era and into the post-Cold War era. The 1972 United Nations Stockholm Conference on the Human Environment started the global emphasis on protection of the Earth's ecosphere. The 1987 Brundtland report, *Our Common Future* underscored three pillars of sustainable development: economic, environmental and social. The Rio Earth Summit in 1992 established Agenda 21, which further outlined the global consensus on environmental conservation, and conventions on both climate change and biological diversity. The Copenhagen meeting (2010) - after the fallout of the GFC - continued the scientific consensus that the global community needed to act in a sustainable way to reduce the impact of climate change and its unprecedented potential to collapse the world economy, as reported by Stern (2006). UNCTAD (2012) defined Sustainability as:

1. Careful management of finite resources;
2. Improved work conditions, as a social condition;
3. A complementary approach to environmental protection, inclusive of social and economic development;
4. An equitable and just global society;
5. The pursuit of economic prosperity, environmental quality and social equity;
6. The plan to integrate environmental and anthropocentric goals;
7. The promotion of social and cultural enrichment; and
8. Sustaining employment and human values, while protecting the vulnerable.

Importantly, Australia played a significant leadership role in implementing UN policies associated with the Decade of Education for Sustainable Development (DESD) through the Australian Research Institute in Education for Sustainability (ARIES). The DESD specifically outlined *ecological sustainability* through the following interconnected systems:

1. Natural;
2. Social and cultural;
3. Economic; and
4. Political.

These interconnected systems are considered across the scope of populations, animal and plant species, ecosystems and natural resources. DESD's rationale is to accommodate informed decisions for the collective future of the planet. In addition,

with the election of the former Rudd/Gillard governments these sustainability policies became embedded in the emerging Australian Curriculum as a cross-curriculum priority (Sustainability).

The majority of students were unaware of the policies of UNESCO and ARIES. ARIES provides Australian teachers with the support of:

[A rich] research program [that] aims to identify key factors and impediments influencing education for sustainability, evaluate existing approaches, and develop effective educational materials and programs to promote behaviour change towards the sustainable practices (ARIES, 2009, para. 2).

The students' ignorance of international and national literature on sustainability reflected the findings of Effeney and Davis (2013). However, some students had read the Science Education unit documents and were developing a superficial awareness of sustainability linked to the Australian Curriculum. The interview responses reinforced the outcomes from Hawkins' (2005) and Kagawa's (2007) studies that concluded educational experiences did assist attitudinal change towards sustainability. However, it is important to note the most significant impact on behavioural change is through national leadership and modelling of good practice, and policy that has strong bipartisan support (Weber & P. C. Stern, 2011). ARIES provides a comprehensive range of practicalities built around solid policy. Furthermore, ARIES sets universities with the task of ensuring social sustainability is an essential part of both degrees and units; linked with occupational health and associative wellness practices; is a natural part of any training and education; and is built into equal opportunity policies and initiatives flowing into the local, national and global sphere (ARIES, 2009). Subsequently, sustainability is embedded within the University's pre-service teacher education programs, consistent with the University's sustainability rationale flowing from ARIES and UNESCO. The GDE-P students consistently referenced their university education as a source of information regarding sustainability; for example, Caddy stated:

... Definitely what has been presented at a university level from my unit. Also, just my associated reading from that unit I think. I didn't have much of an understanding before, and now in a very short period of time I have gained quite a lot more knowledge.

When interviewed about the Australian government's policies across a range of sustainability and climate change issues, students reflected much of the commentary

that was being offered by the mainstream Australian media. Importantly, the students reinforced strong cynicism towards any information that had a connection to commercial interests, reflecting the findings of Weber and P. C. Stern (2011). The power of the Australian media generates a particular bias, especially the commercial extremes that distort or unfairly criticise established consensus science, as demonstrated by Australian Radio 2BG's Alan Jones. As Edis explains, "Jones ... feels little compulsion to cross-reference his statements against the bulk of research published in scientific journals" (2012, para. 3). The GDE-P students reinforced the problem of misrepresentation and commercial bias distorting the common good: for example, Brian stated:

... the shock jocks on the radio could do well to just take a long hard look at themselves. ... I am part of a generation ... used to the 10-second grab on TV or radio. We have to be careful ... I think a lot of the media is distorted and they have their own agendas. ... I am ... pessimistic ... there is a lot of shared and pooled ignorance.

Therefore, the notion of sustainability for contemporary Australians involves a complex interpretivist process, including an ongoing assessment of intersubjectivities, to arrive at a construction of a collective or the shared human cognitive system (Walsham, 1995). Powerful media voices such as Alan Jones or influential business people can easily exercise a privileged capacity to corrupt the narrative. Significantly, only one student referred to a commercial radio broadcaster as a source of information and she explained that her farming community used this radio station as a common communication vehicle.

The discussion of media and its influence reinforced the findings of Wall (2007), which underscored how difficult the reporting of science and environmental issues became when headed against mainstream commercial media. If the dominant narrative of the media is either against or confusing the sustainability and climate change debate, then the general population will reflect the same uncertainty (Leiserowitz, N. Smith & Marlon, 2011). In addition, if political parties present partisan views that project binary policies then individuals tend to lock-in to a tribal political response (L. C. Hamilton, 2012). The dominance of climate change in the Australian media was reflected in the interview responses, directly contrasting the research of the *National Earth Science Teachers Association K-12 Climate Change Education Survey* (2011) (Johnson & Holzer, 2011). Nine students (50%) explicitly discussed climate change during the interviews, with 100 per cent mentioning climate change at some time. The findings of

this research contrast the *National Earth Science Teachers Association K-12 Climate Change Education Survey* (2011), in which 20-30 per cent of respondents did not acknowledge climate change as a phenomenon.

Despite the GDE-P students' limited knowledge of international organisations, with only one mentioning Kyoto, and policy initiatives regarding sustainability, many of the students underscored the importance of independent and science-based authorities as being trustworthy sources of information. Brian summarised the consensus of concern regarding reliable information sources:

... everything is political but they [scientists] ... use ... sound methodology, scientific practices ... to make sure ... they are heading ... in the right direction. The other aspect to this is there is a chorus of members of the scientific community ...

Some students were wary of government communications. Overall, there was a strong awareness of bias and propaganda. The intense political debate after the removal of Prime Minister Rudd in mid-2010, the subsequent election promise from former Prime Minister Gillard not to introduce a carbon tax and her post-election decision to reverse this policy dominated the media throughout the time of the questionnaire piloting and the interviews.

Key Issues Linked to Lifestyle, Attitudes and Behaviours Towards Sustainability

According to Abernethy (1994, 2005), Lovelock (2006), Lowe (2012), and O'Connor and Lines (2008), the Earth's sustainable capacity to support the human population is on the verge of, if not already, being exceeded. Ecosystems have a limited *carrying capacity*. Human populations and corporations behave as if the planet's carrying capacity is infinite. A. D. Brown, (2003), Garnaut (2008), Gore (2006), Lovelock (2006) and Stern (2006) all refer to the scientific modelling that underscores a tipping point and crisis being faced by humanity if proactive sustainability policies are not adopted globally. The extent of the crisis was deemed to be greater than the cost of the two World Wars and the Great Depression (Stern, 2006). Lovelock (2006) spoke of a one-in-thirteen survival rate for humanity. Lynas (2007) carefully detailed the progression of disastrous events that will accommodate as average global temperatures rise. Many in the global community, and particularly in the West, fail to project the reality that civilisation faces if we continue the denial of science. The students did not

reveal any direct appreciation for the enormity of the scientific consensus regarding the pending crisis. However, the students did note some of the impacts and inferred an interrelationship between some of the key factors; for example, Alan noted, “[m]ore people in the world, the more resources we will use...”.

The St James Palace Noble Laureate Symposium (2009) rated climate change as a threat on the scale of a thermonuclear exchange. Gore (cited in Wang, 2010) was emphatic in claiming climate change was a moral issue that usurped political market, national security and employment issues. NASA scientist Hansen (cited in Carell, 2012) said that climate change was a moral issue equal to the scale of world slavery. Markowitz and Shariff (2012) claimed climate change will see the most vulnerable suffer the most, as a minority abuse finite resources whilst a generation lacks the will to tackle greenhouse emissions failing future generations. While the GDE-P students identified climate change as a significant issue in the interviews, they did not make explicit links to the magnitude of fallout from not addressing climate change on a global scale. Any moral issue linking a perceived wealthy Australia to causal suffering in the Pacific Islands or African countries was discussed with caveats.

Since the 1970s, the science of climate change linked to carbon dioxide and methane has been well documented (A. D. Brown, 2003; L. R. Brown, 2006; Diamond, 2005; Leggett, 2000; Lovelock, 2006; Lowe, 2005a, 2005b; Parenti, 2011). Global warming is causally linked to infrared energy being trapped by CO₂ and other gases associated with human activity (Salmon, 2007). The interviews did not elicit convincing scientific understandings even from the four students with Science degrees, including the student with a higher degree in research. Two of the students with Science degrees spoke about climate change; however, the discussion was superficial and focused on the need for action as opposed to elaborating on climate change as a key issue. Des noted, “*Key issue, research obviously, need appropriate data ... I think another key issue is public information, there is a lot of misinformation ...*”; while Helen said, “*I do agree that climate change as a factor is an issue that we need to address and I do agree that people are part of creating that ...*”. Helen’s acknowledgment that climate change is only partially connected to human activity seriously underestimates the scientific consensus that since the 1970s the carbonisation of the Earth’s atmosphere exceeds anything seen for 700,000 years (Flannery, 2010; Lovelock, 2006; Salmon, 2007; Stern,

2006). Therefore, students from this study with a degree in Science enter the sustainability debate with poor conceptualisation of the magnitude of the problem.

Peer-reviewed science, as discussed by Cubby (2012b), continues to underscore a global warming threat of unprecedented scale (“Global warming,” 2012; Hance, 2012). As A. D. Brown, (2003), McNeil (2009), Parenti (2011) and Spratt and Sutton (2008) expanded, the warmer the Earth’s atmosphere becomes the more carbon and methane is released from the tundra stored in frozen soil and drying peat bogs. Deforestation across the planet removes natural mechanisms for storing CO₂ and the potential tipping point with chaotic outcomes becomes a major global risk management consideration. The Earth’s biodiversity and the ocean systems are also put at risk, as temperatures increase and dissolved carbon-based molecules increase the acidity of the planet’s oceans. The interview process did not elicit any level of tertiary scientific understanding from those students who had strong postgraduate qualifications in Science. The self-selected, interested students involved in the graduate pre-service teacher program demonstrated a lack of scientific literacy. Therefore, questions must be asked about the scientific literacy levels of those students entering primary teaching through the Bachelor of Education award, in which their experience in Science is pedagogically centred in a year 1-7 context (often reduced to 36 hours maximum engagement over a four-year degree).

Some students associated their knowledge of sustainability and climate change to the information received through their children. Many of the students were open about their lack of technical knowledge. Technical knowledge is available: for example, covering the impact of the Arctic ice shelf melting due to rising sea temperatures, creating the *albedo effect* (less energy being reflected back into space from the white ice) thus increasing the disruption of the *thermohaline circulation* (i.e., the Gulf Stream) that prevents Western Europe from freezing (Leggett, 2000). Other scientific information in the public domain also explains that methane is 21 times more efficient at trapping infrared energy when compared with CO₂ (Leggett, 2000). Therefore, as previously noted, with the warming of the Tundra regions more methane will escape into the atmosphere.

Only very basic to low levels of scientific literacy regarding key issues were demonstrated during the interviews. The term *carbon footprint* was often used, but not

explained. Students often indirectly referred to causal appreciations of excessive anthropogenic carbon emissions. The notion of renewable energy was often discussed, but not critically analysed or expanded upon in any scientific way; such as Brian, who reinforced the issue of, “... *finite fuels ... and once they are expended they are gone*”. Finite fuels is a broad statement, with often an inference that fossil fuel sources will run down and not meet the energy demand. During the interviews, there seemed to be a disconnection with the notion of supply and the massive impact of the associated carbon emissions. Renewables were often inferred as a means of addressing supply, while some students linked fossil fuels with climate change. The technical implication and integration of the genre of renewable energy in urban design and city planning was not clearly articulated. Nor were associated problems, such as *urban heat islands* linked to domestic-commercial-industrial building and freeway design integrated into projected solutions. However, several students linked renewable energy innovation into discussions about their personal domestic situation, including the design of their homes.

The concept of solar energy was frequently used, but there was not evidence students were conceptually aware of the Sun’s energy being directly linked to *convection* currents (wind) or ocean currents. In respect to the nuclear energy option, many students held diverse views but in many cases claimed they did not have enough technical knowledge to make an informed comment. The students’ limited technical knowledge may reflect the media’s occupation with the consequences of the post-Global Financial Crisis as consistent with the *Nielsen 2011 Sustainability Survey*.

Other factors contributing to climate change, not mentioned by the students, included the massive amount of heat given off by conventional power generation, refrigeration, as well as the heat sinks associated with the roofs and parking areas. At a technical level *Surface Urban Heat Island Intensity* (SUHII) as discussed by Peng et al. (2012), when linked to some four-hundred plus major global cities with huge populations, the impact on both climate change and social sustainability is enormous. At no stage during the interview process did students discuss the integration of green belts (more vegetation) for cooling as a solution. Nor was there any attempt to connect the cost savings linked to power bills if these major urban heat sinks, including contributions from dark roofed dwellings, were removed. Urbanisation was the dominant context of the students involved, except for one student who declared her association with a farming community. Urbanisation impacts stormwater run-off, water absorption and evaporation

and has a major impact associated with the collection of pollution from cities entering into sensitive waterways. As discussed by Akbari, Menon and Rosenfield (2008), in the Los Angeles context green design initiatives could accommodate of 44 giga tonnes of greenhouse gases. Vital technical understandings require professional learning beyond the Science Education unit encountered by the GDE-P students.

Although water conservation was a common theme, again the perception from the students' interviewed focussed on their immediate domestic considerations. There was no meta-appreciation of how super-dams being developed across the planet would disrupt the Earth's surface and ancient river systems with sensitive ecologies: for example, the Aral Sea, or the giant dam construction of China. There was not any appreciation that the planet's water tables are dropping as population increases draw on limited supplies, or the indirect impact on agriculture: for example, loss of local market gardens to urban development.

The Australian context is the most vulnerable to climate change (Lindenmayer, 2007). Throughout the interviews, students did not appear to appreciate the marginal nature of Australia's agricultural land or its vulnerability to flooding, drought and poor soil compatibility associated with British-based farming techniques. With respect to Perth, not one student mentioned the run-off water of recent years has declined by a third of that received between 1900-1975 (Lowe, 2005a). The students did not indicate the trend of increasing temperatures, in excess of 35⁰C (Lowe, 2005a). From a technical point of view, such increases in temperature impact heavily on the protein quantum found in cereal crops produced in Western Australia, thus exposing the limited biomass that can be supported across the Australian continent (A. D. Brown, 2003; Flannery, 1994, 2005, 2010; Jarvis, 2011; Lindenmayer, 2007; Lowe, 2005a).

Soil depletion and soil quality are major issues for Australian agriculture. The theme of soil issues was not articulated through the interview process. The need for extensive use of fertilisers and other mineral compounds to sustain agriculture and horticulture needs adds to the complex carbon footprint and other integrated ecological sensitivities: for example, nitrogen and phosphorous run-off, and sewage management all are important technical challenges. These issues become more complex with effects of unwise land clearing (Beresford et al, 2001) and increasingly frequency of droughts and flooding (A. D. Brown, 2003; King, G. W. King; Yencken & Wilkinson, 2000; Yule, cited in

O'Connor, 1998). Again, students presented perceptions that loosely linked to some themes with agriculture, but the discussion was limited.

Food security was an important area in the sustainability genre that failed to gain any meaningful discussion time. Some students made inferences that linked into the topic but the depth of their knowledge was unrealised. Large populations that can't source their food from their immediate or near environment are forced to locate external produce to survive. Any transaction between nations underscores the need for diplomatic and economic relationships that accommodate the supply of essential foods. The critical realisation of supply links to notions of food and national security appeared to be lacking. The security realisation associated with transporting and protecting food supply incorporates a carbon footprint linked to transportation, refrigeration, waste and protection costs. The World Bank notes that between 2005-2008 the global price of food rose by 80 per cent, pushing circa 100 million people below the poverty line (Hodgson, 2010). Racher (2007) underscored that for every person on the planet there is only 2.39 hectares available for productive food, but this includes deserts, mountains, urban and other factors inconsistent with food production. Therefore, food security is a major trigger point for potential conflict. The GDE-P students did not address the subject of food security with any great depth.

Overall, the students were well aware of how personal choices could help reduce their carbon footprint. Statements regarding reduce, recycle, re-use and renewable energy options seemed to be superficially acknowledged (Popken, 2007). Some students commented about the importance of growing their own food, using public transport over private vehicle use, as well as purchasing local food or second-hand goods. Ann spoke of consciously changing her eating habits, “ ... *I am just not interested in eating red meat, ... as it turns out it is good for the environment [as cows are a high methane producer and water consumer] ... there are so many other things you can eat [for example, kangaroo]*”. However, missing from the discussion was how the pressures on agricultural land and the impacts of climate change accelerate the incalculable loss of biodiversity that is occurring across the planet (A. D. Brown, 2003, Hogo, 2011). Symbiotic relationships, starting at the microscopic level moving through to forests and marine contexts, are the essential systems from which humanity emerged and more importantly, without which, cannot survive (A. D. Brown, 2003). Unfortunately, the

interview responses did not see this conceptualisation being shared to any meaningful extent with the GDE-P students.

There was a disconnection between good intentions and behavioural changes, consistent with Popken (2007) and Wong (2001); some students emphasised convenience or poor government infrastructure from preventing them adopting a more sustainable lifestyle. It was consistent across the interviews that the students looked for strong guidance from government, supporting the research conducted by Bezbatchenko (2011). Therefore, any partisan politics reflected in the media or political policies that antagonised consensus created uncertainty for the well-educated group of participants.

Awareness of Economic and Political Issues Linked to Sustainability

Twelve (12) months prior to the research, the Australian political system had experienced extraordinary levels of partisanship associated with the economic and political nexus linked to the carbon tax versus sustainable development debate. The Labor government claimed the moral high-ground covering leadership in its legislation, committing to a price on carbon. However, the Opposition rhetoric linked the carbon tax legislation with negative consequences for the Australian economy and family expenses during the post-GFC. Thus, any ongoing commitment to climate change action was traded off for political-economic priorities and power (Combet, 2011; Tillett, 2010).

The factors of climate change and the expanded tipping points (Garnaut, 2008; Spratt & Sutton, 2009) were buried in the economic debate and the media's continual attack on the legitimacy of consensus science. The majority of the students picked up the intense rhetoric covering the partisan approach presented in the media: for example, the perception of Alan Jones' extreme views. Students provided insight into the pro-economic position held by the then Opposition (Abbott) and the more long-term sustainability/economic model argued by both the former Rudd/Gillard/Rudd governments. Fred discussed the economic impacts of implementing a carbon tax to accommodate global greenhouse targets:

... there is no way to implement a climate change model without an adverse effect on the economy ... I would think it unwise to implement any drastic climate change measures that may adversely effect the economy.

Fred was more concerned about the short-term impact on the Australian economy during the post-GFC climate, in contrast to the long-term economic catastrophe if emissions were not significantly reduced or maintained (Stern, 2006). Helen was particularly concerned about carbon emissions, stating:

I think they need to certainly stop giving the big carbon emission, big companies that have massive profits, they seem to keep getting let off ... I just believe that they need to start making, ... a carbon producer ... pay ... or be given the incentive [to use alternatives] ...

Daly (2010) best summarised the limits of popular GDP accounting: for example, the costs of pollution clean up or resource depletion, missing forests, extinct fisheries and flooded islands being counted as positives, then perhaps such global accounting needs to be abandoned. In summary, if economic development is intended to increase populations' standard of living and quality of life, then a dead planet is a failed financial plan.

Most of the students were aware of the interrelated nature of economics and politics. The prevalence of economics and politics throughout the interviews reflected the issues in *Mission Australia's 2012 Youth Survey (Youth Survey)*, in which the leading concern was economics (30.8%). The domination of politics throughout the interviews also reflected the diminishing emphasis on environmental issues in both the *Youth Survey* (2012) and in the Australian media, at the time of data collection. They were very aware of globalisation and the competition in which Australia finds itself. However, the concept that sustainability from a global position was not well articulated as part of an international approach to economic development and political consensus as outlined by the United Nations.

Raw nationalism tended to dominate the personal perceptions in favour of an Australian-centred view of trade and economic development. It must be remembered that the research was conducted in the period of the post-GFC. Prior to the crisis, the media and politicians were approaching a consensus that climate change and sustainable development needed to become a high national priority to support other global initiatives (Garnaut, 2008). Therefore, the researcher concluded self-interest and national interest dominated any move towards a comprehensive appreciation of global sustainability, inclusive of the sociocultural wellbeing dimension of the United Nations' definition.

The influence of the GFC on the interview responses directly contrasts some of the deep green debates of the early 1970s. During this period, some of the commentary was far more polemic in attacking notions of *growthmania*. At the time, the political boundaries were clear when it came to a sustainable future for some: for example, Daly (1973) claimed a sustainable future would be impossible if transnational corporations continue the addition of expanding industrial and economic development across the planet, “malady of growthmania” (p. 149). Throughout the interviews, the researcher was conscious of students’ awareness of personal interests linked to economic growth, as portrayed in the Australian media. However, the students often sought consistency and leadership from government in addressing the economic consequences of carbon emissions: for example, by maintaining the subsidies for solar and renewable, and providing quality public transport. Caddy, “... *was horrified that the solar panels [rebate had been stopped] ... [it] was flawed and obviously people were getting ripped off ... [but] overall the idea was fantastic*”. According to some students, consistency and bipartisan policy equates to proactive leadership.

The students demonstrated high critical awareness of ethics and global leadership when it came to aid for developing countries. Yet, often students placed hypothetical caveats on the extent and means by which any aid would be appropriated to deserving communities. When it came to relocation of populations living on Pacific Islands threatened by rising sea levels associated with climate change, the majority of students indirectly saw a link between Australia’s wealth based on exports of fossil fuels and the moral obligation to support the victims of national profiteering. Brian said Australia was morally obliged to relocate Pacific Islanders, “*Yes definitely, they are near neighbours ... if ... it is time to abandon ship then we [need to] put our heads together ...*”.

Only a minority of students said Australia should not accept climate change refugees from the Pacific region, but they thought New Zealand and other neighbouring countries should share the responsibility. Faye did not agree that Australia had a moral obligation saying, “*No. I just think they do not have to come here [Australia] ... there are other islands and other nations*”. Garnaut (2008) discussed shared responsibility for climate change refugees. The issue of skilled immigration underscored diverse opinions specifically linked to personal economic wellbeing and ongoing national threats associated with the fallout of the Global Financial Crisis, as explained by Flannery

(2010) and Lowe (2012). The student responses were organised into three categories: those who said no to skilled immigration, those who supported an open-market response, and several who saw complexity and the need to critique the scheme on merit and capacity.

The issue of providing economic compensation to help developing nations drew mixed responses from the students. The majority thought it was appropriate for Australia to provide leadership in helping others; however, many reinforced the need for conditions and varied the extent of the aid. It was likely students' responses were impacted by their personal experiences and knowledge of Australian fossil fuel exports in deciding an appropriate level of aid for climate change refugees, as described by O'Toole, Wallis and Mitchell (2006). The study by O'Toole, Wallis and Mitchell (2006) determined demographic awareness and cultural experiences significantly impacted on people's perceptions of sustainability and their willingness to assist through established social networks.

Nearly all the students saw ecological conservation and water protection as areas that require essential protection policies by all governments, consistent with Parenti's (2011) viewpoint. Brian discussed government actions regarding water in New South Wales and Western Australia:

... there is the Murray Darling management and that has been ongoing for many years ... In WA ... Kununnara ... the vast river systems and water supplies ... that's one area that the governments locally can start to look [at] ...

The students commented on taxation, subsidies and carbon trading schemes as important mechanisms to ensure government and business compliance, consistent with the tripartite sustainability equation (Brundtland, 1987, cited in UNTAD, 2012). The students saw these as necessary to redirect research and development away from the dependency of carbon-based fuels and lifestyle choices. The influence of corporations and paranoia about national security often linked to Australia's coal and gas exports being sourced elsewhere if excessive carbon tax penalties were to be introduced. The threat and fear carried by the media is consistent with "Coal Trends" (2012). Some students were cautious about immediately removing all subsidies to fossil fuel exporters in Australia, inferring that the associated complexity required cautious reform. The students reinforced the essential need for governments to take leadership with respect to

reform towards sustainability and climate change, as consistent with the Stern Report (2006).

The majority of the students were aware of the option of a high-energy output without carbon emissions linked to nuclear power production. However, the relatively recent disaster in Japan (11 March, 2011) underscored the massive risk associated with radioactive pollutants and the extensive technical knowledge to safeguard against risks, as discussed by Tsuyoshi Inajima and Yasumasa Song (2012). In addition, the students were constantly reminded by the media about the expense for decommissioning the four damaged reactors at Fukushima as a near one trillion yen exercise (Bloomberg, 2012). The majority of students saw renewable energy as a government policy priority. Significantly, educational research for both national and global sustainability was highly recommended by the GDE-P students. Education, science and formally acknowledged independent expert groups were endorsed as part of an overall educational approach to sustainability and wellbeing.

There were some significant areas of silence regarding economic and political issues linked to sustainability in the GDE-P interviews. Singer (2002) continually challenges the notion of sovereign power in Western democracies foreshadowed during the 1944 Bretton Woods Conference. Singer (2002) reinforced the extent by which governments are manipulated by transnational corporations, thus marginalising the sovereignty of people in a particular state. Singer (2002) was very critical of the work of corporate lobbyists. Pearse (2007) accused boards, commissions and the commercial media of applying pressure on the federal government. There was no direct citation of this diminishing notion of sovereignty by any of the GDE-P students interviewed. Similarly, the students did not mention the role of the International Trade Organisation, the World Bank and the International Monetary Fund and their links to the US Treasury Board (Suzuki & Dressel, 2002). However, the students did see bias in the media, but specifically at a local and national level.

Furthermore, the GDE-P students did not communicate a strong understanding of the history of politically stalling that has occurred: for example, Howard refusing to put Australia's economic interests behind that of the Kyoto Protocol (Leggett, 2000). The students demonstrated a perception of mistrust associated with corporations and government, but did not provide decisive evidence or exemplars: for example, Alan

noted, “*I think as far as policies go, it is a very grey area*”. Alan was referring to the perceived interference by big business and the former Gillard government’s policy to introduce a carbon tax. However, from an international perspective, the impact of corporations and national security (September 2009) was widely publicised in the world media when the US Senate failed to pass climate laws prior to the international climate change conference in Copenhagen (Flannery, 2010).

Attitudes Towards Sustainability Population Policy

There was considerable diversity in the attitudes towards population policy and its relationship to an informed conceptual understanding of sustainability. Many of the students reflected former Prime Minister John Curtin’s *Big Australia* policy, in particular the need to grow for defence and economic rationale. Other students identified the link between an increasing population, finite resource and energy consumption. These students reflected a very critical appreciation of the pending dangers of expanding a developed country’s population with an expanding consumerist culture.

Today, the global population trajectory is considered a major international risk management priority (L. R. Brown, 2006; Cribb, 2010; deMenocal & Cook, 2005; Diamond, 2005; Lovelock, 2006; N. Stern, 2006). Even though the students viewed population growth with increased resource consumption, there was a lack of conversation regarding the loss of environmental qualities such as, agricultural land, biodiversity and the capacity of the land to produce food. Social destabilisation was rarely mentioned with any critical detail. There were some inferences of a Malthusian scenario of collapse, but the inference was always linked to developing contexts, supporting deMenocal and Cook (2005). There were not any strong appreciations of the history of population policies or examples of collapse in previous civilisations as explained by Diamond (2005).

Aspects of the factors of the notion of collapse associated with excessive population pressures were identified (e.g. protect water resources, stabilise climate variability and conservation of resources); but there was no elaboration of these factors becoming linked to major conflicts and the use of weapons of mass destruction. Any notion of humans living in a closed system (Diamond, 2005; R. King, 2011; Lovelock, 2006; Stern, 2006) was mentioned indirectly and there were no analogies or the construction

of narratives viewing the anthropocentric context as predator or collective plague upon the ecosphere. The students provided many examples of transpersonal psychology (empathy with people) but there was no evidence of a strongly developed transpersonal ecology (empathising with living systems as an innate and essential part of the planet). Overall, an anthropocentric value system was reinforced: for example, through the discussion of equitable distribution. In particular, Kerry noted, “... *they [international organisations] need to look at fair and equitable distribution ... making the most of what we [citizens of the Earth] have*”.

According to Garnaut (“Climate refuges,” n.d.) delegates from the Pacific nations were urgently encouraging delegates to sign up to the Copenhagen protocols, realising their islands were continually being challenged by rising sea levels, and that inevitably their society would become climate change refugees. The lobbying continued as the Australian government continues to support one of the world’s largest coal export shipments.

In 2010, flooding throughout Queensland (including over 70 towns and cities) was estimated as a loss equivalent to the areas of Germany and France. Floods are Australia’s most expensive form of natural disaster, averaging 377 million dollars per year between 1967-2005 (Queensland Chief Scientist, n.d.). The Queensland floods in 2011 resulted in the loss of local government infrastructure at an estimated two billion dollars, and the total average impact across the state between five and six billion dollars. The ABC reported the flood removed 30 billion dollars from Australia’s gross domestic product (“Floods cost”, n.d.). Significantly, none of the GDE-P students discussed the Queensland floods during the interviews.

When large populations and expensive power generation intersect with unpredictable natural disasters (Inajima & Song, 2012) the impact on large populations is devastating. In the case of Fukushima, a strategic nuclear power plant not only collapsed the industrial capacity across Japan, but the radioactive pollutants will impact on agricultural lands, northern Pacific fisheries, let alone associated health costs and ever-increasing insurance premiums (Inajima & Song, 2012). Yet to be fully determined is the cost to superannuation funds, both in Japan and globally. The loss of confidence in Tokyo Electric Power Company was extreme, especially when the cost to the Japanese government (taxpayer) may be more than 11 trillion yen. The utility has lost 94 per cent

of its trading since the tsunami (Inajima & Song, 2012) while the decommissioning cost for the four damaged reactors will accommodate an exercise of more than a trillion yen. Fukushima was emphasised during the interviews by 17 GDE-P students (94%) without any acknowledgement of, or reference to, its out-dated technology or the fact several recommendations for increasing the height of the seawall had been made over the last two decades, but were continually ignored (Acton & Hibbs, 2012).

With respect to Australia's population, students often perceived a justification for a *Big Australia* in terms of self-interest modelled on old defence paradigms, as discussed by Galton (2001) and Kyle (1995). The attitude of a *Big Australia* reinforces the notion of *populate or perish* established in early 1942 during Prime Minister Curtin's tenure (Flannery, 1994). During World War Two, the Australian government fully appreciated its inability to protect itself against a potential Japanese invasion after the bombing of Darwin (Australian Federal Parliament, 1945). Ann demonstrated values accommodating the *Big Australia* narrative:

... the reason why there is a desire to increase the population in Australia is so that we can protect ourselves in defence reasons then in the global market so that we are actually a player ... Well if we are to stay a country with a population of 20 million indefinitely we are not going to be able to look after our own ... [we] need to keep up with the world ...

In 2004, the Howard government introduced the baby bonus as a mechanism to increase the Australian population from within. Generally, the students were critical of the baby bonus, with Colin stating:

... reduce that stupid baby bonus so that 16 year olds don't go out and get pregnant to get \$1000 not realising that it costs a million bucks to raise a baby ...

In 2009, Rudd reintroduced the *Big Australia* thesis with a population of circa 100 million being achievable by the end of this century ("Rudd welcomes", n.d.). Barbara was pro-population and immigration. She said:

[Australia] should be letting a lot more children in [through immigration]. I don't think they should be encouraging people to have lots more children per family [within Australia] ... I think that Australia could afford to be much larger in terms of population.

Irene supported Barbara in arguing for a *Big Australia*, "I think ... we need to be able to provide space for people who are refugees or immigrants ... So as long as we are planning for that amount of people ...".

Discussion of population and family planning suggested some students had religious affiliation with emphasising the responsibility to populate. Colin expressed concerns about religious institutions and their inability to facilitate birth control in developing countries. He was critical of the Catholic Church's role in Africa:

[According to the Internet] ... the most positive way to get Africa to get over its situation is to give women control over birth and their bodies, and the second best way is to set up women in small industries, and all the church women said is 'all we hear [from the Church], we don't let them have contraception'. Well that is the problem...

Generally, students discussed a pro-choice position on population linked to individual beliefs, supporting the *Swinburne University of Technology Study* (2010). No student mentioned the work of the late seventeenth century intellectual Malthus, who underscored the non-sustainability of expanding human populations as discussed by Weeks (1989). Nor was there any evident knowledge of bodies such as the Sierra Club, that first connected the Earth's ecosystems and human population as an urgent political discussion for the international community (Watson, 2004) or the Club of Rome that commissioned the seminal work *Limits to growth: A report for the Club of Rome's project on the predicament of mankind* (Meadows, Meadows, Randers & Behrens III, 1972; Weeks, 1989). None of the students interviewed indicated any awareness that the Australian population growth exceeded many developing countries, including the Philippines, Malaysia, India and Vietnam (Gordon, 2010). In addition, the students did not acknowledge former Prime Minister Gillard's push for a sustainable population policy, as noted by Gordon (2010).

The correlation between poverty and large populations tended to be reflected on the context of developing countries and in particular, Africa. Again, the dominant discussion of population growth as an issue in developing nations reflected the findings of the *Swinburne University of Technology Study* (2010). Many of the references of a large population were China-centred, as was China's one-child policy to prevent population increase (Greenhalgh, 2008); many students found the one-child policy confronting, even though they saw the value in education for family planning. Barbara discussed the importance of education to control population growth and was, "*not an advocate for that [one child policy] ...*". However, the country that will reach a population of two billion plus by the beginning of the twenty-second century – India –

had only a passing reference. Ehrlich's (1968, 1978) arguments regarding the destructive nature of uncontrolled population growth seemed to be only an inferred consideration in some of the students' perceptions. The researcher infers China and India are tacitly linked to Australia's economic prosperity, although dismissed by many of the students during the interview as these relationships have become normalised in the public media. As Rosenberg (2008) claimed, India and China pose a serious concern for global food, commodity and energy consumption.

Implications for Pre-Service Teacher Education

In Chapter One, the researcher introduced the importance of Sustainability Education as a cross-curriculum priority. Sustainability was introduced as a cross-curriculum priority with ACARA (2011) stating:

Sustainability will allow all young Australians to develop an appreciation of the need for more sustainable patterns of living, and to build the capacities for thinking and acting that are necessary to create a more sustainable future. (para. 5)

Given the direction and expectation from the Australian Curriculum, the implications for teacher education across Australia are significant. That is, teachers in primary schools should be able to make informed teaching and learning decisions on behalf of the children they educate. Such a capacity would include appropriate levels of pedagogy and specialised content knowledge.

The literature review and the structure of the thesis commenced with the United Nations' definition of Sustainability, incorporating the three interrelated pillars of:

1. Economic sustainability;
2. Environmental sustainability; and
3. Sociocultural sustainability.

The literature review provided a comprehensive coverage of the implications of the four interconnected factors:

1. Sources of information on sustainability;
2. Lifestyle, attitudes and behaviours towards sustainability;
3. Awareness of economic and political issues linked to sustainability; and
4. Attitudes towards sustainability population policy.

As realised in the findings and subsequent discussion, there are significant conceptual gaps in the GDE-P students' knowledge regarding the complexity of sustainability. The realisation of this gap is understandable, considering it took many decades to reach consensus across the global political context. The complexity associated with any meaningful understanding of sustainability presents a dilemma for pre-service teacher education. The first dilemma being how much content covering the integrated themes of sustainability can be practically embedded in a pre-service teacher education four-year degree (e.g., Bachelor of Education in Primary), let alone a one-year Graduate Diploma of Education (Primary). In addition, Kagawa (2007) found students thought sustainability was important, but their positive attitude was not matched by critical understandings of concepts regarding sustainability. Therefore, there are significant implications for tertiary institutions to provide meaningful content knowledge to support sustainable development, underscoring the complexities of sustainability.

Given the complexity of sustainability as a cross-curriculum priority, ACARA (together with state and federal governments) needs to consider specialist teacher input in assisting the generalist primary classroom teacher to design meaningful sustainability learning experiences. Furthermore, AITSL requires teachers to be appropriately prepared to facilitate all learning areas in the Australian Curriculum. The research reinforced an inability of pre-service teachers to develop rich learning experiences, as evidenced by the superficial knowledge regarding sustainability. Given the interview participants were self-selected and the fact students had degrees (some with postgraduate qualifications) prior to entering the GDE-P course, the limited knowledge is regarded as a potential catalyst for socially reproducing misconceptions or alternative conceptions inconsistent with consensus science and established UN policy.

Many authorities cited in the literature review spoke of the pending global climate change as an equivalent threat to a thermonuclear war. Given the urgency of many claims, it would be deemed essential that the Australian federal government provide urgent leadership in resourcing education for sustainability directly as an intervention in both the school context and in the pre-service teacher education context within the university sector. The research by Leiserowitz, N. Smith and Marlon (2011) was reinforced, in part by the GDE-P students. Overall, the respondents' knowledge was heavily influenced by the media and respected family members. Although global warming dominated the discourse many students had poor conceptualisation and there

were serious misconceptions regarding the interconnected themes associated with sustainability and climate change. Therefore, like Leiserowitz, N. Smith and Marlon (2011), the researcher concludes that many of the self-selected 18 participants would be making ad-hoc, uninformed decisions regarding sustainability and climate change when entering primary school as teachers.

Given the implications of a poor readiness to implement sustainability as a cross-curriculum priority, strong bipartisan leadership is needed at the federal level to address the situation (L. C. Hamilton, 2012). A rich tertiary education regarding sustainability is crucial for GDE-P students if they are to adequately prepare primary students to be informed citizens, as per the Melbourne Declaration. Furthermore, Hawkins (2005) noted classroom experience did assist in changing students' attitudes and behaviours. If GDE-P students have positive sustainability learning experiences at university, it is likely they will model these experiences in the primary school context with support from established specialists in sustainability education. The Australian government, through ARIES has invested a great deal of resources to connect educational institutions, corporations and government departments with meaningful resources and information about sustainability. There is scope for pre-service teachers to access the information provided by ARIES to complement tertiary sustainability education.

Summary

The interview data indicated the majority of the students used the popular, non-commercial media and selective family and friends to establish their perceptions of sustainability with climate change considered to be by far the dominant factor. Although many saw the need for independent, scientific and informed education on the subject, the majority had very shallow appreciations of the vast amount of peer-reviewed science related to the topic, nor did they have any awareness of the extensive effort of the United Nations to promote global sustainability. In addition, the students demonstrated a lack of any historical background covering the broad theme of sustainability linked to rise and fall of previous civilisations.

Although the students could identify positive lifestyle choices and behaviours that would foster a more sustainable approach, they often indicated a personal inaction. The lack of action extended to limited use of social media (or direct approaches to politicians) in an attempt to counter the situation of consumerist or anti-sustainability

practices. The overwhelming sense of improving personal behaviours was linked to government leadership and proactive policies within a bipartisan approach.

When it came to economic and political issues linked to sustainability the students tended to view the situation from a self-centred and nationalistic perspective. Only limited global citizenship was discussed with caveats often presented in an attempt to continue Australia's wealth status.

Comments about population policy were very diverse and in some cases polemic, as some students expressed strong views that indicated a *Big Australia* whilst others were very conservative about any increase in the current population. At a global level, the students tended to use the African context as the symbol of unsustainable population, only acknowledging China on occasions and limited acknowledgment of India. None of the students were aware of Australia's accelerating population growth surpassing the rates of many of its Asian neighbours.

Finally, the study underscores a need for pre-service teacher education, with support from federal government, to invest in rich sustainability education. Such an approach could include financial support for core units, postgraduate courses, and professional learning linked to other established agencies, such as ARIES, Australian Science Teachers' Association and Australian Academy of Science.

CHAPTER SEVEN: CONCLUSIONS

Introduction

This research coincided with UNESCO's DESD (2005-2014). Education for Sustainability includes incorporating key sustainable development issues into teaching and learning:

- Climate Change;
- Disaster risk reduction;
- Biodiversity;
- Poverty reduction; and
- Sustainable consumption (UNESCO, 2005).

DESD requires participatory teaching and learning methods that accommodates primary school students to develop lifestyles, behaviours and attitudes to support long-term sustainable development (UNESCO, 2005).

Empowering learners assumes that teachers are suitably educated to accommodate meaningful educational experiences for sustainable development, promoting appropriate long-term competencies (UNESCO, 2005).

During the first half of the twenty-first century, primary school teachers will be a part of an essential period of transition to prepare our society for sustainable development: locally, nationally and globally. The process will occur in an educational/political environment of competing interests and emerging policies. Therefore, teachers, communities and institutions will be making judgements to prioritise competing political, economic and philosophical ideas. Importantly, major reports (Stern, 2006), as well as the consensus science endorsed by the UN and its affiliated authorities will have to confront one of civilisation's greatest moral dilemmas – the crisis of anthropogenic carbon emissions leading to global warming and subsequent Climate Change.

In the final chapter, the researcher will discuss the findings as they relate to the research questions. Secondly, the theoretical framework and methods will be outlined, limits of the research project and the capacity of the instruments will be discussed. Finally, the researcher will make recommendations regarding further research into Sustainability in the primary school, in meeting ACARA's expectations.

Reflection on Research Questions and Methods

The study, consistent with ACARA (2011), ARIES (2010) and UNESCO (2005), investigated GDE-P students' perceptions regarding four interconnected factors associated with Sustainability:

1. Sources of information on Sustainability;
2. Lifestyle, attitudes and behaviours towards Sustainability;
3. Awareness of economic and political issues linked to Sustainability; and
4. Attitudes towards Sustainability population policy.

These factors informed the construction of the research questions and the structure of the thesis. The following questions applied:

1. Who and/or what influence WA GDE-P students' perceptions of Sustainability?
2. What are the WA GDE-P students' attitudes regarding Sustainability?
 - a. What personal actions do GDE-P students undertake?
 - b. What behavioural choices do they report?
3. What are WA GDE-P students' perceptions of economic and political factors regarding Sustainability?
4. What are WA GDE-P students' perceptions of Sustainability linked to population?

The research questions form the structure of the reflection of the research journey and findings.

Who And/or What Influence Graduate Diploma Of Education (Primary) Students' Perceptions Of Sustainability?

Within the limitations of the research design, the students indicated they relied on non-commercial media, independent scientific authorities, formal education and informed family and friends. The students also indicated they distrusted commercial media and partisan political rhetoric. The students underscored the desire for bipartisan leadership, covering Sustainability and Climate Change.

What Are The Graduate Diploma Of Education (Primary) Students' Attitudes Regarding Sustainability?

Overall, the students were very supportive of pro-Sustainability initiatives. All of the students interviewed believed Climate Change was real, and the majority demonstrated a moral obligation to help others. Although often coming from a personal and local perspective, many of the students could extrapolate from the local to the global context. The approach was more attitudinal and empathetic rather than informed by strong scientific and technical literacies regarding Sustainability themes.

Personal Actions Undertaken by GDE-P Students

The students were quick to identify themes such as *recycle, re-use, and reduce* and the search for the application of renewable energy options. There was an appreciation of their personal carbon footprint, often highlighting the need for public transport, consumption of locally produced foods, and where possible, a more low-impact sustainable approach within their local community.

Behavioural Choices Reported by GDE-P Students

Many of the students were frank about their limited technical knowledge associated with the complex themes within the Sustainability and Climate Change debate. Some of the students indicated a desire to be more informed about the technical aspects of Sustainability and Climate Change. Many also felt their behavioural change was limited by the partisan approach demonstrated by Australian politicians and confused by self-interests continually exposed in the commercial media.

What Are WA Tertiary Students' Perceptions Of Economic And Political Factors Regarding Sustainability?

From a local context, the majority of the students maintained it was the government's responsibility to provide leadership: for example, in subsidising sustainable public transport. The students also reported the government should use a taxation system to provide subsidies, incentives or deterrents to direct big business and the population into selecting renewable energy options and other sustainable enterprises. However, when it came to understanding interrelated systems covering diverse economic factors and policy the students often found it difficult to see the connections. When the local context linked into global economic and political systems, the majority of students

tended to situate their perspective in the self-interested local context. Regarding issues that required empathy into other people in developing countries, students demonstrated a more integrated or interrelated appreciation of multiple causality: for example, economic aid to developing countries to support Sustainability initiatives, or relocation of Climate Change refugees.

Systems Thinking identifying connections and relationships within polity and the economy relate to big picture or gestalt understandings (as indicated in Figure 2, p. 19). It would be essential that graduating primary school teachers have a developed appreciation of how economic and political decision making integrates into the three pillar approach of Sustainability, as explained by UNESCO and ARIES.

What Are WA Tertiary Students' Perceptions Of Sustainability Linked To Population?

The GDE-P students presented a dichotomous view on Australian population. Many agreed with the *Big Australia* (populate or perish paradigm) of the post-Curtin era and reinforced by both Prime Ministers Howard and Rudd. The paradigm made assumptions that supporting an Australian population of 35-100 million could be achieved with technical innovation and urban design as a speculative outcome. Other students discussed links between population, consumerism and Climate Change as incompatible with a *Big Australia*. The second group demonstrated, often by inference, an appreciation of a finite and fragile planetary system. Again, the section on Sustainable population relates to systemic knowledge that is inclusive of a range of science-based indicators such as optimum food production, climate variability, waste management, sustainable transport, wellbeing indicators and global security. Finally, many of the students did not make the link between population and Sustainability, some viewed population as a significant problem of the *developing world*, and no student was aware that Australia's population growth rate exceeded many of its Asian neighbours.

Conceptual and Theoretical Framework

The research was conducted within a qualitative interpretivist-social constructivist framework. The intention to explore students' *perceptions* indicated the dynamic nature of intersubjectivity of the student participants, notwithstanding the intersubjectivity of the researcher (Walsham, 1995). The interpretivist framework underscored the

complexity of the students' lifeworlds and their interaction with Sustainability concepts. The social-constructivist framework supported interpretivism, as students construct their perceptions of Sustainability through social interactions with others (both face-to-face and through various media). However, it must be considered that the findings of the research are subsequently linked to the Australian context during the 2011 period, and as such cannot be generalised to populations not reflecting the research context.

Research Methods

The research initially followed an explanatory mixed methods approach, in which a questionnaire was initially piloted prior to the 18 semi-structured interviews. The researcher constructed the questionnaire from the literature on Sustainability, taking into consideration the political climate of 2011. The questionnaire was initially piloted with secondary teachers, prior to a Phase Two pilot being conducted with 113 Western Australian GDE-P students. However, following Phase Two and subsequent analysis of questionnaire data, it was determined a quantitative approach was unreliable. Therefore, the data collection was limited to the researcher's 18 interviews with the GDE-P students to gauge their perceptions of Sustainability. The semi-structured interviews were coded for themes to determine common ideas across individual perceptions of Sustainability and Climate Change.

Limitations of the Research Project

A number of limitations were noted during the research journey. A majority of the limitations reflect the research methods undertaken to collect data, namely the challenges of a quantitative approach, and the limited time (Semester 2, 2011) in which data could be collected prior to the GDE-P students' graduation. The intense media debate at the time of data collection may have skewed the data and subsequently limits the validity of the students' responses.

Quantitative Approach to Data Collection

The researcher initially undertook a mixed methods approach to data collection, involving the administration of a questionnaire prior to the semi-structured interviews. After the Phase Two pilot with 113 GDE-P students, a Cronbach's Alpha Coefficient test was run on the pilot data to determine the internal consistency of the instrument. The results were very low across all sub-scales of the instrument, causing the

abandonment of a quantitative approach for the research project and the focus on semi-structured interviews to gather data.

The poor internal consistency most likely reflected the complexity of Sustainability as a concept, as it has been acknowledged that scientific consensus on Sustainability has only been a recent achievement (ACARA, 2011; ARIES, 2009; Flannery, 2010; Garnaut, 2008; Stern, 2006; UNESCO, 2005).

The questionnaire, in trying to accommodate the complexity nature of Sustainability, also included some statements and questions that may have skewed the data and limited the reliability of the instrument. These errors included:

- ‘Double-barrelled’ questions: These were questions in which two subjects were included in the item and subsequently measured more than one variable (e.g., *My attitudes, values and concepts regarding Sustainability and Climate Change are largely formed though my friends and/or colleagues*);
- Negation: The inclusion of negation in questions amidst similar questions may have confused students and increased misinterpretation of the question (e.g., *My attitudes, values and concepts regarding Sustainability and Climate Change are not largely formed by television and/or radio commentary* – N.B. This question was following the statement above in the questionnaire);
- Inclusion of jargon or technical terms: The questionnaire included some technical terms relating to Sustainability and Climate Change that may have been misinterpreted. It became evident in the interviews that students had different interpretations for some terms, such as *carbon emissions trading scheme*; and
- Leading questions: Some items were worded strongly, and may have lead students’ responses (e.g., *The Australian Federal Government should not continue to promote the interests of the fossil fuels industries such as coal, oil and gas*). The use of words like *promote* is emotive and may affect responses. It may also have multiple interpretations; such as promote through policies, media and advertising.

The issues in the questionnaire would have to be considered if a new quantitative instrument were to be constructed. It is also possible the polarisation of student responses, also evident in the semi-structured interviews, may have contributed to the

poor reliability of the instrument. Given the limitations of Doctoral research and the fact the Phase Two pilot informed the interview questions, further research would use the outcomes of the interviews to carefully construct a new questionnaire.

Limits of the Qualitative Approach to Data Collection

The qualitative approach to data collection still had limitations, although not to the extent of the quantitative instrument. The semi-structured interviews were collected after the questionnaire had been administered, and during a Science Education unit in the GDE-P course. Subsequently, the prior awareness of key issues in the questionnaire may have impacted on the GDE-P students' discussion. One of the students who participated in the interview stated she did so because of the responses she saw at the Phase Two questionnaire pilot (the responses were shown on a screen instantaneously). Some of the students may also have been influenced by the content discussed in their Science Education unit at the University, Sustainability and Climate Change in the unit. Many of the students may have been influenced by the intense media coverage at the time of data collection (i.e., Fukushima, former Prime Minister Rudd's removal and former Prime Minister Gillard's post-election decision to introduce a carbon tax).

The GDE-P students participating in the interviews were self-selected volunteers, which is a unique group of participants. The nature of purposive sampling includes acknowledging the risk that only students with strong attitudes towards Sustainability and Climate Change, or with high self-efficacy in the topic, would participate in the interviews. While the GDE-P students had strong views regarding most issues discussed, it is acknowledged these students, by their own admission, had low levels of scientific and technical literacies. Therefore, the limited technical knowledge of the students who volunteered to be interviewed underscores a concern for those without the self-efficacy to participate in the research. However, to appreciate the limits of technical knowledge relating to Sustainability, specialised questions would need to be developed and trialled, prior to implementation.

Intense Media Debate at Time of Data Collection

Further to the limitations of the qualitative data collection, the interviews were conducted during a tense political period. The research was conducted across 2010 and 2011, during which time the media discussed significant issues including: the post-GFC, the removal of former Prime Minister Rudd, and the Japanese Fukushima tragedy.

These issues were prominently discussed in the media and were often surrounded by tense media debate. The GDE-P students interviewed discussed the media's presentation of these issues, with Fukushima being most explicitly considered by the students. The presentation of the aforementioned issues in the media reaffirms the social construction of knowledge, and as such, it would be impossible for students to present impartial attitudes in the semi-structured interviews. The high visibility of the tragedy in Japan reinforced a powerful and lasting image onto people across the globe. Nihilism projected, according to Weber and P. C. Stern (2011), had a positive effect in allowing individuals to internalise a scale of what can happen on the planet. In addition, the flooding of Queensland provided a graphic example of the indirect impact of Climate Change as the key factor of what the 18 GDE-P students perceived to be the major component of Sustainability. Yet interestingly, the floods in Queensland did not impact or evoke a connection to the theme of Climate Change, as did the tragedy at Fukushima, due to the discussion on the use of nuclear energy (as an alternative to fossil fuels) linked to global warming. The tragedy in Japan influenced the way the GDE-P students reflected on nuclear energy as a potential solution to global warming, as discussed in the findings.

Furthermore, the development of the Australian Curriculum occurred during the research study, in which Sustainability was listed as a cross-curriculum priority (ACARA, 2011). Media discussion of the Australian Curriculum, in addition to students' own research and university-based discussion, is likely to have impacted on their perceptions regarding Sustainability and Climate Change.

Recommendations for Further Research

The research resulted in a number of recommendations for further research. Firstly, the researcher suggests there is a need to further explore the tertiary context to ensure pre-service primary teachers are adequately prepared to integrate Sustainability into their teaching, both on practicum and post-graduation. Secondly, due to the limited scientific and technical literacies determined by the 18 GDE-P student interviews, there might be a need to develop practical resources to support teachers in planning rich teaching and learning experiences in Sustainability. Thirdly, recommendations are provided regarding the development of a quantitative instrument to measure perceptions of Sustainability. Finally, recommendations for future research in Sustainability risk management are presented.

Interventions at the Tertiary Context

The 18 GDE-P students interviewed showed low-level scientific and technical literacies, although this could have been due to the limits of previous science education and prior experience of the students. In addition, it would assume the students had limited access to specialised knowledge not only from their previous tertiary studies, but also from their secondary education. The GDE-P students were sampled as they have at least an undergraduate degree prior to entering the GDE-P course, and were subsequently assumed to be a well-educated and informed sample. Therefore, the implied limitations of their knowledge emphasise a need to explore how Sustainability and Climate Change themes are presented in the tertiary context to ensure pre-service teachers graduate with the required content knowledge to integrate Sustainability as a cross-curriculum priority, and meet AITSL Standard Two (2011) discussed below.

ACARA (2011) and AITSL (2011) emphasise the importance of content knowledge in Sustainability. ACARA (2011) has included Sustainability as a cross-curriculum priority, to ensure students lead more sustainable lifestyles and build the capacity for thinking and acting in sustainable ways as discussed by ARIES. Furthermore, the AITSL *National Professional Standards for Teachers* Standard Two: “Know the content and how to teach it” (AITSL, 2011), underscores the necessity to have well-informed teachers who are able apply their content knowledge to ensure rich learning experiences for students. Therefore, on graduating their course, GDE-P students should be prepared to structure learning experiences in Sustainability across Learning Areas. The perceived deficit needs to be appreciated by the complexity of the definition of Sustainability as assessed by UNESCO.

With ACARA and AITSL’s requirements, it is necessary for tertiary institutions to provide rich learning experiences for pre-service teachers, inclusive of GDE-P students. Currently, the GDE-P students, and those who were interviewed, receive 30 hours of Science Education (Primary). Although much of the inquiry Science being taught links to the Australian Academy of Science: *PrimaryConnections* program, the nature of the unit only allows an integrated approach to Sustainability over a number of resource booklets. Also, the students have a Humanities and Social Sciences (Primary) unit, which offers some links into Social Sustainability. Like all university programs, pre-service teacher education is funded on a credit-point model and the units provided exist

in a competitive curriculum structure (literacy and numeracy appear to be priority, as evidenced by the National Assessment Program – Literacy and Numeracy).

ARIES provides a diverse range of resources that need introduction to teachers. It may happen in many cases that individual schools and teachers have accessed this opportunity. However, often teachers need explicit professional learning to engage what is available. Science Teachers' Associations and Green Education Groups (e.g., the Australian Association for Environmental Education and WA Ribbons of Blue) are well established in Australia. The intention of Sustainability as a cross-curriculum priority is an extremely positive reinforcement of the many decades of work that the UN and UNESCO have facilitated. It also underscores a bipartisan approach by Australian governments that support exists for Sustainability although the major political parties differ on their interpretation. Importantly, key authorities link into the Australian Curriculum (e.g., ARIES, Australian Academy of Science, CSIRO).

As discussed in the literature review, universities around the world and in particular, liberal democratic countries, have Sustainability listed online as part of their mission statements (e.g., Portland University). Australian universities (e.g., Macquarie University) have strong Sustainability statements on their websites. The issue for further research is how an appropriate level of intervention crystallised by testing the statements from universities match well-intended rhetoric to graduate outcomes. The intervention needs to audit tertiary students' understandings, attitudes and values in relation to Sustainability outcomes. Therefore, any intervention would need to survey the diverse degrees and the embedded units, and provide concrete evidence that the students hold attributes that accommodate Sustainability on graduation. Key authors (A. D. Brown, 2003; L. R. Brown, 2006, 2011; Cribb, 2010; Flannery, 2010; Garnaut, 2008; Gilding, 2011; Gore, 1993; Leggett, 2000; Lovelock, 2006; Lynas, 2007; Stern, 2006) all discuss a pending planetary disaster on a scale that is the equivalent of the wars of the twentieth century. Inaction in preventing such a scenario seems to be irrational in terms of the cost to billions of people and the planet's biodiversity. Therefore, engaging all levels of education as described by DESD seems an essential priority. Non-engagement would reinforce many aspects of the broader Polity have failed to cognitively accommodate the reality of Sustainability and Climate Change. The 18 GDE-P students interviewed were explicit in seeking strong bipartisan leadership, in line with other studies cited: for example, Bezbatchenko (2011).

Support for Primary Teachers to Successfully Accommodate Sustainability and Climate Change in Teaching and Learning

Given that Sustainability is part of the Australian Curriculum, the value of this priority is well established as policy. Education is complex, covering a range of diverse student needs across a K-12 context. With ACARA driving the outcomes for an Australian Curriculum, Sustainability needs extra professional support to accommodate explicit instructional approaches suitable for the primary school context. Teachers require ongoing professional learning to improve their knowledge and expertise in this priority area. ACARA and other authorities need to help teachers to *buy-into* the Sustainability project. Available resources, which already exist, need to be reintroduced to developing and mentoring teachers, as aligned with AITSL (2011). In summary, strong instructional leadership is needed from the Federal government, through the State systems, and into the local primary school context. The approach requires an explicit process covering the three pillars of Sustainability within the context and pedagogical scope of years 1-7, building on a network of supportive associations (e.g., Science Teachers' Association of Western Australia).

Development of a Quantitative Instrument to Measure Perceptions of Sustainability and Climate Change

The research methods undertaken in this project show that an exploratory, rather than an explanatory, mixed methods approach is required. The questionnaire piloted in this research was deemed unreliable and was abandoned. However, the semi-structured interviews gathered strong narratives from the GDE-P students. Subsequently, an exploratory mixed methods approach would use the rich findings from the qualitative data to construct a new questionnaire underscoring the complexities arising in the interviews.

Due to the prompting required by the researcher throughout the interviews and the diversity of technical understandings from the majority of GDE-P students, the researcher would consider using closed nominal questions with multiple choices to prompt students' responses. A text response (*Other*) would be offered to allow for diversity beyond multiple-choice responses offered. It is anticipated using closed questions would more effectively elicit students' breadth of knowledge, as the

interviewed students tended to discuss topics that were of most interest to them: for example, Edith was particularly concerned with cost to consumers and this idea dominated the interview discussion.

Furthermore, to validate a new instrument it would have to be administered to a much broader sample of people. The researcher suggests the instrument could be piloted across the whole university, or multiple universities, providing detailed demographic information was collected.

Sustainability Risk Management Research Implications

In the forward to J. Painter's (2013) *Climate change in the media: Reporting risk and uncertainty*, N. Stern wrote:

How the media communicates risk and uncertainty to their audiences is a critical issue ... vitally important ... public are aware of risks associated with unmanaged climate change ... need to convey this information clearly and accurately without ... scaremongering" (para. 1).

Recent research from the USA and UK suggested acceptance of Climate Change is linked to personally experiencing natural disasters, with media reporting of tragic events (e.g., Hurricane Katrina) affecting people's risk assessment (Lewandowsky, Risbey & Oreskes, 2013). Memories of disastrous events shape people's estimates of risk, and in addition the media's focus on such events is likely to alert people to the increasing risks of climate change (Lewandowsky et al., 2013).

Weber and P. C. Stern (2011) wrote of risk management as a possible means to driving practical applications and/or adaptations. However, Painter (2013) claimed uncertainty increases people's lack of willingness to take action due to wishful thinking that things may not be that bad, ignoring uncertainty implies risk (or hence ignoring uncertainty is a risk in itself). Therefore, future research needs to investigate both what is happening in pre-service teacher education and what is happening in the primary school context. As ARIES suggests, Sustainability in the primary school context should be developed a whole school approach that engages partnership networks associated with major scientific and Sustainability focused organisations. The tertiary sector invites further research to audit the immersion of Sustainability as a testable graduate outcome. Global Sustainability commences at a local level and is concerned with the realisation the planet is at serious risk due to anthropogenic activities (Stern, 2006). In the next decade,

the transformation of attitudes, values and concepts through a whole societal approach to education. Sustainability will determine the risks that future human populations will face as well as the essential biodiversity on which humanity is reliant, when the Earth's population reaches circa nine billion by 2050 (Diamond, 2005; Flannery, 2010; Garnaut, 2008).

Summary

The research coincided with UNESCO's Decade of Education for Sustainability Development (2005-2014). The study was unique in respect that it captured the perceptions of Sustainability from 18 self-selected mature age GDE-P students who held an undergraduate degree (four with postgraduate qualifications). The group represented a sample of people entering primary teaching as graduate teachers at the beginning of 2012.

The research elicited perceptions covering four interconnected factors:

1. Sources of information on Sustainability;
2. Lifestyle, attitudes and behaviours towards Sustainability;
3. Awareness of economic and political issues linked to Sustainability; and
4. Attitudes towards Sustainability population policy.

Importantly, the research provided a snapshot of a specific group of pre-service teachers in Western Australia during the intense political debate covering the carbon tax, associated with the election of the former Gillard Labor Government. The intense media coverage provided an unparalleled focus on Climate Change and carbon emissions. Therefore, the response to the interview questions provides a unique historical insight to the psychology and social constructions of 2010 and 2011. In addition to the Australian condition, the study collected data after the well-publicised tragedy of the Japanese tsunami (March 11, 2011) and the destruction of the nuclear power plant at Fukushima.

Initially, the study sought to capture the GDE-P students' perceptions of Sustainability; however, both the Australian political debate carbon tax and global warming (carbon emissions) pushed responses towards Climate Change as discussed in the findings (Chapter Five). Therefore, the study captures the influence of the media in the time of extreme debate in Australia.

The research exposed a variety of attitudes towards lifestyle, linked to Sustainability reinforcing a positive concern for making personal adjustments at the domestic and local level. All the interviewed students confirmed a belief that Climate Change was caused by human activity, and that proactive steps were needed to change the consequences of this activity. Importantly, many students reflected on their very limited scientific and technical understanding of Climate Change and also expressed a strong desire to invest in further education and professional learning.

The students were, in part, aware of the interrelationships of the Australian economy and polity. However, most saw the interconnections with the global context from a self-interest and nationalistic perspective. In terms of moral responsibility, linked to Australia's contribution to carbon emissions and Climate Change, the majority believed that collectively Australians should support developing countries. However, the students tended to have limited technical knowledge and a limited appreciation of Systems Thinking.

Population attitudes contributed a new level of knowledge, not found in any other studies linked to Sustainability at the time of writing. Specifically, the population section of the research provided a unique Western Australian perspective that might flow into the primary school context. The issue of what is a sustainable population for Australia provided a dichotomy, one that was presented by both major political parties in Australia. Interestingly, former Prime Minister Rudd presented a policy that accommodated the *Big Australia* philosophy of Curtin/Chifley/Calwell (Chapter Two), also supported by the Howard Government. With the election of former Prime Minister Julia Gillard, the population policy shifted to a more sustainable approach (Gordon, 2010). Many of the students did not connect Sustainability with population and this requires further investigation. In Australia, the philosophy of the Curtin and particularly the post-Curtin era was *populate or perish*. The philosophy of many in the scientific community in the early years of the twenty-first century is now *populate and perish*.

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APPENDIX A: GLOBAL WARMING PROJECTIONS (N. STERN, 2006)

The following table is adapted from the Stern Report (2006).

Temp rise °C	Water	Food	Health	Land	Environment	Abrupt Large-scale Impacts
1°C	Small Glaciers in the Andes disappear completely, threatening water supplies for 50 million people	Modest increases in cereal in temperate regions	At least 300 000 people each year die from climate-related diseases (predominately diarrhoea, malaria and malnutrition) Reduction in winter mortality in higher latitudes (Northern Europe, USA)	Permafrost thawing damages buildings and roads in parts of Canada and Russia	At least 10% of land species facing extinction (according to one estimate) 80% bleaching of coral reefs, including Great Barrier Reef	Atlantic Thermohaline Circulation starts to weaken
2°C	Potentially 20-30% decreases in water availability in some vulnerable regions e.g. Southern Africa and Mediterranean	Sharp declines in crop yield in tropical regions (5-10% in Africa)	40-60million more people exposed to malaria in Africa	Up to 10 million more people affected by coastal flooding each year	15-40% of species facing extinction (according to one estimate) High risk of extinction of Arctic species including polar bear and caribou	Potential for Greenland ice sheet to begin melting irreversibly, accelerating sea level rise and committing world to an eventual 7m sea level rise
3°C	In Southern Europe, serious droughts occur once every 10 years 1-4 billion people suffer water shortages, while 1-5 billion gain water which may increase flood risk	150-550 additional millions at risk of hunger (if carbon fertilisation weak) Agricultural yields in higher latitudes likely to peak	1-3 million more people die from malnutrition (if carbon fertilisation weak)	1-120 million more people affected by coastal flooding each year	20-50% of species facing extinction (according to one estimate), including 25-60% mammals, 30-40% birds and 15-75% butterflies in South Africa Collapse of Amazon rainforest (according to some models)	Rising risk of abrupt changes to atmospheric circulations, e.g. the monsoon Rising risk of collapse of West Atlantic Ice Sheet Rising risk of collapse of Atlantic Thermohaline Circulation
4°C	Potentially 30-50% decrease in water availability in Southern Africa and Mediterranean	Agricultural yields decline by 15-35% in Africa, and entire regions out of production (e.g. parts of	Up to 80 million more pole exposed to malaria in Africa	7-300 million more people affected by coastal flooding each year	Loss of around half of Arctic tundra Around half of all	

	Australia)	the world's nature reserves cannot meet 2021 objectives
5°C	<p>Possible disappearance of large glaciers in Himalayas, affecting one-quarter of China's population and hundreds of millions in India</p> <p>Continued increase in ocean acidity seriously disrupting marine ecosystems and possibly fish stocks</p> <p>Sea level rise threatens small islands, low lying coastal areas (Florida) and major world cities such as New York, London and Tokyo</p>	
More than 5°C	<p>The latest science suggests that the Earth's average temperature will rise by even more than 5 or 6°C if emissions continue to grow and positive feedbacks amplify the warming effect of greenhouse gases (e.g. release of carbon dioxide from soils of methane from permafrost). This level of global temperature rise would be equivalent to the amount of warming that occurred between the last ice age and today – and is likely to lead to major disruption and large scale movement of population. Such “socially contingent” effects could be catastrophic, but are currently very hard to capture with current models as temperature would be so far outside human experience.</p>	

Note: This table shows illustrative impacts at different degrees of warming. Some of the uncertainty is captured in the ranges shown, but there will be additional uncertainties about the exact size of impacts (more detail in Box 3.2). Temperatures represent increases relative to pre-industrial levels. At each temperature, the impacts are expressed for a 1°C band around the central temperature, e.g. 1°C represents the range 0.5 – 1.5°C etc. Numbers of people affected at different temperatures assume population and GDP scenarios for the 2080s from the Intergovernmental Panel on climate Change (IPCC). Figures generally assume adaptation at the level of an individual or firm, but not economy-wide adaptations due to policy intervention.

APPENDIX B: RENEWABLE ENERGY SOURCES

Renewable Energy

One of the main facts used in the debunking of renewable energy is that it is incapable of a satisfactory base load, a reliable supply of energy irrespective of weather conditions. In 2007 an experiment funded by the German Economics Ministry showed “... that distributed power can indeed produce base load in a secure and reliable manner” (Leggett, 2009, p. 50). This was achieved by using detailed weather data and linking wind, solar, biogas and hydro plants nationally via a central computer controlling a national network. Drexel University’s College of Engineering claimed to have developed a new fast and reliable method of storing electrical energy. A combination of flow batteries and super capacitors have been formed into an electrochemical storage system capable of integrating with present grid distribution (“Making ‘renewable’ viable”, n.d.).

Biomass/Biofuels

With Australia’s dependence on imported fossil fuel, it would be greatly advantageous to transition to biofuels, both ethanol derived from plant matter and biodiesel from fats and oils. According to WA’s Sustainable Energy Now, any organic material that stores solar energy is biomass (“Sustainable biomass”, n.d.). As previously mentioned, it has become a contentious point as to whether land producing food crops should be diverted to producing crops for biofuels, but sources of biomass encompasses much more. Sewerage plants, household waste, algae, bagasse from sugarcane farms and timber mills all produce biomass feed stock. Several Scandinavian countries derive up to 30% of their electricity from biomass by-products or residues of their paper making and other timber industries Hodgson (2010). Researchers at the University of Copenhagen have released a report announcing how to increase, by more than 200%, the production of biomass. Not only would 20,000 jobs be created within the industry and production, but a large reduction in the amount of nitrogen in run off from farms would enhance the aquatic environment (“Denmark can triple,” n.d.).

At Narrogin WA there is an oil mallee tree facility, mothballed at present (S. Dawkins, personal communication, August 22, 2012), capable of producing electricity and having the most desirable by-product of biochar. Here is the added advantage of encouraging

plantings of mallee in marginal lands that helps, not only in the usual carbon sequestering but also retarding dryland salinity and fighting soil erosion. In many cases land not suitable for food production can be utilised to produce vegetation for biofuels. However, Hodgson (2010) did note the House of Lords' observation that the logging, burning and subsequent ploughing of what was tropical rain forest negates, with the destruction of such a carbon bank and the resultant carbon emissions, any advantage of the equivalent fossil fuel reduction. Pearce (2012c) detailed the extensive clearing, throughout the world, of forests and grasslands, and local peoples from that land, in order to plant suitable vegetation for biodiesel production. Many of these investment companies not only had dubious connections or histories, failed before producing much in the way of production, but in the meantime caused gross environmental and social devastation. Be that as it may, most of the biodiesel available in Western Australia is second generation, that is, it comes from crop residue or other 'left over' vegetable matter (Johansen, chemist, Biodiesel Australia, personal communication, 2009).

MRD Energy has established research and development works using carbon dioxide from a large coal fired power plant in Queensland to feed algae ("Micro-algae", 2011). Currently this produces biodiesel and stockfeed. Three others are planned in the eastern states to produce not only diesel and stockfeed, but oil for plastics while Murdoch University, University of Adelaide and SQC Pty Ltd are planning a pond pilot plant in Karratha WA. It was announced at the Green Chemistry & Engineering Conference that a breakthrough into the economical production of sustainable biodiesel from algae had been achieved. Whereas previously a number of chemical steps have been required to remove the lipids from the algae, Zimmermann (Coyle, 2012) found that by using non-toxic supercritical carbon dioxide, the process could not only be done in one reaction, but it was carried out at a lower temperature and hence required less energy (Coyle, 2012).

Over recent years a number of propositions have been put forward in an effort to counteract the rising temperatures. These range from installing large mirrors in space to absorbing CO₂ by 'seeding' the oceans with iron particles. The mirrors concentrate the sun's rays and beam it down as solar power or they can reflect the incoming sunlight. Spraying particles into the atmosphere in an effort to achieve the same reflective outcome has also been proposed. Marshall (2012) reported on a successful trial of iron fertilisation. Previous attempts had produced the desired bloom, but crustaceans had

been consuming it. In this trial, not only was it carried out at a slowly revolving eddy, but the water was high in silicic acid producing unpalatable diatoms with hard silica cell walls that on dying, sank and took the absorbed CO₂ with them. What the extent of overall global effect would be is not knowable but Boyd (2012) states at least, with increased bloom, it would halt the decrease of krill on which whales rely for their survive. However, the alga consumes nutrients that could produce a deleterious effect on diatom production to the disadvantage of other ocean species.

With this proposed geoengineering, would the oceans not heat-up sufficiently to produce the life giving rains of the monsoons or would some drought stricken areas get more rain and lower temperatures? The introduction of carbon pricing has sparked entrepreneurial interest (Pearman, 2011). Not only does this raise an ethical question as to whether such techniques should ever be used, it becomes compounded by the fact that investors in these technologies may seek to protect their intellectual property under patents. According to Marshall (2012) iron fertilisation was intended by some firms to be a way of accumulating sellable carbon credits but the London Convention Protocol of 2008 has disallowed it. Kravitz and Calderia (“Carnegie Institution”, 2012) claimed the sulphate-based aerosols required to scatter 2% of the incoming solar energy, would cause the sky to be not only whiter but also two to three times brighter. Because of the diffused light, global photosynthesis would increase allowing more carbon dioxide to be extracted from the atmosphere, a positive possibly to be countered by the negative effect on solar power generation due the lack of sunlight.

Geothermal

Depending on location, heat or heated water escaping from within the interior of the planet, can be sourced to produce energy or directly heat homes. Hot Fractured Rocks or Enhanced Geothermal Systems (EGS) is a process whereby two deep land based wells are drilled to a depth of 5 kilometres, fracturing the rock structures there. Water is pumped down the injection well, through these rocks and up through what is called the production well and on in to a turbine. Hot Sedimentary Aquifer (HAS) is where the hot water usually occurs in porous limestone and often doesn't require extra fracturing to be extracted. This latter method has been used internationally and in Australia for decades (“About Geothermal Energy,” n.d.). However Hodgson (2011) considered at this time it is economically not a viable form of energy being some four times more expensive than wind. Research is being undertaken by the WA Geothermal Centre of Excellence

into the direct use of heat from underground water for heating and cooling of buildings and industrial uses for horticulture and aquaculture (“Programs,” n.d.). Burger (2011) claimed that Australia, and specifically Western Australia, is amongst several countries where their energy demands are far out weighted by their geothermal capacity.

Hydroelectric

This form of generation utilises the potential energy of falling water that is captured by driving turbines. The head of water is achieved by means of a dam, direct or divisional, weir or barrage (Kaltschmitt, Streicher & Wiese, 2007). They cause massive environmental damage when constructed and are more often than not plagued by on going problems of silting on the upper dam side and deprivation of silt downstream (Hodgson, 2010). Despite built-in devices, fish migration is disrupted and habitats altered resulting in deaths. In some cases as with the Wellington Dam near Harvey, Western Australia, the water becomes too saline for human consumption; an eventuality predicted by a hydraulic engineer (personal communication, 1958) at the time of its upgrade in the 50s. The drying of southern WA negates a future for this form of power. Similarly the Snowy River Scheme, Australia’s largest such installation, caused problems for those down stream particularly during recent dry years (“Water Operations” 2011). The wisdom in constructing China’s Three Gorges Dam, the world’s largest hydro scheme, is already being challenged by silting up and the massive social dislocation of 1.2 million people (Chan, 2007). Solomon (2010) claimed the number of people forced to move is over 1.4 million and that by September 2007 even top Chinese bureaucrats were publically speaking of “ ‘hidden dangers’ ” (p. 438) in regard to the dam, not least that the weight of 320 million tons of water was exerting enormous pressure on what is a seismically active area. It is all part of China’s massive South-to-North Water Diversion engineering program. According to Pearce (2012b, 2012c) China intends to harness the waters that flow from Tibet’s plateau. This is the source of five of the world’s largest rivers, the Indus, Brahmaputra, Irrawaddy, Salween and the Mekong. There are five major dams under construction including the massive Xiaowan dam being constructed on the Mekong and the Bunji on the Indus, not far from the epicentre of the 2005 earthquake that killed in excess of 100,000 people. A further 14-19 others are planned. Perhaps that which will have the greatest impact on South East Asia are the proposed plans to divert the waters. China is planning to divert 40% of the Brahmaputra to its northern plains via a canal. India is to build a 400 kilometres long tunnel linking that river to the Ganges that would then facilitate irrigation of dry

areas 1000 kilometres. to the south. It is estimated that 20 million farmers in Bangladesh alone rely on the Brahmaputra for two thirds of their water (Pearce, 2012b). However, as to how it will all play out in the not too distant future is unknown, but Burma, Laos, Thailand, Cambodia and Vietnam all stand to be negatively affected by China's rapacious acquisition of these waters.

Pearce (2012a) reported that the Aral Sea disaster is being re-run in Mali where the Government has allowed Illovo, a South African enterprise, and a Chinese state consortium to divert the total Niger River's summer water supply for other sugar, cotton and rice crop irrigation. In conjunction with this, is Guinea's proposal to build a hydroelectric dam taking most of the river's wet season water. These projects will cause the demise of one of the world's biggest wetlands, the inner Niger delta forcing over a million people to migrate.

Hydrogen

For a number of decades hydrogen has been spoken of as the fuel for the future as it is abundant, burns easily and releases a large amount of heat per unit it mass. On the negative side are the facts it's expensive to produce, transport and from an automotive perspective is largely, at the moment, impractical in respect to storing sufficient amounts and refilling (Tabak, 2009). Due to the lack of a supply of freely available hydrogen, it is a secondary energy source and can be produced from water, methane, nuclear, ammonia and, were satisfactory collection and use of carbon dioxide developed, coal.

Marine Power

Wave

The techniques used to produce power rely on floating platforms, buoys or columns to capture the motion of the ocean and its varying pressures. Many sites around Australia's long coastline are suitable for this form of electricity production. There are now several in Australia that have passed the pilot project phase. Carnegie Wave Energy (CWE) is producing electricity for the naval base at Garden Island from its set-up off Fremantle (Paul Willis, developer CWE, personal communication, October 24, 2009). In 2012 this company announced that it would be building an installation in Bermuda after their study found the ocean there suitable for marine power (Willis, 2012). Oceanlink Wave

Energy Co. now has a turbine and power generator working off Pt. Kembla in NSW (“Marine energy,” n.d.).

Temperature differential

Known as ocean thermal energy, this method utilises the temperature differences between the surface water that is warmer than the layers at the ocean depths to drive a heat engine.

Tidal

The production of power, known as an ebb generating system, comes from the movement of the water across turbines placed as part of a dam or barrage in a tidal river or in a bay. It is nearly a decade since a proposal to build a tidal dam across Doctor’s Creek near Derby in the Kimberly area of Western Australia was rejected on environmental grounds, largely due to alleged required clearing of large areas of mangrove swamps, and according to Chapple (2011) a new proposal has not addressed the same issues. The plan was to use a barrage and turbines not the technique that only uses turbines. Certainly there are hardly any GHEs with this form of electrical generation but the resultant emissions from decaying cleared mangroves, the energy required in the construction of the dam and the continual necessity of dredging negates the benefit. Even at the world’s largest and most successful tidal power station the La Rance Barrage in Brittany, built on rock, and throughout the world where barrages have been placed in rivers or narrow bays, silting has been an ongoing problem (Dr K. Lyon, researcher Murdoch University, personal communication, 2006). However, Salequzzaman (2004) claimed that on the Bangladesh coastline due to cyclones and tidal surges, embankments and slush gates are already in place, thus avoiding the usual prohibitive infrastructure cost and damage to the surrounding environment. With the addition of tidal wheels, much needed power could be produced on a small local level to aid development.

Solar

Solar thermal collectors, the heating of water via the sun’s rays, though first used in 1767, did not gain popularity till the end of the nineteenth century. This occurred largely in areas of America where electricity was not available and the price of gas out of the affordable range for many (Leggett, 2009). The energy crisis of 1973 spurred the

construction of solar thermal concentrators. Using lens or reflectors, many of which track the sun, the rays are concentrated on to a small area producing super heated steam, generating electricity by driving a heat engine. Production of electricity via solar rays has been known since 1876 but it was not till 1954 that with the production of the first photovoltaic cell that the resultant energy really became of a useful level. Since then continuing developments have reduced weight, thickness of cells, now to a film, and costs have made this form of renewable energy a serious player. It may consist of a small number, usually 7-9 on the roof of a house, to cladding of city buildings or solar farms covering many hectares of land. Professor Dastoor has developed a printable solar cell consisting of semiconducting polymer nanoparticles within water. At this time the printed plastic sheets may be put on large surfaces, but the intention is, with further development, to be able to paint straight onto the surface/roof of a building (Knight, 2010).

Wind

One of the oldest forms of energy used to produce power is that of wind. Ancient Sumerians were known to have used it (Oremus, 2012). He wrote of a British firm planning to build a cargo ship with massive sail area to traverse along known windy routes between Britain and the Baltic states. Should the wind be insufficient it will run on biofuelled engines. In 2011 bunker fuel emissions were responsible for 3% of the world's total GHE (Morales and Chipman, 2011). It is planned that the International Marine Organisation will put a charge on shipping fuels with the raised revenue going to the UN's proposed Green Climate Fund and to compensate companies in the developing nations hit by rising shipping costs.

Currently of global energy, 2% is produced by wind with it expected by 2020 to have risen to 10%. The American Chemical Society (2012) found that there is a relationship between the larger the wind turbine the 'greener' the produced energy is. With increased knowledge, improved materials and better design, larger blades on the turbine capture more wind without an increase in the mass of the structure. Thirty years ago the diameter was 50 feet (approximately 15.25 metres.), now it is approximately 500 feet. (152.5 metres) and the prediction is that giant turbines of 1000 feet (305 metres) will be built. However, under the laws of thermodynamics, Kleidon of the German Max Planck Institute of Biochemistry claims that neither wind nor wave energy is forever renewable

as its continual use will deplete the solar energy reservoir within the atmosphere (M. Buchanan, 2011).

There is also considerable debate as to health effects caused by the turbines. A number of doctors claim that infrasound, barely audible low frequency noise, can contribute to a condition called wind turbine syndrome exhibiting symptoms of depression, high blood pressure and headaches (Colvin, 2011; Gray, 2011). Renewable Energy Solutions Australia has developed a near silent 23 metre high, thirty blade, rotating head turbine that hopefully overcomes some of the audio as well as the visual impact of this form of electrical generation. It has now been established that there is a 0.5° C average (greater at night) temperature rise in a turbine's surrounding square km. due to it drawing down warmer air from the atmosphere ("Warm reception", 2012).

Nuclear

The most controversial form of what has been called a renewable energy, is nuclear. As such it requires a greater coverage than the previously noted forms. The fact that it has been estimated there is only approximately 70-80 years supply of uranium remaining to be mined, brings into question as to whether it's renewable (T. Johnson, 2010; "Current and Future" 2011). Possibly the term non-fossil energy is more appropriate. However, Fetter (2009) claimed at present rate of use there is at least 200 years supply remaining. As for being a solution to the immediate problem of transferring from fossil fuel power generation, it is estimated there would be up to a ten-year delay before new nuclear power plants could be brought into the distribution streams, too long according to Leggett (2009). Their construction also has a history of delays and running over budget. Monbiot (2011) wrote of his challenge to prominent environmentalist Porritt as to why there has to be a choice between nuclear and conventional renewable energy, suggesting a portfolio of power sources. Hickman (2011) recorded that in 2010 when Professors Hawking and Cox were asked what they considered humanity's most pressing scientific challenge, both replied fusion energy production of electricity. Perhaps the greatest negativity to nuclear power production comes from the emotive concern regarding what can be its terrifying destructive use. Coupled with this is the problem of the waste produced from its energy production. Professor Leslie Kemeny (2011), Australian foundation member of the International Nuclear Energy Academy, wrote that Australia was the only one of the top 25 world economies that did not include nuclear power in its

electricity generation, but the Australian Treasury's global energy model of 2050 has 30% of the clean energy coming from nuclear generation.

From the emotive perspective, photographic and film images of the devastating destruction of Hiroshima in August 1945 has over the decades since then, continued to be reproduced and referenced (Barnett & Mariani, 2011). Writing for *The Australian*, Lomborg (2011a) noted that through out the daily 24-hour coverage of Fukushima, Chernobyl continually featured. The comparison that Chernobyl directly resulted in 31 deaths and that coal-mining accidents in China alone kill 2000 per year was not raised. US economist Jeffrey Sachs claimed that in regard to climate change, nuclear power is the only way forward and that without a financial incentive, the low-carbon energy will be wrecked by comparatively cheap fossil fuels (Harvey, 2012).

On the fictional side, but that which very much became part of Western social culture, in 1962, set and filmed during the Cold War arms race, came *Doctor No*. Collins (2012, para. 1) wrote that Professor Phillips, President of the Royal Society of Chemistry, considered the evil protagonist of the film, with his threats of global destruction, “ ‘have tarnished nuclear reputation’ ”. This film became a fiat for a genus. Some 37 years later Bond in *The world is not enough* was still battling nuclear destruction plots. At this time audiences were probably sensitised to the negative side of nuclear, as its release followed Chernobyl. Move forward to 2011, there is Fukushima, and though not a hydrogen explosion as such there was that possibility. The damage to infrastructure caused by the tsunami and explosion, has resulted in a wreck nuclear plant with the surrounding country and seas exhibiting a high degree of radioactive contamination. As Switkowski (2012) said it will be people's fear and depression worrying about future outcomes from Fukushima, not the possibly few sickness caused by radiation (“Fukushima increases”, n.d.) that will have the long lasting affect on the population's perspective of nuclear power.

Hodgson (2010) wrote extensively in defence of nuclear power comparing its production with other sources, not only in cost generation details but the history of human causalities and risk factors. Until recently all nuclear power generation was produced by fission, splitting of atoms, producing extremely high temperatures that requires massive amounts of water to cool the rods and a waste product. Not only does this waste remain radio active for centuries, but unfortunately can be upgraded to

nuclear weapons grade. The accidents at Chernobyl, Three Miles Island and Fukushima, all largely due to human error (Spencer & Loris, 2009; Colvin, 2012; “Fukushima, Three”, 2012), were all water-cooled nuclear fission plants. The Fukushima Nuclear Accident Independent Investigation Commission arrived at the conclusion of 1100 interviews “that the accident was ‘a profoundly man-made disaster that could and should have been foreseen and prevented’ ” (Gilhooly, 2012).

The necessity for increased safety and greatly diminished, if not eradicated, dangerous remaining waste has driven the development of 4th Generation reactors. Depending on their methodology, they are also known as pebble or fast breeder reactors that actually ‘feed’, rely on their ‘waste’, as their fuel source for continuing operating. Connor (2011) reported that the UK Government has now, in theory, allowed the conversion into mixed oxide of the country’s plutonium waste that could be utilized as fuel in any new fast reactors. At this stage there is not a commercial partner for the project to proceed. Behr (2011) reports that Microsoft’s Bill Gates is backing the development of a ‘wave reactor’. The company wishes to team up with countries pursuing fast breeder systems. The wave reactor is slow-burning, consuming most of its starting fuel supply and does not need refuelling for over 40 years. This negates the necessity of having to store the spent fuel and the previous pattern of refuelling or reprocessing that was a window of opportunity for theft. In 2012 Richard Branson approached the White House, apparently without success, pushing for development of yet another form of integral fast reactors (Halper, 2012).

Lynas (2012) reported that a UK-French nuclear power deal was entered into due to the fact that within a decade the UK will lose through decommissioning all but one of its nuclear power generation. This represents a fifth of its total electrical power generation. Several months later a feasibility study was to be carried out on building a fast breeder reactor at Sellafield, Cumbria. This facility would use the on site plutonium waste in its generation of electricity (Connor, 2012).

The first attempt was made in Britain during the 1950s, with a mechanism called Zeta, to produce electrical energy by nuclear fusion. It was not until 2011 that similar work was carried out (“Next ITERation,” 2011). Instead of smashing nuclei apart, a fusion reactor would force them together and for this the International Thermonuclear Experimental Reactor (ITER) has been built in the south of France. In theory, when

deuterium and tritium are fused to form a plasma and helium is produced, there is enough energy to run the reactor and also provide that which can create electricity. There have been problems with the necessary secondary counteractive magnetic field's current supply that's induced within the plasma itself. The Wendelstein 7-X is now being built with a twisted tokamak, a doughnut shaped vacuum device, called a stellarator. Designed by modern computers that can handle the required complex calculations, the magnetic field inducing coils will be so placed as to ensure even distribution. Currently the energy required to produce such a condition of fusion is far greater than the energy given off by it (Stanway, 2011). By producing higher temperature and pressures, laser fusion is faster and requires the plasma to be held for only billionths of a second thereby avoiding its propensity to become unstable or leak. Should this be successful, nuclear fusion will have arrived. Hecht (2011) wrote of Laser Fusion as a new method of clean energy production.

Thorium is found though out the world and there appears to be sufficient for thousands of years of civilisation's power requirements. A weapons grade material is not a by-product (D. Smith & Kerr, 2011). A thorium based molten salt reactor system runs without the need of computers or electrical pumps. Should overheating occur a small plug melts, and the salts drain away. When the photo beam ceases blasting the neutrons the fission also ceases, as it cannot run independently. There is not a chain reaction (Evans-Pritchard, 2011). As Richard Martin (Flatow, 2012; Niiler, (2012) wrote a group of American scientists are proposing not only to convert existing nuclear reactors to use thorium but to build new liquid-fluoride thorium reactors. These are not pressurised, burn at a higher temperature than those using uranium and hence use up more fuel. The future for nuclear power lies with either, or and, fast breeder reactors, thorium or fusion. Quite possibly there will not be a 'silver bullet' solution to the eradication of fossil fuel use but a collection of alternatives.

APPENDIX C: NEWSPAPER REPORTS PRIOR TO INTERVIEWS

A review of this State's only daily and some National newspapers over several months prior to the interviews of Sustainability relevant issues and when the carbon tax debate was perhaps at its zenith, found little other than fear followed by contradiction given to the reader.

February (2011) saw the Opinion piece "Stand by for more pain on power prices" (2011) claiming that to get the disintegration of the State run power company the energy minister, Eric Ripper, of the then Labor government had to promise freezing domestic prices for several years. This virtually held down prices to householder for some 15 years before "... reality hit in mid-2009". A month later Boddy, Eliot and Tillett (2011) report that Ripper was demanding of the Federal Government that they "... declare they will not keep a single cent of the revenue from the carbon tax and they will return it all to Australian families in the form of income tax cuts and pension increases". Later that month, Probyn (2011) wrote of Hockey's declaration to repeal [if they won office] the carbon tax pointing out that families, even if they get a tax concession, are with the tax worse off throughout the year. The Opinion ("Bogged in", 2011) piece in April repeated Climate Change Minister Combet's simile of the carbon tax will be like getting one's first injection leaving them better for the experience. Again in April, Butterly (2011) wrote that a number of companies had written to the PM saying, without international support, the tax would do nothing regarding Climate Change but would be detrimental to exports and Australian living standards would decrease. He also noted that the Australian Workers Union had threatened that if one job was lost they would no longer support the Government.

In June, Wright and Tillett's (2011) "Tension grows over carbon tax" noted that consumer confidence had dropped, particularly those on less than \$40,000, and people were worried about losing their jobs. This was at a time when there was talk of compensating coal mines and coal fired power generators. Not at any stage in the above articles was there any mention of the fact that most of the need for more revenue for the electricity power service providers was due to considerable increase in new and or improved infrastructure needed to cope with Australia's high population growth. Some two months later the quantitative survey of this research was conducted with the interviews the following month.

The Australian Government set an initial price of \$23 per tonne to start on 1st July 2012 and increasing until 2015, when it is planned to shift to a trading scheme wherein the market will set the price. Banks's (2011) article in October was titled "Warning on high cost of carbon tax" and continued that the production costs will "... jump ..." and that "... the burden will inevitably be passed on to households and businesses". In August *The Australian* gave extensive coverage of Lord Lawson, chairman of UK's Climate Change sceptics' funding body Global Warming Policy Foundation, stating that Prime Minister Thatcher being instrumental in establishing the IPCC was as a way to break the coaling unions and promote nuclear energy, and describing Australia's climate change plan as "totally misconceived" (Lloyd, 2010, para. 3)

APPENDIX D: ETHICS DOCUMENTS

Participant Information Letter

Western Australian Graduate Diploma of Education (Primary) Students' Perceptions of Sustainability

Fellow student,

For my Ph.D, I am researching Post Graduate Diploma of Education (Primary) students' perceptions of sustainability with the aim being to establish the level of knowledge and understanding of the topic.

The first stage is to gather quantitative data by means of a 40 question questionnaire via digital keypad technology. This will involve 150 voluntary students for approximately 15 minutes within class time. Your personal identity is not being sort and data collected will not be linked to you or any other individual.

The second stage will require 9-12 participants for a 5 question follow up interview of 30-40 minute duration. Audio recording will be used for the questions and the responses to such without your personal identity being linked in any way.

Information gained will contribute towards the structure of Primary education in sustainability and may sensitise participants to various facets of sustainability not previously considered.

The procedure is risk free with any inconvenience consisting of firstly 15 minutes and for those who volunteer for the interview a further 30-40 minutes. Travel will be limited to the University campus.

If you have any questions or require any further information about the research project, please do not hesitate to contact me/

If you have any concerns or complaints about the research project and wish to talk to an independent person, you may contact:

Research Ethics Officer Edith Cowan University 270 Joondalup Drive JOONDALUP
WA 6027 Phone: (08) 6304 2170 Email: research.ethics@ecu.edu.au

Yours faithfully,

Judith Odgaard [jodgaard@our.ecu.edu.au]

(Ph. D Student: Edith Cowan University –Faculty of Education & Arts)

Principal Supervisor: Dr Geoffrey Lummis [g.lummis@ecu.edu.au]

Associate Supervisor: Dr Graeme Lock [g.lock@ecu.edu.au]

Questionnaire Consent Form

Western Australian Graduate Diploma of Education (Primary) Students' Perceptions of Sustainability

Fellow student,

You have no doubt read the Participants' Information Letter that laid out the details of my request but I have reiterated it below.

The first stage is to gather quantitative data by means of a 40 question questionnaire via digital keypad technology. This will involve 150 voluntary students for approximately 15 minutes within class time. Your personal identity is not being sort and data collected will not be linked to you or any other individual.

The second stage will require 9-12 participants for a 5 question follow up interview of 30-40 minute duration that will be audio recorded but data collected will not be linked to you or any other individual.

Information gained will contribute towards the structure of Primary education in sustainability and may sensitise participants to various facets of sustainability not previously considered.

The procedure is risk free with any inconvenience consisting of firstly 15 minutes and for those who volunteer for the interview a further 30-40 minutes. Travel will be limited to the University campus.

If you are willing to participate, would you please sign this questionnaire consent form and for those prepared to be interviewed, please sign and submit to the researcher after the questionnaire, the separate interview consent form with your contact details. This separated sheet will secure anonymity from the questionnaire.

Yours faithfully,

Judith Odgaard [jodgaard@our.ecu.edu.au]

(Ph. D Student: Edith Cowan University –Faculty of Education & Arts)

Principal Supervisor: Dr Geoffrey Lummis [g.lummis@ecu.edu.au]

Associate Supervisor: Dr Graeme Lock [g.lock@ecu.edu.au]

Participant's signature

Interview Consent Form

Western Australian Graduate Diploma of Education (Primary) Students' Perceptions of Sustainability

Fellow student,

I thank you for agreeing to be interviewed.

Please provide the following:

Email contact-

Home telephone number-

Mobile/cell contact number-

Postal address-

I will contact you in the near future to set up the 30-40 minute interview covering key research questions.

Yours faithfully,

Judith Odgaard [jodgaard@our.ecu.edu.au]

(Ph. D Student: Edith Cowan University –Faculty of Education & Arts)

Principal Supervisor: Dr Geoffrey Lummis [g.lummis@ecu.edu.au]

Associate Supervisor: Dr Graeme Lock [g.lock@ecu.edu.au]

Participant's signature

APPENDIX E: QUESTIONNAIRE INSTRUMENT (PILOT PHASE ONE)

1. Do you think Australia's current population of 21 million is too high?

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

2. Should the Australian Federal Government have a policy on sustainable population?

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

3. Should the Australian Federal Governments continue to have policies of high immigration rates?

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

4. Should renewable energy resources such as solar, wind, geothermal, wave and tidal etc. be provided with tax incentives/subsidies by the Australian Federal Government?

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

5. Would you change your life style habits to reduce your carbon footprint?

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

6. As your main source of meat, due to its low methane emission, would you consider eating kangaroo, instead of lamb, beef, or pork?

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

7. Would you restrict the size of your family to at least replacement level?

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

8. Should the Australian Federal Government, by means of educational /welfare benefits or the like, encourage parents to have only one or two children?

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

9. Should the Australian Federal Government continue the current baby bonus scheme?

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

10. Should the Australian Federal Government charge a carbon tax on parents who have more than two children?

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

APPENDIX F: QUESTIONNAIRE INSTRUMENT (PILOT PHASE TWO)

Section A: How GDP students source information regarding Sustainability

The following statements were put using a six-point Likert scale in the 2011 survey.

- My attitudes, values and concepts regarding Sustainability and Climate Change are largely formed through family and friends.
- My attitudes, values and concepts regarding Sustainability and climate are formed by TV.
- My attitudes, values and concepts regarding Sustainability and Climate Change are largely formed by talk back radio.
- My attitudes, values and concepts regarding Sustainability and Climate Change are not largely formed by the print-media.
- My attitudes, values and concepts regarding Sustainability and Climate Change are largely formed from the Internet.
- My attitudes, values and concepts regarding Sustainability and Climate Change are largely formed by formal education. This being a reverse order question.

Section B: Environment economic lifestyle and Climate Change.

In this section the following statements were offered to the students for a response:

- The Australian Government should not have a policy on Sustainability (*this was not only a negative statement, but as it dealt with policy that was related to Part Three*).
- Full employment is more important than Climate Change (*this question/statement underscored the need to critically reflect upon the interlocking nature of factors within Sustainability*).

Lifestyle attitudes and behaviours

- I am prepared to change my eating habits to reduce my carbon footprint.
- I prefer to buy local food and goods that have a low carbon footprint.
- I would not consider eating meat from low methane producing animals such as kangaroo to reduce emissions.
- The Australian government should continue to support water intensive crops e.g. cotton and rice (*this asked the students to critically reflect upon Government policy and big business interests*).
- Your university sees Sustainability as an important issue.
- The Australian Government should not provide extra overseas aid for Sustainability activities in developing countries (*a reverse statement*).
- The Australian Government should strengthen its policies protecting biodiversity, rainforests marine parks and the like.
- The Australian Government should pursue nuclear energy in order to reduce carbon emissions.
- I do not believe in Climate Change (*a reverse statement*).

Interview questions

It was assumed that those students who volunteered to participate in the qualitative survey questions were most likely to hold strong opinions regarding Climate Change. Some had a science background, or an activist pro-Sustainability attitude.

Section C: Emissions, taxation, subsidies and renewable energy

This group of factors also contributed to a large portion of questions and responses of the 18 interviews. The survey statements being:

- The Australian Government should tax big carbon emission producers.
- The Australian Government should introduce a market-based emissions trading scheme for greenhouse gases.
- The Australian Government should not provide tax incentives for renewable energy (*reversed*).
- The Australian Government should provide tax benefits for fossil fuel industries (coal, oil & gas).
- The Australian Government should not introduce a carbon tax on family energy usage (*it has since the survey*).
- The Australian Government should subsidise a network of renewable energy fuelled public transport options to reduce car usage in cities.

Interview questions

The interview questions sought to find how the respondents personally perceived Sustainability in relation to Government policy, economics, big business, resource depletion and alternative energy sources were:

- What policies would you introduce in Australia to develop environmental, economic and social Sustainability?
- What about nuclear energy, does that have a priority?
- How do you think the Government should manage its water resources... e.g. crops, farming techniques? What should the Australian Government do to reduce carbon emission in both Australia and overseas?
- Should the government subsidize families to shift to solar and renewables?
- Should the Government remove subsidies from fossil fuel producers?
- Should the Government provide tax disincentives so families and individuals reduce their carbon footprint?

Section D: Australia's Population

At the time of the quantitative survey, the topic of population had recently received more publicity than it had for many years. The writings on population discussed in the literature review were readily available to the public, and therefore the GDE-P participants had they so chosen to access it. With the exception of the statement with which the survey ended and was of a personal perspective, Section D: Australia's population, consisted of statements regarding the Australian Government's policy, or

lack of, on this country's sustainable population. It was considered that perceptions and attitudes to population effect on Sustainability could be elicited from Likert responses to the following statements:

- The Australian Government should not seek a sustainable population for Australia.
- The Australian Government should pay 'new' parent/s a 'baby bonus'.
- Australia's population should be: Under 20 million people; 20-40 million people; 40-60 million people; 60-80 million people; 80-100 million people; Over 100 million people.
- The Australian Government should charge a tax on parents who have more than two children.
- The Australian Government should increase skilled immigration rather than increase national education expenditure.
- The Australian Government should increase foreign aid to developing countries that supply Australia with skilled professionals.
- The Australian Government should finance the relocation of environmental refugees from submerging Pacific Island Nations to Australia.
- The Australian Government should provide extra overseas aid for family planning in developing nations.
- If I were starting a family today I would plan my family to that of replacement level.

Interview questions

By volunteering to participate in the follow up interview, it was deemed that these were students who had a positive attitude to desiring a sustainable future. Below are the eleven interview questions:

- How do you see the relationship between Australia's population growth and Sustainability?
- And what can governments and individuals do to get the balance right?
- Should the Government seek a sustainable population that balances biophysical, social and economic interests for the long term?
- Should the Government develop policies that encourage smaller families that will allow a long-term sustainable population?
- What population should Australia maintain?
- Do you think Australia has a moral obligation to help developing nations with the problems of Sustainability and Climate Change?
- Should the Government provided developing nations with aid for Sustainability projects?
- Should Australia give aid to developing countries to help with birth control and family planning?
- Should Australia seek skilled immigration to develop its natural resources, if and when its existing workforce is not sufficient?

If Australia allows professional workers such as scientists, engineers and doctors from developing countries do you think the Government should compensate those countries for the loss of expertise? Should Australia help relocate people on Pacific islands when

their land floods due to carbon emissions Climate Change? What actions are/or will you, as an individual be taking in regard to Sustainability? This last question was added to see if, as individuals, they were active in attempting to ensure a sustainable future.

APPENDIX G: CRONBACH'S ALPHA COEFFICIENT RESULT TABLES

Note: Item coding was rechecked for all constructs, and deemed to be correctly coded based on the Likert responses.

Cronbach's alpha for Construct A: How GDP students source information regarding Sustainability

Reliability Statistics

Cronbach's Alpha	N of Items
.007	6

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
My attitudes, values and concepts regarding sustainability and climate change are formed through family and friends.	16.77	9.744	.075	-.074 ^a
My attitudes, values and concepts regarding sustainability and climate are formed by TV.	17.03	10.637	.021	-.011 ^a
My attitudes, values and concepts regarding sustainability and climate are informed by talk back radio.	18.04	9.868	.068	-.065 ^a
My attitudes, values and concepts regarding sustainability and climate change are not largely formed by print media.	17.33	13.035	-.261	.259
My attitudes, values and concepts regarding sustainability and climate change are largely formed from the Internet.	17.34	10.055	-.016	.029

My attitudes, values and concepts regarding sustainability and climate change are formed by formal education.	16.56	8.366	.169	-.217 ^a
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a. The value is negative due to a negative average covariance among items. This violates reliability model assumptions. You may want to check item codings.

Cronbach's alpha for Construct B: Environment economic lifestyle and Climate Change

Reliability Statistics

Cronbach's Alpha ^a	N of Items
-.050	11

a. The value is negative due to a negative average covariance among items. This violates reliability model assumptions. You may want to check item codings.

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
The Australian Government should not have a policy on sustainability.	34.33	19.557	.153	-.107 ^a
Full employment is more important than climate change and sustainability.	32.76	16.476	.247	-.245 ^a
I am prepared to change my eating habits to reduce my carbon footprint.	31.77	26.005	-.469	.282
I prefer to buy local food and goods that have a low carbon footprint.	31.00	20.116	-.109	.029

I would not consider eating meat from low methane producing animals such as kangaroo to reduce emissions.	32.67	15.702	.106	-.181 ^a
The Australian Government should continue to support water intensive crops e.g. cotton and rice.	32.33	15.267	.291	-.318 ^a
Your university sees sustainability as an important issue.	31.10	19.541	.044	-.077 ^a
The Australian Government should not provide extra overseas aid for sustainability activities in developing countries.	33.19	18.704	.001	-.058 ^a
The Australian Government should strengthen its policies protecting biodiversity rainforests marine parks and the like.	30.33	22.050	-.224	.064
The Australian Government should pursue nuclear energy in order to reduce carbon emission.	32.84	17.758	.039	-.093 ^a
I do not believe in climate change.	33.69	19.175	-.016	-.044 ^a

a. The value is negative due to a negative average covariance among items. This violates reliability mode assumptions. You may want to check item codings.

Cronbach's alpha for Construct C: Emissions, taxation, subsidies and renewable energy

Reliability Statistics

Cronbach's Alpha ^a	N of Items
-.174	6

a. The value is negative due to a negative average covariance among items. This violates reliability model assumptions. You may want to check item codings.

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
The Australian Government should tax big carbon emission producers.	17.81	7.081	.127	-.464 ^a
The Australian Government should introduce a market-based emissions trading scheme for greenhouse gases.	18.14	7.660	.168	-.456 ^a
Australian Government should not provide tax incentives for renewable energy.	20.81	11.574	-.277	.001
The Australian Government should provide tax benefits for fossil fuel industries (coal oil & gas).	19.79	9.359	-.112	-.067 ^a
The Australian Government should not introduce a carbon tax on family energy usage.	17.94	10.692	-.266	.172
The Australian Government should subsidise a network of renewable energy fuelled public transport options to reduce car usage in cities.	17.29	8.671	.028	-.256 ^a

a. The value is negative due to a negative average covariance among items. This violates reliability model assumptions. You may want to check item codings.

Cronbach's alpha for Construct D: Australia's Population

Reliability Statistics

Cronbach's Alpha	N of Items
.167	8

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item- Total Correlation	Cronbach's Alpha if Item Deleted
The Australian Government should not seek a sustainable population for Australia.	19.76	26.969	-.226	.295
The Australian Government should pay 'new' parent/s a 'baby bonus'.	18.27	24.519	-.156	.329
The Australian Government should charge a tax on parents who have more than two children.	19.83	22.521	.070	.143
The Australian Government should increase skilled migration rather than increase national education expenditure.	19.87	22.027	.175	.090
The Australian Government should increase foreign aid to developing countries that supply Australia with skilled professionals.	18.40	20.475	.214	.048

The Australian Government should finance the relocation of environmental refugees from submerging Pacific Island Nations to Australia.	18.51	18.630	.255	-.009 ^a
The Australian Government should provide extra overseas aid for family planning in developing nations.	18.30	19.691	.179	.055
If I were starting a family today I would plan my family to that of replacement level.	18.86	20.704	.064	.146

a. The value is negative due to a negative average covariance among items. This violates reliability model assumptions. You may want to check item codings.

APPENDIX H: INTERVIEW SCRIPT

1. What do you think are the key issues regarding sustainability and climate change?

No prompts

2. Who do you believe provides the most reliable information on the topic?

Prompts:

- *Family and friends;*
- *TV (Commercial or ABC/SBS);*
- *Radio (Commercial or ABC);*
- *Print media (e.g. newspapers, magazines etc.);*
- *Internet, blogs; and*
- *Education.*

3. What policies would you introduce in Australia to develop environmental, economic or social sustainability?

Prompts:

- *What do you think the Australian Government's Sustainability/Climate Change policy should include?*
- *How do you see the link between Sustainability /Climate change and the economy?*
- *What do you think you could do to reduce your carbon footprint? e.g. local foods, change of diet and transport options etc.*
- *Should nuclear energy be a priority in reducing a nation's carbon emissions?*
- *What renewable energy options should be developed to reduce carbon emissions?*
- *How do you think the Government should manage its water resources? e.g. crops, farming techniques etc.*
- *What areas of the environment should get extra protection or less?*

4. What should the Australian Government do to reduce carbon emissions, both here and overseas?

Prompts:

- *Should the Government tax big carbon emission producers?*
- *Should the Government remove subsidies from fossil fuel producers?*
- *Should the Government allow carbon emissions to be traded on the stock market?*
- *Should the Government subsidise the development of renewable energy?*
- *Should the Government subsidise the development of public transport that uses renewable energy?*
- *Should the Government subsidise families to shift to solar and other renewable energy options?*

- *Should the Government provide tax incentives so families and individuals reduce their carbon footprint?*

5. How do you see the relationship between Australia's population growth and sustainability? And what can governments and individuals do to get the balance right?

Prompts:

- *Should the Government seek a sustainable population that balances biophysical, social and economic interests for the long term?*
- *Should the Government develop policies that encourage smaller families that will allow a long-term sustainable population?*
- *Are you worried about Australia's population increasing?*
- *What population should Australia maintain?*

6. Do you think Australia has a moral obligation to help developing nations with problems of sustainability and climate change?

Prompts:

- *Should the Government provide developing nations with aid for sustainability projects?*
- *Should Australia give aid to developing countries to help with birth control and family planning?*
- *Should Australia seek skilled migration to develop its natural resources, if and when its existing workforce is not sufficient?*
- *If Australia allows professional workers such as scientists, engineers and doctors from developing countries do you think the Government should compensate those countries for the loss of expertise/*
- *Should Australia help relocate people on Pacific Islands when their land floods due to carbon emissions climate change?*


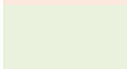
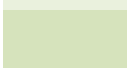
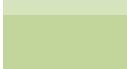




7. What actions are/or will you, as an individual be taking in regard to sustainability?

No prompts

8. Have you got any comments?

APPENDIX I: INTERVIEW DATA

The following is a summary of the coding from the 18 GDE-P student interviews. A matrix was constructed for responses to each interview question. Preceding the matrix is a response key linking the codes to relevant literature. The matrices are coded using the following colour key:

Not mentioned	
Mentioned once	
Mentioned twice	
Mentioned three times	
Mentioned four times	
Mentioned five times	
Mentioned six times	
Mentioned seven times	

Due to the microanalysis of the interview data, it was necessary to split the coding into multiple tables for the interview questions. Subsequently for interview question one, the coding is presented in three tables (Tables 1.1-1.3 respectively). At the bottom of each table the number of respondents are summarised (e.g. 1x2 means one respondent mentioned the sub-theme twice). Percentages (rounded up) of the respondents commenting on the sub-theme are also given at the bottom of each table.

The coding per interview question was then summarised into key themes across the four interrelated factors of sustainability discussed throughout the thesis.

Question One: What Do You Think Are The Key Issues Regarding Sustainability and Climate Change?

22 sub-themes were determined for question one and are presented in Tables 1.1 - 1.3.

Response Key (Table 1.1)

CC1	Icecaps melting (IPCC, 2001; Flannery, 2005; Pittock, 2009)
CC2	Sea level rising (Cribb, 2010; IPCC, 2001; Lowe, 2005a; Pittock, 2009)
CC3	Changing ecological environment (A. D. Brown, 2003; Cribb, 2010; Diamond, 2005; Flannery, 1994; Garnaut, 2008; D. Klein, 1969; Leggett, 2000; Lovelock, 2006; Lynas, 2007; Pittock 2009; O'Connor, 1998; O'Connor & Lines, 2008; Spratt & Sutton, 2009; Stern, 2006; Walters, 2007)
CC4	Changing weather patterns/rainfall (A.D. Brown, 2003; Cribb, 2010; Foley, 2005; Garnaut, 2008; Lindenmayer, 2007; Lovelock, 2006; Lowe, 2005a & 2005b; Lynas, 2007; O'Connor & Lines, 2008; Pittock 2009; Spratt & Sutton, 2009)
CC5	Environmental refugees (Cribb, 2010; Gibney, 2004; O'Connor & Lines, 2008)
CC6	Impact of climate change on sustainability (Cribb, 2010; SPA, 2009; Flannery, 2010; Weaver & Weaver, 2008)
CC7	Propaganda [denial of anthropogenic climate change] (Cubby, 2012; 'Deception is', 2012; Friel, 2010; Goldenberg, 2012; C. Hamilton, 2010; Lloyd, 2011; Lomborg, 2001; McCright & Dunlap, 2011; Readfearn, 2011a & b; Readfearn, 2012; Stephens, 2011; Wallace, 2010)
CC8	Cost to consumers (Singer, 2001; Stern, 2006)

Table 1.1

Interviewee	CC1	CC2	CC3	CC4	CC5	CC6	CC7	CC8
AlanA35A								
AnnA43A								
BarbaraO29A								
BrianA49A								
CaddyA33A								
ColinA51A								
DebraO40S								
DesO33S								
EdithA37A								
FayeAO34A								
FredA23A								
GregO31A								
HelenA33S								
IreneA26A								
JoyA37A								
KerryA40A								
LornaA38S								
MaryA29A								
No Rx1	1x1	2x1	2x1	1x1	2x1	1x2	2x1	3x1
No Rx2	0	0	0	0	0	2x1	0	1x2
Informed density	1	2	2	1	2	3	2	4
Percentage	6%	11%	11%	6%	11%	17%	11%	22%

Response Key (Table 1.2)

PG	Population growth [regarded as a threat to sustainability] (A. D. Brown, 2003; L.R. Brown, 2006; Chittleborough 2006; Daly, 1973; Diamond 2005; Ehrlich 1968,1978; Ehrlich & Ehrlich, 1983; Flannery, 2005 & 2010; , 1993, 1973 & 1998; Kile, 1995; D. Klein, 1969; Lattimore and Pobke, 2008; Lindenmayer 2007; Lowe, 2005a, 2005b & 2012; Martin, 2006; Malthus, 1973; Meadows, Meadows, Randers & Behrens III, 1972; O'Connor & Lines, 2008; Andrew Simms, 2010; Watson, 2004; Wattenberg, 2004; Weeks, 1989)
PC	Curbing population growth
CI	Changing our impact on planet
E	Education and research (ARIES, 2009; ACCI 2009; Hammond & Churchman, 2007; UNESCO, 2002)
EGP	General emissions pollutants (Lindermayer, 2007; Trivedi, 2008; Wilson & Edwards, 2008)
CDE	Carbon dioxide (A. D. Brown, 2003; L. R. Brown, 2006; Diamond, 2005; O'Connor & Lines, 2008; Leggett, 2000; Lowe, 2005a, 2005b & 2012; Lovelock, 2006; Lynas, 2007; Leggett, 2000; Stern, 2006)
CA	Too many chemicals used/added to crops and animals (L. R. Brown, 2006; Cribb, 2010; G. W. King, 1988; Spratt & Sutton, 2009; Yencken & Wilkinson, 2000).
PP	Plastic pollutants

Table 1.2

Interviewee	PG	PC	CI	E	EGP	CDE	CA	PP
AlanA35A								
AnnA43A								
BarbaraO29A								
BrianA49A								
CaddyA33A								
ColinA51A								
DebraO40S								
DesO33S								
EdithA37A								
FayeAO34A								
FredA23A								
GregO31A								
HelenA33S								
IreneA26A								
JoyA37A								
KerryA40A								
LornaA38S								
MaryA29A								
No Rx1	2x1	2x1	0	6x1	3x1	3x1	1x1	1x1
No Rx2	1x2	0	0	1x2	0	1x2	0	0
No Rx3	0	0	1x3	0	0	0	0	0
Informed density	3	2	1	7	3	4	1	1
Percentage	17%	11%	6%	39%	6%	22%	6%	6%

Response Key (Table 1.3)

RD	Resource depletion (A. D. Brown, 2003; L. R. Brown, 2006; Chittleborough, 2006; Korten, 1996; O'Connor, 1998; O'Connor & Lines, 2008; Lowe, 2005a, 2005b & 2012; Lindenmayer, 2007; Ophlus, 1973; Rolls, 1969; Weeks, 1989)
RN	Renewable resources (Flannery, 2010; Grattan & Colebatch, 2008; Leggett, 2000; McNeil, 2009; O'Connor & Lines, 2008; Pearse, 2007; Spratt & Sutton 2009)
RU	Re-use or recycling of waste as a resource (Cribb, 2010; McNeil, 2009)
W	Diminishing supply (A. D. Brown, 2003; L. R. Brown, 2006; Leggett, 2000; Lowe, 2005a & 2005b; Martin 2006; McNeil, 2009; Spratt & Sutton 2009; UNESCO 2002)
FS	Food security (Cribb, 2010; Diamond, 2005; D. Klein, 1969; Martin 2006; McNeil, 2009; O'Connor & Lines, 2008; Wallace, 2010; Spratt & Sutton 2009)
LFA	Lack of funding for adaption to climate change (Singer, 2002; Spratt & Sutton, 2009)

Table 1.3

Interviewee	RD	RN	RU	W	FS	LFA
AlanA35A						
AnnA43A						
BarbaraO29A						
BrianA49A						
CaddyA33A						
ColinA51A						
DebraO40S						
DesO33S						
EdithA37A						
FayeAO34A						
FredA23A						
GregO31A						
HelenA33S						
IreneA26A						
JoyA37A						
KerryA40A						
LornaA38S						
MaryA29A						
No Rx1	5x1	1x1	1x1	1x1	1x1	0
No Rx2	1x2	0	0	0	0	0
Informed density	6	1	1	1	1	0
Percentage	33%	6%	6%	6%	6%	0%

Question Two: Who Do You Believe Provides The Most Reliable Information On The Topic?

16 sub-themes were determined for question two (Tables 2.1-2. 2).

Response Key (Table 2.1)

F1	Family
F2	Friends
T	TV not specific
TC	TV commercial
TG	TV government
TN	TV news not specific
RC	Radio commercial
RG	Radio government

Table 2.1

Interviewee	F1	F2	T	TC	TG	TN	RC	RG
AlanA35A								
AnnA43A								
BarbaraO29A								
BrianA49A								
CaddyA33A								
ColinA51A								
DebraO40S								
DesO33S								
EdithA37A								
FayeAO34A								
FredA23A								
GregO31A								

HelenA33S								
IreneA26A								
JoyA37A								
KerryA40A								
LornaA38S								
MaryA29A								
No Rx1	4x1	3x1	1x1	0	1x1	2x1	0	2x1
No Rx2	0	0	0	0	1x2	0	0	0
Informed density	4	3	1	0	2	2	0	2
Percentage	22%	17%	6%	0%	11%	11%	0%	11%

Response Key (Table 2.2)

P	Print media
PB	Better quality magazines, journals
IW	Internet (general)
IB	Internet (blogs)
E1	Education (general)
E2	Education (tertiary)
RP	Personal research
SC	Scientific community and research

Table 2.2

Interviewee	P	PB	IW	IB	E1	E2	RP	SC
AlanA35A								
AnnA43A								
BarbaraO29A								
BrianA49A								
CaddyA33A								
ColinA51A								

DebraO40S								
DesO33S								
EdithA37A								
FayeAO34A								
FredA23A								
GregO31A								
HelenA33S								
IreneA26A								
JoyA37A								
KerryA40A								
LornaA38S								
MaryA29A								
No Rx1	3x1	1x1	10x1	2x1	8x1	1x1	1x1	4x1
No Rx2	0	0	0	0	0	1x2	0	1x2
No Rx3	0	0	0	0	0	0	0	1x3
Informed density	3	1	10	2	8	2	1	6
Percentage	17%	6%	55%	11%	44%	17%	6%	33%

Question Three: What Policies Would You Introduce In Australia To Develop Environmental, Economic Or Social Sustainability?

33 sub-themes were identified for question three and are presented in Tables 3.1 – 3.4

Response Key (Table 3.1)

C	Costs/economic output (N. Stern, 2006; Walters, 2007)
P	Population (Abernethy, 1994 & 2005; Bandarage, 1997; A. D. Brown, 2003; L. R. Brown, 2006; Chittleborough, 2006; Diamond, 2005; Ehrlich, 1968, 1978; Ehrlich & Ehrlich, 1983; Hardin , 1973, 1993 & 1998; Malthus, 1973; Meadows, Meadows, Randers & Behrens III, 1972; Lindenmayer, 2007; Lowe, 2005a, 2005b & 2012; Martin, 2006; O'Connor, 1998; O'Connor & Lines, 2008. Paddock, 1975; Watson, 2004; Weeks, 1989)
PC	Curbing population growth
TI	Tax/incentive
TS	Trading scheme, emission
TR	Transport
PM	Planning/management
CI	Changing peoples' ideas

Table 3.1

Interviewee	C	P	PC	TI	TS	TR	PM	CI
AlanA35A								
AnnA43A								
BarbaraO29A								
BrianA49A								
CaddyA33A								
ColinA51A								
DebraO40S								
DesO33S								
EdithA37A								
FayeAO34A								
FredA23A								
GregO31A								
HelenA33S								
IreneA26A								
JoyA37A								
KerryA40A								
LornaA38S								
MaryA29A								
No Rx1	3x1	4x1	3x1	4x1	2x1	5x1	4x1	1x1
No Rx2	5x2	0x2	0	6x2	0	0	0	0
No Rx3	2x3	1x3	0	0	0	0	0	0
No Rx4	0	0	0	1x4	0	3x4	0	0
Informed density	10	5	3	11	2	8	4	1
Percentage	55%	28%	18%	61%	11%	44%	22%	6%

Response Key (Table 3.2)

SC	Suitable crops/geographic location (Beilharz, 2012; Cribb, 2010; Diamond, 2005; Lowe, 2005a, 2005b & 2012; O'Connor, 1998; O'Connor & Lines, 2008)
ED	Education (ACARA, 2009, 2010, 2011; AITSL, 2010, 2011, 2012)
E>EC	Environment of greater importance than economy (A. D. Brown, 2003; Fisher, 2008; Flannery, 1994; Lindermayer, 2007; Lovelock, 2006; O'Connor, 1998; O'Connor & Lines, 2008)
E<EC	Environment of lesser importance than economy
EPF	Environmental protection for forests/need for trees
EPM	Environmental protection for marine parks/wild life
PF	Post fossil fuels (L. R. Brown, 2006; Cribb, 2010; Heinberg, 2004 & 2011; McNeil, 2009)
RE	Renewable/sustainable energy/new technologies (Flannery, 2010; Grattan & Colebatch, 2008; Leggett, 2000; O'Connor & Lines, 2008; Pearse, 2007; Spratt and Sutton, 2009; Willis, 2012)

Table 3.2

Interviewee	SC	ED	E>EC	E<EC	EPF	EPM	PF	RE
AlanA35A								
AnnA43A								
BarbaraO29A								
BrianA49A								
CaddyA33A								
ColinA51A								
DebraO40S								
DesO33S								
EdithA37A								
FayeAO34A								
FredA23A								
GregO31A								
HelenA33S								
IreneA26A								
JoyA37A								
KerryA40A								
LornaA38S								
MaryA29A								
No Rx1	1x1	9x1	7x1	2x1	6x1	2x1	2x1	4x1
No Rx2	3x2	1x2	1x2	0	2x2	1x2	1x2	2x2
No Rx3	0	0	1x3	0	1x3	0	0	2x3
No Rx4	0	1x4	0	0	0	0	0	1x4
No Rx5	0	0	0	0	0	0	0	1x5
No Rx7	0	0	0	0	0	0	0	1x7
Informed density	4	11	9	2	9	3	3	11

Percentage	22%	61%	50%	11%	50%	17%	17%	61%
-------------------	------------	------------	------------	------------	------------	------------	------------	------------

Response Key (Table 3.3)

NP	Nuclear energy, pro. (Hodgson, 2010; Lovelock, 2006)
NA	Nuclear energy, against
NU	Nuclear unclear/undecided
W	Water, systems, pollution, saving, water tables, conservation, usage (Cribb, 2010; Diamond, 2005; Lowe, 2005a, 2005b & 2012; O'Connor, 1998; O'Connor & Lines, 2008)
WR	Water recycling/purification
D	Desalination
S	Salination (Beresford et al, 2001; Cribb, 2010; O'Connor, 1998; O'Connor & Lines, 2008)
RT	Rainwater tanks

Table 3.3

Interviewee	NP	NA	NU	W	WR	D	S	RT
AlanA35A								
AnnA43A								
BarbaraO29A								
BrianA49A								
CaddyA33A								
ColinA51A								
DebraO40S								
DesO33S								
EdithA37A								
FayeAO34A								
FredA23A								
GregO31A								
HelenA33S								
IreneA26A								
JoyA37A								
KerryA40A								
LornaA38S								
MaryA29A								
No Rx1	5x1	5x1	10x1	6x1	3x1	3x1	2x1	2x1
No Rx2	0	0	0	1x2	1x2	1x2	0	1x2
No Rx3	0	0	0	3x3	3x3	0	0	0
Informed density	5	5	10	10	7	4	2	3
Percentage	28%	28%	55%	55%	39%	22%	11%	17%

Response Key (Table 3.4)

PW	Piping water/irrigation
PX	Proximity to public transport, shops etc.
GV	Growing vegetables
LF	Locally grown foods
V	Vegetarian/vegan (Cribb, 2010; O'Connor & Lines, 2008).
VR	Recycling
NC	Non-consumer
RD	Reduce use, power, fuel etc.
HC	Environmentally constructed housing

Table 3.4

Interviewee	PW	PX	GV	LF	V	VR	NC	RD	HC
AlanA35A									
AnnA43A									
BarbaraO29A									
BrianA49A									
CaddyA33A									
ColinA51A									
DebraO40S									
DesO33S									
EdithA37A									
FayeAO34A									
FredA23A									
GregO31A									
HelenA33S									
IreneA26A									

JoyA37A									
KerryA40A									
LornaA38S									
MaryA29A									
No Rx1	3x1	2x1	5x1	7x1	4x1	4x1	3x1	3x1	4x1
No Rx2	0	0	0	2x2	0	1x2	0	4x2	1x2
No Rx3	0	0	0	0	0	1x3	0	1x3	0
No Rx4	0	0	0	0	0	0	0	0	1x4
No Rx5	0	0	0	1x5	0	0	0	0	0
Informed density	3	2	5	10	4	6	3	8	6
Percentage	17%	11%	28%	55%	22%	33%	17%	56%	33%

Question Four: What Should The Australian Government Do To Reduce Carbon Emissions, Both Here And Overseas?

22 sub-themes were identified for question four and are presented in Tables 4.1 – 4.3.

Response Key (Table 4.1)

TEP	Tax carbon emission producers/incentive for them to reduce emissions (Spratt& Sutton, 2008)
TFP	Tax fossil fuel producers/incentive for them to reduce production/emissions (Leggett, 2000; Pearse, 2007)
SMY	Yes to carbon emission trading on stock market
SMN	No to trading
SMU	Unsure of trading or too lacking in knowledge of stock market
SRE	Subsidise development of renewable energy (Spratt& Sutton, 2008).
SPT	Subsidise development of public transport that uses renewable energy
SFY	Yes subsidise families to shift to renewable energies

Table 4.1

Interviewee	TEP	TFP	SMY	SMN	SMU	SRE	SPT	SFY
AlanA35A								
AnnA43A								
BarbaraO29A								
BrianA49A								
CaddyA33A								
ColinA51A								
DebraO40S								
DesO33S								
EdithA37A								
FayeAO34A								
FredA23A								
GregO31A								
HelenA33S								
IreneA26A								
JoyA37A								
KerryA40A								
LornaA38S								
MaryA29A								
No Rx1	11x1	9x1	6x1	4x1	3x1	10x1	12x1	13x1
No Rx2	4x2	1x2	0	0	0	3x2	0	1x2
No Rx3	2x3	0	0	0	0	0	0	0
Informed density	17	10	6	4	3	13	12	14
Percentage	94%	55%	33%	22%	17%	72%	67%	78%

Response Key (Table 4.2)

SFN	No to subsidising families
TDY	Yes to tax disincentives to families to reduce carbon footprint
TDN	No to tax disincentives to families to reduce carbon footprint
TI	Tax incentives to families to reduce carbon footprint
R	Research, money into research
E	Education
II	Incentive to industry to reduce emissions directly or indirectly
MN	Money needed for change to be brought about

Table 4.2

Interviewee	SFN	TDY	TDN	TI	R	E	II	MN
AlanA35A								
AnnA43A								
BarbaraO29A								
BrianA49A								
CaddyA33A								
ColinA51A								
DebraO40S								
DesO33S								
EdithA37A								
FayeAO34A								
FredA23A								
GregO31A								
HelenA33S								
IreneA26A								
JoyA37A								

KerryA40A								
LornaA38S								
MaryA29A								
No Rx1	1x1	7x1	3x1	8x1	2x1	0x1	3x1	2x1
No Rx2	0	0	0	0	2x2	1x2	0	0
No Rx3	0	0	0	0	0	1x3	0	0
Informed density	1	7	3	8	4	2	3	2
Percentage	6%	39%	17%	44%	22%	11%	17%	11%

Response Key (Table 4.3)

PT	Public transport, more or including infrastructure
CD	Control our demands on overseas resources
TC	Too much consumption (A. D. Brown, 2003; Meadows, Meadows and Randers, 1992; R. Smith, 1993; Weeks, 1989).
EC	Encourage change (A. D. Brown, 2003; Meadows, Meadows and Randers, 1992; R. Smith, 1993; Weeks, 1989).
RNO	Renewable energy projects for overseas countries
C	Cost to individuals

Table 4.3

Interviewee	PT	CD	TC	EC	RNO	C
AlanA35A						
AnnA43A						
BarbaraO29A						
BrianA49A						
CaddyA33A						
ColinA51A						
DebraO40S						
DesO33S						
EdithA37A						
FayeAO34A						
FredA23A						
GregO31A						
HelenA33S						
IreneA26A						
JoyA37A						
KerryA40A						

LornaA38S						
MaryA29A						
No Rx1	4x1	2x1	1x1	1x1	2x1	1x1
No Rx2	1x2	2x2	0	1x2	1x2	0
No Rx3	0	0	0	0	0	1x3
Informed density	5	4	1	2	3	2
Percentage	28%	22%	6%	11%	17%	11%

Question Five: How Do You See The Relationship Between Australia's Population Growth And Sustainability? And What Can Governments And Individuals Do To Get The Balance Right?

51 sub-themes were developed from this question and are presented in Tables 5.1 – 5.7.

Response Key (Table 5.1)

CB	Cut baby bonus/negative comment on payment of
ID	Increase population for defence reasons
BC	Big country small population (O'Connor, 1988; O'Connor & Lines, 2008; Lindenmayer, 2007; Lowe, 2005a, 2005b, 2009 & 2012)
4 SY	Government should seek to balance (Chittleborough, 2006; Cribb, 2010; Diamond, 2005; Flannery, 2005 & 2010; Lattimore & Pobke, 2008; Lindenmayer, 2007; Lowe, 2005a, 2005b & 2012; O'Connor, 1988; O'Connor & Lines, 2008; Walters, 2007).
SN	Government should not seek to balance
GY	Government should develop policies that encourage smaller families (Malthus, 1973; Martin, 2006; O'Connor & Lines, 2008; Pearse, 2007; Spratt. & Sutton, 2008; Walters, 2007).
GN	Government should encourage people to have more children per family (Singer & Singer, 1988).
NC	Not the "Chinese way", not like other countries, sad that a cut off point in population needed (Greenhalgh, 2008).

Table 5.1

Interviewee	CB	ID	BC	SY	SN	GY	GN	NC
AlanA35A								
AnnA43A								
BarbaraO29A								
BrianA49A								
CaddyA33A								
ColinA51A								
DebraO40S								
DesO33S								
EdithA37A								
FayeAO34A								
FredA23A								
GregO31A								
HelenA33S								
IreneA26A								
JoyA37A								
KerryA40A								
LornaA38S								
MaryA29A								
No Rx1	3x1	1x1	4x1	14x1	0	9x1	7x1	7x1
No Rx2	1x2	0	0	0	0	0	0	0
Informed density	4	1	4	14	0	9	7	7
Percentage	22%	6%	22%	78%	0%	50%	39%	39%

Response Key (Table 5.2)

KM	People having babies to get money/lessen the number “having kids to get money”
HM	People should be allowed to have as many children as they want
PI	Problems increase with population growth
WY	Are worried about Australia’s population increasing (Bruce, 2009; Chittleborough, 2006; Cohen, 2009; Cribb, 2010; Flannery, 2005 & 2010; Hogo, 2011; Lindenmayer, 2007; Lowe, 2005a, 2005b, 2009 & 2012; McNamara, 2009; O’Connor, 1988; O’Connor & Lines, 2008; Walters, 2007).
NW	Not worried about Australia’s population increasing
G	Worried about global increase in population/considers it a world wide problem
WS	Water shortage (A. D. Brown, 2003; L. R. Brown, 2006; Chittleborough, 2006; Leggett, 2000, Lindenmayer, 2007; Lowe, 2005a; Lowe, 2005b & 2012; Martin, 2006; O’Connor, 1998; O’Connor & Lines, 2008; Stern, 2006; Trompiz, 2012).
NI	Population size needs to increase (Legrain, 2006; Lomborg, 2001 & 2006c)

Table 5.2

Interviewee	KM	HM	PI	WY	NW	G	WS	NI
AlanA35A								
AnnA43A								
BarbaraO29A								
BrianA49A								
CaddyA33A								
ColinA51A								
DebraO40S								
DesO33S								
EdithA37A								
FayeAO34A								
FredA23A								
GregO31A								
HelenA33S								
IreneA26A								
JoyA37A								
KerryA40A								
LornaA38S								
MaryA29A								
No Rx1	3x1	3x1	1x1	6x1	10x1	2x1	1x1	1x1
No Rx2	0	0	0	0	0	0	0	2x2
No Rx3	0	1x3	0	0	0	0	0	0
Informed density	3	4	1	6	10	2	1	3
Percentage	17%	22%	6%	33%	55%	11%	6%	17%

Response Key (Table 5.3)

SP	Size in millions to which population should grow
CP	Control population through immigration
G2	Government support for 2 children only (Pollock, 2008)
R	Refugees/asylum seekers accepted
SPI	Stable population inevitable due to how much it costs to have children
RN	Reduced numbers would reduce unemployment
E	Education
I	Immigration desirable

Table 5.3

Interviewee	SP	CP	G2	R	SPI	RN	E	I
AlanA35A								
AnnA43A	100							
BarbaraO29A								
BrianA49A	<40							
CaddyA33A	23							
ColinA51A	25-30							
DebraO40S	50-60							
DesO33S	40							
EdithA37A	23							
FayeAO34A								
FredA23A								
GregO31A	20							
HelenA33S								
IreneA26A	35							
JoyA37A								

KerryA40A								
LornaA38S								
MaryA29A	23							
No Rx1	N/A	1x1	2x1	3x1	1x1	1x1	2x1	4x1
No Rx2		0	0	0	0	0	1x2	1x2
No Rx3		0	0	0	0	0	2x3	0
Informed density	10	1	2	3	1	1	5	5
Percentage	55%	6%	11%	17%	6%	6%	28%	28%

Response Key (Table 5.4)

BGI	Big growth industries, battery cars, solar energy, robotics and nano-technology
IC	Immigration of children desirable
ICP	Acknowledgment of India and China's/global growing population (Martin, 2006).
GI	Global increase in population
DO	Do not have the right to tell others what to do (in regard to population)
IL	Immigration a lever with which to dictate population size (“Confusion reigns”, 2008; Lowe, 2012; O’Connor & Lines, 2008).)
CC	Cities will collapse under a bigger population/can’t cope with present size
PS	Planning will solve problems of population increase

Table 5.4

Interviewee	BGI	IC	ICP	GI	DO	IL	CC	PS
AlanA35A								
AnnA43A								
BarbaraO29A								
BrianA49A								
CaddyA33A								
ColinA51A								
DebraO40S								
DesO33S								
EdithA37A								
FayeAO34A								
FredA23A								
GregO31A								
HelenA33S								
IreneA26A								
JoyA37A								

KerryA40A								
LornaA38S								
MaryA29A								
No Rx1	1x1	1x1	1x1	1x1	3x1	0	0	1x1
No Rx2	0	0	0	0	0	1x2	1x2	1x2
Informed density	1	1	1	1	3	1	1	2
Percentage	6%	6%	6%	6%	17%	6%	6%	11%

Response Key (Table 5.5)

AP	Aging population (Daly, 1973; Healy, 2009; Lattimore, & Pobke, 2008).
HS	Health system not to get overloaded
PB	Push business to renewable energy supply
TT	Trying carbon tax
SGG	Slow global growth a good thing
PG	Population growth more of a problem than greenhouse gas emissions
FF	Fossil fuels depleted

Table 5.5

Interviewee	AP	HS	PB	TT	SGG	PG	FF
AlanA35A							
AnnA43A							
BarbaraO29A							
BrianA49A							
CaddyA33A							
ColinA51A							
DebraO40S							
DesO33S							
EdithA37A							

FayeAO34A							
FredA23A							
GregO31A							
HelenA33S							
IreneA26A							
JoyA37A							
KerryA40A							
LornaA38S							
MaryA29A							
No Rx1	1x1	1x1	1x1	1x1	1x1	1x1	1x1
No Rx2	0	0	0	0	0	0	0
Informed density	1	1	1	1	1	1	1
Percentage	6%	6%	6%	6%	6%	6%	6%

Response Key (Table 5.6)

PGP	Plan for growing population both here and globally
FS	Food security (Chittleborough, 2006; Cribb, 2010; Flannery, 2005 & 2010; Lindenmayer, 2007; Lowe, 2005a, 2005b & 2012; O'Connor, 1988; O'Connor & Lines, 2008; Simms, 2010).
CS	Consumer society (R. Smith, 1993).
RR	Reduce recourse use, resource allocation the problem
DES	When people want and can have the most and best at no cost they don't care about environment or sustainability
TF	Tax families for having more children, keep it at 2
RD	Rash decisions about resources (welfare) by Government for electoral agenda and /or alleviate demand from growing number of people
PV	People on people violence (Parenti, 2011)

Table 5.6

Interviewee	PGP	FS	CS	RR	DES	TF	RD	PV
AlanA35A								
AnnA43A								
BarbaraO29A								
BrianA49A								
CaddyA33A								
ColinA51A								
DebraO40S								
DesO33S								
EdithA37A								
FayeAO34A								
FredA23A								
GregO31A								
HelenA33S								

IreneA26A								
JoyA37A								
KerryA40A								
LornaA38S								
MaryA29A								
No Rx1	1x1	1x1	0	2x1	1x1	1x1	1x1	1x1
No Rx2	0	0	1x2	0	0	0	0	0
Informed density	1	1	1	2	1	1	1	1
Percentage	6%	6%	6%	6%	6%	6%	6%	6%

Response Key (Table 5.7)

MR	More population more resources required
LSL	Live more simple lives
GV	Growing vegetables
C	Cycling

Table 5.7

Interviewee	MR	LSL	GV	C
AlanA35A				
AnnA43A				
BarbaraO29A				
BrianA49A				
CaddyA33A				
ColinA51A				
DebraO40S				
DesO33S				
EdithA37A				
FayeAO34A				

FredA23A				
GregO31A				
HelenA33S				
IreneA26A				
JoyA37A				
KerryA40A				
LornaA38S				
MaryA29A				
No Rx1	2x1	1x1	1x1	1x1
No Rx2	0	0	0	0
Informed density	2	1	1	1
Percentage	11%	6%	6%	6%

**Question Six: Do You Think Australia Has A Moral Obligation To Help
Developing Nations With Problems Of Sustainability And Climate
Change?**

33 sub-themes were determined from this question and are presented in Tables 6.1 – 6.4.

Response Key (Table 6.1)

Y	Yes Australia does have a moral obligation
N	No Australia does not have a moral obligation
EGO	Environmental global organisation to work out how to spend money to help environment
NATO	National Atlantic Treaty Organisation
GK	We have greater knowledge and should share it
GW	We have greater wealth and should share it
SD	Subsidise doctors
ASP	Aid for sustainable projects

Table 6.1

Interviewee	Y	N	EGO	NATO	GK	GW	SD	ASP
AlanA35A								
AnnA43A								
BarbaraO29A								
BrianA49A								
CaddyA33A								
ColinA51A								
DebraO40S								
DesO33S								
EdithA37A								
FayeAO34A								
FredA23A								
GregO31A								
HelenA33S								
IreneA26A								
JoyA37A								
KerryA40A								
LornaA38S								
MaryA29A								
No Rx1	15x1	0	1x1	1x1	3x1	3x1	1x1	11x1
No Rx2	0	0	0	0	0	0	0	0
Informed density	15	0	1	1	3	3	1	11
Percentage	83%	0%	6%	6%	17%	17%	6%	61%

Response Key (Table 6.2)

FPY	Family planning yes (L. R. Brown, 2006; Cribb, 2010; Diamond, 2005; Ehrlich, 1978; Flannery, 1994, 2004 & 2010; Goldie, 2009; Lovelock, 2006; Lowe, 2005b, 2009 & 2012; Malthus, 1973; Martin, 2006; Meadows, Meadows, Randers & Behrens III, 1972; O'Connor, 1998; O'Connor & Lines, 2008; Ophlus, 1973; Sample, 2008; Walters, 2007; Washer, 2008; Weeks, 1989)
FPN	Family planning no
TC	Their choice whether to use provided condoms, family planning their choice
FRH	Female reproductive health
SM	Skilled migration for short-term fix ("Confusion reigns", 2008; Furan, 2011; Goldman, 2008; Lowe, 2009 & 2012; O'Connor & Lines, 2008; "Skeptical economist's", 2006; "Where is", 2008).
SMN	Skilled migration no, not if at cost to the environment
TH	Train workers at home [here]
CY	Compensation to previous residential nation (Owers, 2006).

Table 6.2

Interviewee	FPY	FPN	TC	FRH	SM	SMN	TH	CY
AlanA35A								
AnnA43A								
BarbaraO29A								
BrianA49A								
CaddyA33A								
ColinA51A								
DebraO40S								
DesO33S								
EdithA37A								
FayeAO34A								
FredA23A								
GregO31A								
HelenA33S								
IreneA26A								
JoyA37A								
KerryA40A								
LornaA38S								
MaryA29A								
No Rx1	11x1	1x1	2x1	2x1	13x1	2x1	2x1	7x1
No Rx2	3x2	0	0	0	0	0	0	0
No Rx4	0	0	0	0	1x4	0	0	0
Informed density	14	1	2	2	14	2	2	7
Percentage	78%	6%	11%	11%	78%	11%	11%	39%

Response Key (Table 6.3)

CN	Compensation not to be paid
RE	Remittances, migrants sending money back home
E	Education
ED	Education decreases birth-rate
SP	Sourcing professionals from developing countries money may not compensate, is self-centred
RPY	Relocate Pacific Islanders yes (Leggett, 2000).
RPN	Relocate Pacific Islanders no
R	Relocate in conjunction with other counties

Table 6.3

Interviewee	CN	RE	E	ED	SP	RPY	RPN	R
AlanA35A								
AnnA43A								
BarbaraO29A								
BrianA49A								
CaddyA33A								
ColinA51A								
DebraO40S								
DesO33S								
EdithA37A								
FayeAO34A								
FredA23A								
GregO31A								
HelenA33S								
IreneA26A								
JoyA37A								
KerryA40A								

LornaA38S								
MaryA29A								
No Rx1	7x1	1x1	3x1	1x1	5x1	11x1	2x1	5x1
No Rx2	1x2	0	1x2	0	0	0	0	0
No Rx3	0	0	1x3	0	0	0	0	0
Informed density	8	1	5	1	5	11	2	5
Percentage	44%	6%	28%	6%	28%	61%	11%	11%

Response Key (Table 6.4)

AC	Australian’s large carbon [emission] producers, we have polluted the world
OQN	Overseas qualifications not valued here
HW	Heading to a ‘one world’ desirable
FH	Fix things here first
UN	UN, lacks knowledge of it, many think it’s American resulting in huge debt
WSI	Setting women up in small industries
CC	Catholic church against contraception
YI	Yes if we’re providing the resources that contribute to climate change
RDI	Re-develop Pacific Islands

Table 6.4

Interviewee	AC	OQN	HW	FH	UN	WSI	CC	YI	RDI
AlanA35A									
AnnA43A									
BarbaraO29A									
BrianA49A									
CaddyA33A									
ColinA51A									
DebraO40S									
DesO33S									
EdithA37A									
FayeAO34A									
FredA23A									
GregO31A									
HelenA33S									
IreneA26A									
JoyA37A									

KerryA40A									
LornaA38S									
MaryA29A									
No Rx1	2x1	1x1	1x1	3x1	1x1	1x1	1x1	1x1	1x1
No Rx2	0	0	1x2	0	0	0	0	0	0
Informed density	2	1	2	3	1	1	1	1	1
Percentage	11%	6%	11%	17%	6%	6%	6%	6%	6%

Question Seven: What Actions Are/Or Will You, As An Individual Be Taking In Regard To Sustainability?

33 sub-themes were identified and are presented in Tables 7.1 – 7.4.

Response Key (Table 7.1)

RW	Reduce waste
WW	Water wise (A. D. Brown, 2003, L. R. Brown, 2006; Leggett, 2000; Lowe, 2005a; Martin, 2006; McNeil, 2009; Stern, 2006)
EF	Encourage friends to be more environmentally friendly
R	Recycle or re-use
DM	Doesn't eat red meat
APF	Avoids packaged/processed foods
NC	Non-consumer
PS	Power saver

Table 7.1

Interviewee	RW	WW	EF	R	DM	APF	NC	PS
AlanA35A								
AnnA43A								
BarbaraO29A								
BrianA49A								
CaddyA33A								
ColinA51A								
DebraO40S								
DesO33S								
EdithA37A								
FayeAO34A								
FredA23A								

GregO31A								
HelenA33S								
IreneA26A								
JoyA37A								
KerryA40A								
LornaA38S								
MaryA29A								
No Rx1	2x1	5x1	2x1	4x1	1x1	1x1	2x1	3x1
No Rx2	0	0	1x2	0	0	0	1x2	0
No Rx4	0	0	0	1x4	0	0	0	0
Informed density	2	5	3	5	1	1	3	3
Percentage	11%	28%	17%	25%	6%	6%	17%	17%

Response Key (Table 7.2)

PTU	Public transport user
LMP	Limits material possessions
STP	Speaks to people about renewable energies, growing vegetables
BL	Buying local
DL	Do lots “we’re little hippies”
UPU	Use premium unleaded petrol
CP	Car pooling
BD	Biodegradable products, pump packs use of

Table 7.2

Interviewee	PTU	LMP	STP	BL	DL	UPU	CP	BD
AlanA35A								
AnnA43A								
BarbaraO29A								
BrianA49A								

CaddyA33A								
ColinA51A								
DebraO40S								
DesO33S								
EdithA37A								
FayeAO34A								
FredA23A								
GregO31A								
HelenA33S								
IreneA26A								
JoyA37A								
KerryA40A								
LornaA38S								
MaryA29A								
No Rx1	4x1	1x1	2x1	1x1	1x1	1x1	2x1	1x1
No Rx2	0	0	0	0	0	0	0	0
Informed density	4	1	2	1	1	1	2	1
Percentage	22%	6%	11%	6%	6%	6%	6%	6%

Response Key (Table 7.3)

BSP	Both sides of paper use of
RTP	Recycled toilet paper use of
E	Education
NT	New technologies
SP	Solar panels, if she could afford
EFH	Environmentally friendly house construction
RG	Replacing garden with water wise plants

Table 7.3

Interviewee	BSP	RTP	E	NT	SP	EFH	RG
AlanA35A							
AnnA43A							
BarbaraO29A							
BrianA49A							
CaddyA33A							
ColinA51A							
DebraO40S							
DesO33S							
EdithA37A							
FayeAO34A							
FredA23A							
GregO31A							
HelenA33S							
IreneA26A							
JoyA37A							
KerryA40A							

LornaA38S							
MaryA29A							
No Rx1	1x1	1x1	5x1	1x1	1x1	2x1	1x1
No Rx2	0	0	1x2	0	0	0	0
Informed density	1	1	6	1	1	2	1
Percentage	6%	6%	33%	6%	6%	11%	6%

Response Key (Table 7.4)

US	Uses scooter rather than the 4 wheel drive
GV	Growing vegetables
WC	Works for charity that runs sustainable education and health care overseas
LSL	Lead a simple life
ERU	Efficient resource use
CFA	Carbon foot print awareness
LEG	Local environmental groups keeping up with, participating in

Table 7.4

Interviewee	US	GV	WC	LSL	ERU	CFA	LEG
AlanA35A							
AnnA43A							
BarbaraO29A							
BrianA49A							
CaddyA33A							
ColinA51A							
DebraO40S							
DesO33S							
EdithA37A							
FayeAO34A							

FredA23A							
GregO31A							
HelenA33S							
IreneA26A							
JoyA37A							
KerryA40A							
LornaA38S							
MaryA29A							
No Rx1	1x1	2x1	1x1	0	1x1	1x1	1x1
No Rx2	0	0	0	0	0	0	0
Informed density	1	2	1	0	1	1	1
Percentage	6%	11%	6%	0%	6%	6%	6%