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Global Warming Responses at the Primary Secondary Interface

1. Students' Beliefs and Willingness to Act

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Abstract

Using survey methodology, students' beliefs, and willingness to act, about 16 specific actions related to global warming are compared across the primary secondary interface. More primary students believed in the effectiveness of most actions to reduce global warming and were willing to take those actions. In general there was a disparity between students' beliefs and their actions and explanations are proffered for these differences. Characteristics that distinguish primary from secondary schooling are proposed for the variations across the interface and these have implications for practice.

Introduction

Global warming is the major environmental issue of the 21st century; at this stage its effects cannot be removed, only contained (Orr, 2009). Australia, and NSW in particular, has a very high *per capita* level of greenhouse gas emission, with residential use and car travel being two major contributors (NSW Greenhouse Office, 2005). In order to change behaviours of individuals to reduce greenhouse gas emissions, it is likely that a multidisciplinary approach will be needed, with education being an important component. Given the magnitude and imminence of the problem of global warming, it is reasonable to suggest that such education should now be directed, at least in part, to inducing behaviour change.

A recently completed survey of secondary school students in NSW (Skamp, Boyes, & Stannistreet, 2009) found considerable differences between these students' beliefs about the effectiveness of different actions in alleviating global warming, and disparity in their willingness to take action. By comparing students' beliefs about the usefulness of actions with their willingness to undertake them, a series of novel indices were constructed. For example, it was possible to produce a measure of "environmental responsiveness" and, separately, an index of the potential efficacy of education about different actions in terms of students' willingness to change behaviours. In the present paper we report students' responses to the same survey at the end of primary school

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(Grade 6) and compare their views with students after one year in secondary school (Grade 7).

Global Warming in the Primary Curriculum

It is now acknowledged that moving towards sustainability literacy is an imperative in formal school education (Colucci-Gray, Camina, Barbiero, & Gray, 2005; NAAEE, 2004). Sterling (1998) suggests that sustainability learning outcomes for the upper primary years should address an understanding of how human systems work in terms of concepts such as inputs, outputs, sources, sinks and flows; a consideration of how resources may be managed more sustainably in, for example, the house, the school, and the farm; and an ability to develop indicators for students' own lifestyles and communities that they can use to monitor sustainability. These outcomes readily relate to global warming. For example, schools could address, in part, the energy and transport "doorways" in the Education for Sustainability Framework in England (Scott, 2007); and the notion of a "carbon-footprint" is suggested as a key middle school concept in a draft American sustainability education framework (US Partnership for Education for Sustainable Development, 2008). In middle school grades (5 to 8) in NSW, global warming is receiving increased emphasis through the Schools Climate Change Initiative. The aim of this Initiative is "to assist in the implementation of the NSW Greenhouse Plan by developing teacher and student awareness, understanding and environmental citizenship in regard to the local-to-global measures required to reduce greenhouse gas emissions and adapt to future climate changes in NSW" (NSW DET, 2007).

Given these developments, global warming clearly has a place in the primary curriculum. Grade 6 students will be well aware of it from the intense media coverage and its inclusion in resources - texts and Internet sites - that they would access. Also, if they are similar to young people in NSW (15-24 year olds), they would rank it the most important social issue for the State government to address (DECC, 2007). Furthermore, although grade 6 and secondary students may hold varying conceptions about global warming that may influence consequent actions (Boyes & Stanisstreet, 1993; Lester, Ma, & Lambert, 2006; Rule, 2005), there is evidence that young children can be quite sophisticated in their environmental thinking and reasoning and are "highly active thinkers in the realm of environmental issues" (Palmer & Suggate, 1996; 2004, p. 32) capable of "systemic thinking" (Wylie, Sheehy, McGuinness, & Orchard, 1998). Moreover, Sobel (1996, pp. 12, 27; also see Hutchison, 1998, p. 147) has argued that social actions have a "more central role" for 12 to 15 year olds, and can be appropriate prior to the adolescent years when the "scope is local and manageable" (p. 35). For example, he describes how 8-11 year olds turned a "local and manageable" styrofoam litter issue into a collective action with their local council. Jensen (2002) and Jensen and Schnack's (2006) "action competence" research also supports this position.

None-the-less, primary (and secondary) students' environmental knowledge and thinking about issues can be limited, incomplete (Rickinson, 2001) and unidimensional - even after instruction (Birdsall, 2006). They may struggle to distinguish factors impacting on an environmental issue (Boyes & Stanisstreet, 1997) and find it difficult to think intuitively of political and societal decision-making as causes of environmental problems (Mogensen, cited in Amarant, 2006). Despite this, it is important to acknowledge students' voices. Children of different ages have opinions about environmental matters and "want to be listened to" (Kwan & Miles, 1998, p. 17). The present study's findings may help teachers to "truly" listen to what their students are saying about environmental matters - something they do not always do (Barratt Hacking et al., 2006).

Primary Students' Concerns, Knowledge, Beliefs, Attitudes and Behaviours in Relation to Global Warming

Research on perceptions of global warming has referred mainly to secondary students (see, e.g., Rickinson's 2001 review), although there are a few exceptions (Frances, Boyes, Qualter, & Stanisstreet, 1993; Lester et al., 2006). Australian, Singaporean and British secondary students were concerned about global warming a decade ago, although this was not found in other international studies from the USA and Europe (Amarant, 2006). More recently, Scott (2007), referring to secondary and primary students' responses to sustainability in schools in England, reported many children are worried about climate change. Interestingly, Rickinson's review concluded that older students were more concerned about environmental issues than younger students, but that age decreased as a key factor by the secondary grades, suggesting that in earlier grades it may be more important. Other studies have reported primary and secondary students' willingness to take various environmental actions (Amarant, 2006; Chu et al., 2007; Rickinson 2001; Yilmaz, Boone, & Anderson, 2004), including primary students' "social activism", defined by Lester et al. (2006, p. 315) as students "taking personal responsibility and actions in solving societal problems" and influencing the actions of others. These studies indicate that social activism increased with better knowledge about global warming.

Research Questions

This study investigates the relationships between primary students' beliefs about the effectiveness of specific actions to reduce global warming, and their declared intention to take those specific actions. A questionnaire was designed which ensured a degree of "measurement correspondence" (Kaiser, Wolfing, & Fuhrer, 1999) by covertly pairing items, first asking about intentions to undertake an action then, separately, inquiring about the extent to which such an action was believed to be effective in reducing global warming.

The study was guided by the following questions:

1. What do Grade 6 students believe about the extent to which various actions might reduce global warming? We have termed this measure their *Believed Usefulness of Action*.
2. To what degrees do Grade 6 students intend to undertake these actions? This we called their *Degree of Willingness to Act*.
3. Is there a connection between students' *Believed Usefulness of Action* and their *Degree of Willingness to Act*? In order to address this, we have constructed, for different actions, *Environmental Friendliness Coefficients* to provide a measure of environmental "responsiveness".
4. Is there a relationship between the *Believed Usefulness of Action* and the *Degree of Willingness to Act* for specific actions? Since such a relationship indicates the possible changes that may be wrought by increasing the belief that a specific action is useful, it provides a measure of the *Potential Effectiveness of Education* in terms of increasing pro-environmental behaviour.
5. What trends, if any, occur in the above measures and indices across the primary/secondary interface?

In the present paper we explore the first three and last of these questions; the fourth query will be addressed in a subsequent publication.

Methods

Questionnaire Design

Details related to the design and validation of the questionnaire are reported in Skamp, Boyes and Stanisstreet (2009). The questionnaire began by asking students to record their grade, age and gender. The first main section probed students' willingness to undertake certain actions, their *Degree of Willingness to Act*, while the second explored their beliefs about the usefulness of these actions in reducing global warming, their *Believed Usefulness of Action*. Of the 20 actions around which the items in the two main sections of the questionnaire were constructed, 12 related to direct actions which will reduce global warming, four to indirect actions and four were scientifically incorrect distracters, based on previous research (Boyes & Stanisstreet, 1993). Four items at the end of the questionnaire probed how worried students were about the environmental impact of global warming, how much they thought they knew about global warming, how "environmentally friendly" they thought they were, and whether they thought global warming was happening now. The wording of the questionnaire items is shown in Appendices 1 and 2.

An important feature of the questionnaire design was that the available responses to the two sets of items were "matched" semantically and assigned particular scores (see Appendix 3). Thus, other things being equal, one might expect that the greater the perceived usefulness of a particular action, the more likely that action is to be undertaken. For example, if an action was thought to help to reduce global warming *by quite a lot*, it might be expected that people would *definitely* undertake it, other things being equal. On the other hand, if an action was thought to help to reduce global warming *by nothing at all really*, it would be reasonable to anticipate that people would *probably not* undertake it. Intermediate positions on each scale were designed with similar matching in mind, so that deviation from the anticipated approximate "norm" would be an indication of the degree of environmental "responsiveness" of individuals given their belief about the issue, or of additional incentives or disincentives for specific actions.

Student Cohort, Questionnaire Administration and Analyses of Results

Responses from 283 Grade 6 primary students were obtained from five randomly selected NSW Department of Education and Training (DET) primary schools. One school was in Sydney, three were in relatively large regional centres and another in a smaller regional location. For the comparison with secondary schools, responses from 130 Grade 7 students were obtained from two randomly selected New South Wales DET secondary schools (see Skamp, Boyes, & Stanisstreet, 2009). Both surveys were administered by the students' usual classroom teachers, in November or December 2006. Students were assured that their responses were anonymous, and no time limit was imposed for completion of the questionnaires.

Results

Students' Degree of Willingness to Act and Believed Usefulness of Action

In the descriptions that follow, percentages given for *Degree of Willingness to Act* are the combined responses from students who would "definitely" or "almost certainly" take the action, while the percentages for *Believed Usefulness of Action* are the pooled percentages for students who believe that the action would reduce global warming "by quite a bit" or "by a fair amount". Where there were statistically significant differences ($p < 0.05$, ANOVA) between the responses of the primary students and those of Grade 7 students, the percentages for the primary students are given first, followed by those for

the Grade 7 students, in the form (x%, y%). Where there was no statistically significant difference, the percentages are given in the form (x%≈y%).

Students' Views About Direct Actions

In terms of personal transport, one quarter of primary students were willing to take public transport rather than their own cars, compared to less than a tenth of Grade 7 students (26%, 8%). This was despite the fact that nearly three quarters of both groups (71%≈66%) believed this action would reduce global warming. More primary than Grade 7 students were willing to drive smaller cars (39%, 24%) even though fewer students (61%≈52%) believed this to be as effective as using public transport.

With reference to the domestic use of energy, less than half of the primary and Grade 7 students (41%≈34%) were willing to add extra insulation to their home, and this was similar to the number who believed that this would reduce global warming, although more primary than Grade 7 (43%, 30%) held this view. More than half of all students were willing to buy energy-efficient domestic appliances (61%≈55%) but more primary than Grade 7s (46%, 29%) believed this action to be effective. The action that primary and Grade 7 (84%, 71%) were most willing to take was to switch off electronic appliances when they were not needed. This was far more than the number of primary and Grade 7 (55%, 42%) students who believed this would be effective in reducing global warming

For electricity supply, although almost three quarters of primary students and half of Grade 7 students (72%, 59%) believed the use of renewable sources of energy would reduce global warming, this was not matched by those believing nuclear power would have similar effects (42%, 32%). Far fewer primary and Grade 7 (13%≈11%) students were willing to pay more for electricity generated by nuclear power while more would be willing to pay for electricity from renewable resources, but the percentage was still relatively low (35%≈26%).

On a personal level, more primary students were willing to buy fashion items less often than Grade 7 students (35%, 22%); this was similar to the numbers that believed this would reduce global warming (32%, 19%). Only about a quarter of both primary and Grade 7 students (29%≈22%) were willing to eat less meat in their diets, although more primary than Grade 7 students thought this could reduce global warming (22%, 13%).

Higher numbers of students were willing to take communal actions, with recycling being the preferred action by three quarters of primary students, although fewer Grade 7 students accepted this action (76%, 61%). Interestingly, fewer primary and Grade 7 students believed this to be an effective action (45%, 39%). A similar trend was found in the willingness to pay for more trees to be planted (69%, 57%), although the numbers holding beliefs about the effectiveness of tree planting more closely matched those willing to take action, again with more primary than Grade 7 students willing to take action (69%, 57%). In comparison to these actions, only about a two fifths of primary and Grade 7 students (46%≈37%) were willing to buy more expensive foods that did not use fertiliser, and even fewer primary and Grade 7 (39%, 22%) believed that this was effective.

Students' Views About Indirect Actions

Of special interest was the general unwillingness of students to opt for decisions related to policy changes, despite on occasions believing that they could have an influence on global warming. Surprisingly, although about three quarters of both primary and Grade 7 students (76%≈68%) thought signing international agreements would be helpful, only a third of primary and even fewer Grade 7 students (32%, 16%) indicated

a willingness to vote for such actions. Similar percentages were willing for their taxes to be increased, although again more primary than Grade 7 students (30%, 16%) felt this way; in this instance, compared to international agreements, fewer actually believed this could be an influencing factor, but more so with Grade 7 than primary students (48%, 29%). Slightly more primary and Grade 7 (41%, 25%) students were willing to support legislation as a means of reducing global warming, but this was still less than the number of primary and Grade 7 students (56%, 43%) who believed this would be an effective action. Even with more than half primary and Grade 7 students (61%, 50%) thinking that being taught more about global warming would help, a willingness to be personally involved in further education fell away considerably in Grade 7 compared to primary (48%, 31%).

Students' Feelings About Global Warming

More primary students believed global warming was happening now compared to Grade 7 students (75%, 65%) and similarly, were also worried about global warming (66%, 55%). However, about equal numbers of primary and Grade 7 students (63%≈62%) considered themselves “environmentally friendly”. In contrast, more primary students thought they were reasonably well informed than Grade 7 students (63%, 45%).

Consistency Between Beliefs About Usefulness of Actions and Willingness to Act

Indices for each pair of items concerning the same action were calculated by subtracting the scores for the *Believed Usefulness of Action* item from the score for the *Degree of Willingness to Act* corresponding item. This index, which we named the *Environmental Friendliness Co-efficient*, provided, for each pair of items and for each student, a measure of the alignment or discrepancy between beliefs about the extent to which an action would alleviate global warming and their willingness to take that action. Because of the way in which the scoring of responses had been defined, each index can have a value of between -1 and +1. A score of zero indicates that the intended action of a student is more or less consistent with their belief in the usefulness of that action, according to the semantic matching of the two scales. A positive value means that they intend to do more than they believe necessary; a negative value means that they are only willing to do less. It is likely, therefore, that students regard those actions with positive scores as being relatively convenient or uncostly, or having other benefits, whereas for those actions with negative scores there are likely to be disincentives to acting in this way.

The mean values of each of the 16 *Environmental Friendliness Coefficients* for Grade 6 students are shown in Figure 1, where they have been arranged in rank order. The overall mean index for all these primary students and all 16 pairs of questionnaire items was -0.06. The fact that this value is close to zero suggests that the semantic matching of the available responses to the two sets of items was broadly as it should be. For the actions near the top of Figure 1, students in general were willing to act “more than” their beliefs in the usefulness of the action might warrant. Switching off un-used electrical devices, recycling, and purchasing more energy-efficient household appliances were actions that fell into this category. For actions near the bottom of Figure 1, students were more resistant to taking action than their beliefs might suggest. Here, electricity supply in the form of nuclear energy or energy from renewable sources and, particularly, using public transport, appeared to dominate. All of the pairs of questionnaire items concerned with indirect actions produced negative indices, with the willingness to vote for international agreements producing the highest level of discordance between students’ *Believed Usefulness of Action* and the *Degree of Willingness to Act*.

Action	Index
<i>Direct actions</i>	
Use less electricity in homes (switch off)	0.21
Recycle things more	0.19
Purchase more energy-efficient appliances	0.08
Eat less meat	0.07
Use less artificial fertiliser	0.02
Plant more trees	0.02
Buy fewer new things	-0.01
Improve home insulation	-0.01
Use smaller cars	-0.14
More energy from nuclear power stations	-0.20
More energy from renewable sources	-0.24
Use cars less	-0.32
<i>Indirect actions</i>	
Vote for pro-environmental legislation	-0.11
Vote for pro-environmental taxation	-0.15
Vote for pro-environmental international agreements	-0.30
Increase education	-0.06

FIGURE 1: Mean (across primary students) indices for the pairs of items to indicate degree of environmental 'responsiveness'

There were no statistically significant differences between the values of the *Environmental Friendliness Coefficients* for corresponding actions between the primary and Grade 7 students, except that the primary students were more willing to act on their belief that public transport is preferable to private vehicle travel than the Grade 7 students (-0.32, -0.49, $p < 0.001$). This general stability between the primary and Grade 7 students indicates that the increased proportions of primary students holding beliefs about the effectiveness of various actions is, in approximate terms, paralleled by an increased proportion expressing their willingness to take the corresponding action. It would appear, then, that when more students believe in the effectiveness of a particular action there is a relatively consistent ratio of such students who indicate that they are willing to undertake that particular action. This ratio appears to remain approximately the same for *each* action, which suggests that the relationship that has been found between belief and action, for *each* action, is relatively stable, at least for these samples of students. This would be compatible with more primary students believing and being willing to take an action than secondary, while their environmental "responsiveness" remains approximately the same.

Discussion

Students' Feelings About Global Warming

A decade ago Australian secondary students were only moderately aware of the enhanced greenhouse effect (Connell, Fien, Sykes, & Yencken, 1998). The present study indicates that the majority of Australian primary students believe that global warming is a real phenomenon. Rather fewer Grade 7 students, although still two

thirds, hold similar views, suggesting that there has been an increase in awareness in the intervening years. A recent study shows that a high proportion of Australian adults believe that global warming is happening (Carson, 2008). Taken with the present results, this might suggest that there is a drop in acceptance of global warming as a genuine phenomenon over the period of secondary schooling, which later increases again. Although temporary, this lowering of belief in global warming does come at a time when students have opportunities to learn, from authoritative school sources, about the science of global warming and ways to ameliorate it. There is also a concomitant, possibly related, decrease in the level of concern about global warming in the Grade 7 students, although the levels of anxiety are still higher than a decade ago (Kwan & Miles, 1998), probably because evidence about the damaging effects of global warming has accumulated since then.

Students' Believed Usefulness of Actions

Although the relationship between knowledge about *general* environmental issues may not be directly related to subsequent environmental action (see *Environmental Education Research*, 8(3) for reviews), other research (e.g., Lester et al., 2006) does indicate a relationship between knowledge about *specific* environmental actions and taking action. In any case, knowledge of various types is still a prerequisite to informed environmental decision making (Jensen, 2002), and conceptions about global warming which can persist into adulthood influence consequent actions (Boyes & Stanistreet, 1993; Lester, Ma, & Lambert, 2006; Rule, 2005). It is, however, acknowledged that taking environmental action, whether direct or indirect, is influenced by a multitude of variables whose influence can change depending upon context (e.g., Barr, 2006).

One relevant intervening variable is perceived self-efficacy – high levels of perceived self-efficacy appear to be associated with an increased willingness to take pro-environmental action (P. Devine-Wright, H. Devine-Wright, & Fleming, 2004). In the present study, the direct pro-environmental actions that were most frequently believed by a majority of primary students to be effective in reducing global warming were generating energy from renewable sources, travelling by public rather than private transport, planting trees and using smaller, more fuel-efficient cars. These actions are seen as contributions to the reduction of carbon dioxide emissions into the atmosphere. While the effects of carbon dioxide are well known by school students (Boyes & Stanistreet, 1993, 2001; Schreiner, Henriksen, & Kirkeby Hansen, 2005; Skamp, 2008), the impacts on global warming of eating meat, buying new things, and eating foods produced with the aid of fertilisers, are less well known. Meat and dairy products do indeed have a higher “greenhouse price” than fruit and vegetables (Lenzen, Day, & Murray, 2002), but primary students are less familiar with the impact of nitrogen oxides and methane on global warming (Boyes & Stanistreet, 1993; 2001; Schreiner et al., 2005). The fact that few students in the present study made connections between global warming and consumerism may be because it has not been stressed in Australian environmental education materials related to the global warming (Lenzen & Smith, 1999/2000). In questionnaire responses, primary students thought that taxation would be least effective in reducing global warming, but more than half had confidence in the effectiveness of international agreements, education and legislation.

More primary than Grade 7 students believed in the effectiveness of these various actions, although for a few of the actions the differences were not statistically significant. A number of factors may contribute to this difference. Firstly, there may be a link between primary students' sense that they were informed about global warming. This finding is consistent with the Loughland, Reid, Walker, and Petocz (2003) observation that more Australian primary than secondary students felt they “learnt a lot” about

the environment at school. In addition, the primary sector has been more successful in establishing sustainable schools than the secondary (Henderson & Tilbury, 2004; Tilbury & Wortman, 2006), so more Grade 6 students may hold these beliefs because particular environmental actions such as planting trees, reducing energy use and taking alternative transport may be more familiar. Further, analyses of Australian science curricula suggests that environmental emphases may be more common in NSW primary than secondary syllabi (Heck, 2003; Skamp, 2009; Venville & Dawson, 2006), with environmental issues often being taught within the Science Key Learning Area in NSW schools (Heck, 2003; Tilbury, Coleman, & Garlick, 2005).

Those actions that were thought to be less effective at *both* levels, such as eating less meat, may be omitted from primary school content because primary teachers may be less familiar with them (Papadimitriou, 2004; Rule, 2005). In addition, these issues are rarely mentioned in the media as sources of greenhouse emissions, and television is secondary students' main source of environmental knowledge (Rickinson, 2001). Finally, the general decrease in beliefs about the effectiveness of various actions across the primary/secondary interface may be linked to a drop in positive attitudes towards school science that occurs with this transition (Logan & Skamp, 2008). A consequence may be that secondary students do not believe they know as much about global warming as they did in primary school and hence become less confident in their views about the usefulness of specific actions.

Students' Degree of Willingness to Act

The majority of primary students were willing to take those actions that were convenient and most likely practised in primary schools that are working towards sustainability such as conserving electricity, recycling and planting trees (Tilbury, Coleman, & Garlick, 2005; Tilbury & Wortman, 2006). For example, an action that many students were willing to take was to switch off un-used electrical appliances, as reported in other primary (Chu et al., 2007) and secondary (Amarant, 2006; Rickinson, 2001) studies. A number of reasons probably contribute to an unwillingness to take some actions. A reluctance to reduce meat consumption, for example, may be related to lack of awareness of its environmental impacts, while poor support for nuclear-generated electricity may relate to safety concerns. An unwillingness to use public transport may be based on an anticipation of inconvenience, as others have also noted (Amarant, 2006; Rickinson, 2001).

Students' lack of willingness to take some indirect actions was an unexpected finding. This may relate to a lack of awareness about what communal environmental actions are possible, as was found with secondary students (Connell et al., 1998); and teachers may not be introducing knowledge about collective environmental actions (Jensen, 2002). Although many primary students engage in school-wide initiatives such as recycling, effective collaboration beyond the classroom may be less common (Tilbury, Coleman, & Garlick, 2005).

More primary than Grade 7 students were willing to take action on every item. A number of reasons may contribute to this difference. For example, this may be because a higher percentage of primary students believe in the positive impact of such actions, possibly as a result of their involvement in sustainable school initiatives (Tilbury & Wortman, 2006). It also may be that primary students are more worried about the impact of global warming than Grade 7s, a claim that is similar to Hicks and Holden (1995) and Jenkins and Pell (2006) studies which found that students' environmental concerns peak at the end of primary school. The reductions in readiness to act in the secondary years might also be due to a more realistic assessment of the nature of environmental issues and the impact they, as students, can have (Rickinson, 2001).

There could also be an increase in students' "learned helplessness" (Nagel, 2005), especially if their school experiences are more focussed on education "about" and possibly "in" the environment, rather than "for" the environment (Heck, 2003).

Students' Environmental Friendliness Coefficients

Construction of *Environmental Friendliness Coefficients* for the different pro-environmental actions revealed those actions for which students might be more responsive than their beliefs warranted, and those actions for which students might be less reactive. In the case of the former, incentives other than an environmental obligation might be operating. Switching off un-used electrical appliances, for example, is a minor inconvenience and has additional financial benefits. In the case of the latter, other disincentives probably counterbalance the wish to act in a pro-environmental manner. Disinclination to take actions in which students believe may relate to such actions being inconvenient and economically costly, as Fortner et al. (2000) found with American adults. The fact that the values of the *Environmental Friendliness Coefficients* remained similar across the primary/secondary interface, despite the differences in these values between different actions, might suggest that such incentives and disincentives associated with different actions remain reasonably consistent.

Conclusion: the Primary/Secondary Transition

The findings reported here indicate that more primary than Grade 7 students believe in the effectiveness of various pro-environmental actions and are willing to take them. Given the small difference in age between these two cohorts of students, it is unlikely that educational maturation plays a major role. Loughland et al. (2003, p. 11) found that the "organisation of the primary school" was a key factor, more important than development with increasing age. Primary students usually have one teacher across all subjects, so any environmental education is taught as an integrated school experience; neither of these happens in most secondary schools. Even in secondary schools moving towards sustainability, there is little integration of environmental education across subjects and between teachers (Eames, Cowie, & Bolstad, 2008). The overall greater willingness by primary students to take action on environmental matters may also be related to an inference Ballantyne, Fien, and Packer (2001) draw that a greater emphasis on affective learning such as "enjoyment" and "emotion" at the primary level, compared to the traditional secondary emphasis on discipline knowledge (e.g., see Rennie, Goodrum, & Hackling, 2001), is important in improving the quality of student environmental learning outcomes (Loughlan et al., 2003). Certainly Brody's (2005) theory of environmental learning as a matrix, with one axis depicting *acting, thinking* and *feeling* intersecting with another having the constructs of *physical (setting)*, *personal (individual)*, *social (shared)*, and *time (continuum)* would support emphasising the affective in environmental education. Furthermore, Littledyke (2008) has argued for a greater focus in secondary environmental education on a social constructivist viewpoint, rather than only a personal constructivist perspective (seen especially in science), in order to provide greater opportunity for the affective domain. If secondary environmental education is taught mainly in "science" and "human society and its environment" contexts (Heck, 2003), and if most secondary science education practice is still "traditional, discipline-based and dominated by content", then it is probably in sharp contrast to most primary school science (Rennie et al., 2001, p. 473). As science is often the key conduit for environmental education at both levels (Tilbury, Coleman, & Garlick, 2005), this difference may be important in understanding the primary/secondary differences reported here. Finally, if at the secondary level, environmental

issues are mainly associated with abstract scientific concepts then this could lead to alienation as learners struggle to see real-life connections.

Such fundamental differences between primary and secondary schools may be at the “root” of the differences observed. If this is correct, the very nature of environmental education at the secondary level needs to be addressed if it is to be more effective in changing behaviour. It may be that secondary environmental education should be directed, in part, towards seeking to retain and further develop the more positive attitudes seen in our study in primary students.

Keywords: Global warming; environmental education; beliefs, actions; primary and secondary students.

References

- Amarant, A. (2006). *An investigation into the environmental knowledge, attitudes and behavioural intentions of elementary school students*. Unpublished doctoral thesis, Curtin University of Technology, Perth.
- Ballantyne, R., Fien, J., & Packer, J. (2001). School environmental education programme impacts upon student and family learning: A case study analysis. *Environmental Education Research*, 7(1), 23–37.
- Barr, S. (2006). Environmental action in the home: Investigating the “value-action” gap. *Geography*, 91(1) 43–54.
- Boyes, E., & Stanisstreet, M. (1993). The “Greenhouse Effect”: Children’s perceptions of causes, consequences and cures. *International Journal of Science Education*, 15, 531–552.
- Boyes, E., & Stanisstreet, M. (1997). The environmental impact of cars: Children’s ideas and reasoning. *Environmental Education Research*, 3, 269–282.
- Boyes, E., & Stanisstreet, M. (2001). Plus ca change, plus c’est la meme chose? School students’ ideas about the “Greenhouse Effect” a decade on. *Canadian Journal of Environmental Education*, 6, 77–101.
- Barratt Hacking, E., Barratt, R., Scott, W., Talbot, W., Nicholls, D., & Davies, K. (2006). Education for sustainability: Schools and their communities. In J. Lee & M. Williams (Eds.), *Environmental and geographical education for sustainability* (pp. 123–138). New York: Nova Science.
- Birdsall, S. (2006). Sustainability means something clean and tidy, doesn’t it? Developing and assessing students’ conceptual understanding of sustainability. In S. Woollorton & D. Marinove (Eds.), *Sharing wisdom for our future. Environmental Education in action* (pp. 261–269). Proceedings of the 2006 Conference of Australian Association of Environmental Education.
- Brody, M. (2005). Learning in nature. *Environmental Education Research*, 11(5), 603–621.
- Carson, R. (2008). Australians want decisive action on climate change. Newsroom report, University of Technology, Sydney. Retrieved March 4 from <http://www.newsroom.uts.edu.au/news/detail.cfm?ItemId=12359>
- Chu, H., Eun, A., Hee, R., Dong, H., Lee, M., Byeong, M., & Kyung, J. (2007). Korean year 3 children’s environmental literacy: A prerequisite for a Korean environmental education curriculum. *International Journal of Science Education*, 29(6), 731–746.
- Colucci-Gray, L., Camina, E., Barbiero, G., & Gray, D. (2005). From scientific literacy to sustainability literacy: An ecological framework for education. *Science Education*, 90, 226–252.

- Connell, S., Fien, J., Sykes, H., & Yencken, D. (1998). Young people and the environment in Australia: Beliefs, knowledge, commitment and educational implications. *Australian Journal of Environmental Education*, 14, 39–48.
- Department of Environment and Climate Change (DECC). (2007). *Who Cares About the Environment in 2006?* Sydney: DECC. Retrieved November 21, 2009, from http://www.environment.nsw.gov.au/resources/community/20070002_whocares06part2.pdf
- Devine-Wright, P., Devine-Wright, H., & Fleming, P. (2004). Situational influences upon children's beliefs about global warming and energy. *Environmental Education Research*, 10(4), 493–505.
- Eames, C., Cowie, B., & Bolstad, R. (2008). An evaluation of characteristics of environmental education practice in New Zealand schools. *Environmental Education Research*, 14(1), 35–51.
- Fortner, R., Lee, J., Corney, J., Romanello, S., Bonnell, J., Luthy, B., Figuerido, C., & Ntsiko, N. (2000). Public understanding of climate change: Certainty and willingness to act. *Environmental Education Research*, 6(2), 127–141.
- Francis, C., Boyes, E., Qualter, A., & Stanisstreet, M. (1993). Ideas of elementary students about reducing the “Greenhouse Effect”. *Science Education*, 77, 375–392.
- Heck, D. (2003). The state of Environmental Education in the Australian school curriculum. *Australian Journal of Environmental Education*, 19, 115–124.
- Henderson, K., & Tilbury, D. (2004). *Whole-school approaches to sustainability: An international review of whole-school sustainability programs*. Report prepared by ARIES for the DEH, Australian Government. (Available at http://www.aries.mq.edu.au/pdf/international_review.pdf [Available September 17, 2007])
- Hicks, D., & Holden, C. (1995). Exploring the future: A missing dimension in environmental education. *Environmental Education Research*, 1(2), 185–194.
- Hutchison, D. (1998). *Growing up green*. New York: Teachers' College Press.
- Jenkins, E., & Pell, R. (2006). “Me and the environmental challenges”: A survey of English secondary school students' attitudes towards the environment. *International Journal of Science Education*, 28(7), 765–780.
- Jensen, B. (2002). Knowledge, action and pro-environmental behaviour. *Environmental Education Research*, 8(3), 325–334.
- Jensen, B., & Schnack, K. (2006). The action-competence approach in Environmental Education. *Environmental Education Research*, 8(3), 471–486.
- Kaiser, F., Wolfing, S., & Fuhrer, U. (1999). Environmental attitudes and ecological behaviour. *Journal of Environmental Psychology*, 19, 1–19.
- Kwan, T., & Miles, J. (1998). In the words of children and young people: The opinions and concerns about their environments of some Brisbane school students. *Australian Journal of Environmental education*, 14, 11–18.
- Lenzen, M., Day, C., & Murray, J. (2002). A personal approach to teaching about climate change. *Australian Journal of Environmental Education*, 18, 35–46.
- Lenzen, M., & Smith, S. (1999/2000). Teaching responsibility for climate change: Three neglected issues. *Australian Journal of Environmental Education*, 15/16, 65–76.
- Lester, B., Ma, L., & Lambert, J. (2006). Social activism in elementary science education. *International Journal of Science Education*, 28(4), 315–339.
- Littlelyke, M. (2008). Science Education for environmental awareness: Approaches to integrating cognitive and affective domains. *Environmental Education Research*, 14(1), 1–17.
- Logan, M., & Skamp, K. (2008). Engaging students in science across the primary secondary interface: Listening to the students' voices. *Research in Science Education*, 38(4), 501–527.

- Loughland, T., Reid, A., Walker, K., & Petocz, P. (2003). Factors influencing young people's conceptions of environment. *Environmental Education Research*, 9(1), 3–20.
- Nagel, M. (2005). Constructing apathy: How environmentalism and Environmental Education may be fostering “learned hopelessness” in children. *Australian Journal of Environmental Education*, 21, 71–80.
- North American Association for Environmental Education (NAAEE). (2004). *Excellence in environmental education guidelines for learning (Pre K-12)*. Retrieved November 21, 2009, from http://www.naaee.org/npeee/learner_guidelines.php
- NSW DET. (2007). *Climate change learning community*. Retrieved March 12, 2009, from http://www.illawarra-e.schools.nsw.edu.au/ieec/IEEC_%7C%7C_News_%7C%7C_Learning_For_Sustainability_%7C%7C_Dapto_Learning_Community_files/Climate%20change%20strategic%20plan.pdf
- NSW Greenhouse Office. (2005). *NSW greenhouse plan*. Sydney: NSW Government. Retrieved November 21, 2009, from <http://www.environment.nsw.gov.au/resources/climatechange/2811FINALNSWGHPlanweb.pdf>.
- Orr, D. (2009, March). Nearly trapped: Design in the age of climate consequences. Invited lecture for The Institute for Sustainable Design, Cooper Union, New York.
- Palmer, J., & Suggate, J. (1996). Influences and experiences affecting the pro-environmental behaviour of educators. *Environmental Education Research*, 2(1), 109–122.
- Palmer, J.A., & Suggate, J. (2004). The development of children's understanding of distant places and environmental issues: Report of a UK longitudinal study of the development of ideas between the ages of 4 and 10 years. *Research Papers in Education*, 19(2), 205–237.
- Papadimitriou, V. (2004). Prospective primary teachers' understanding of climate change, greenhouse effect, and ozone layer depletion. *Journal of Science Education and Technology*, 13(2), 299–307.
- Rennie, L., Goodrum, D., & Hackling, M. (2001). Science teaching and learning in Australian schools: Results of a national study. *Research in Science Education*, 31(4), 455–498.
- Rickinson, M. (2001). Learners and learning in environmental education: A critical review of the evidence. *Environmental Education Research*, 7(3), 207–320.
- Rule, A. (2005). Elementary students' ideas concerning fossil fuel energy. *Journal of Geoscience Education*, 53(3), 309–318.
- Schreiner, C., Henriksen, E., & Kirkeby Hansen, P. (2005). Climate education: Empowering today's youth to meet tomorrow's challenges. *Studies in Science Education*, 41, 3–50.
- Scott, W. (2007). *Raising standards: Making sense of the sustainable schools agenda*. London: Specialist Schools and Academies Trust.
- Skamp, K. (Ed.). (2008). Materials and change. In K. R. Skamp (Ed.), *Teaching primary science constructively* (3rd ed., pp. 304–347). Melbourne: Thomson Learning.
- Skamp, K. R. (in press). School science and environmental education. In S. Ritchie (Ed.), *The World of science education: Australasia*. Rotterdam: Sense.
- Skamp, K., Boyes, E., & Stanisstreet, M. (2004). Students' ideas and attitudes about air quality. *Research in Science Education*, 34(3), 313–342.
- Skamp, E., Boyes, E., & Stanisstreet, M. (2009). Australian secondary students' views about global warming: beliefs about actions, and willingness to act. *Research in Science Education*, 39(5), 661–680.
- Sobel, D. (1996). *Beyond ecophobia*. Great Barrington: The Orion Society and the Myrin Institute.

- Sterling, S. (1998). First Annual Report 1998 Annex 4 - Submission to the Qualifications and Curriculum Authority. A Report to DfEE/QCA on Education for Sustainable Development in the Schools Sector from the Panel for Education for Sustainable Development- 14 September 1998. Retrieved November 28, 2007, from <http://www.defra.gov.uk/environment/sustainable/educpanel/1998ar/ann4.htm#d>
- Tilbury, D., Coleman, V., & Garlick, D. (2005). *A National Review of Environmental Education and its Contribution to Sustainability in Australia: School Education*. Canberra: Australian Government Department of the Environment and Water Resources and the Australian Research Institute in Education for Sustainability (ARIES).
- Tilbury, D., & Wortman, D. (2006). "Whole school" approaches to sustainability. In J. Lee & M. Williams (Eds.), *Environmental and geographical education for sustainability* (pp. 65–78). New York: Nova Science.
- US partnership for education for sustainable development. (2009). *Draft education for sustainability K-12 student learning standards*. Retrieved November 21, 2009, from http://www.uspartnership.org/resources/0000/0081/USP_EFS_standards_V3_10_09.pdf
- Venville, G., & Dawson, V. (2006). An overview and comparison of Australian State and Territory K-10 science curriculum documents. *Teaching Science*, 52(2), 17–24.
- Wylie, J., Sheehy, N., McGuinness, C., & Orhard, G. (1998). Children's thinking about air pollution: A systems theory analysis. *Environmental Education Research*, 4(2), 117–137.
- Yilmaz, O., Boone, W., & Anderson, H. (2004). Views of elementary and middle school Turkish students towards environmental issues. *International Journal of Science Education*, 26(12), 1527–1546.

APPENDIX 1: Wording and ‘Pairing’ of the Items in the Two Main Sections of the Questionnaire

Focus of interest	Items about students’ Degree of Willingness to Act	Items about students’ Believed Usefulness of Action
Direct actions		
Transport	Even if it took me longer and was more inconvenient, I would try to use buses and trains instead of a car	If people didn’t use their cars so much, global warming would be reduced
	Even if it was not as fast or luxurious, I would try to get a car that uses less petrol or diesel	If people had smaller cars that used less petrol or diesel, global warming would be reduced
Power generation	Providing more of our energy was produced from the wind and waves and sun, I would be willing to pay more for electricity	If more of our energy was produced from the wind, waves and sun, global warming would be reduced
	Providing more of our energy was produced from nuclear power stations, I would be willing to pay more for electricity	If more of our energy was produced from nuclear power stations, global warming would be reduced
Domestic	To save electricity, I would switch things off at home when I didn’t need them	If people used less electricity in their homes, global warming would be reduced
	Even though it cost me money, I would get extra insulation for my home	If people got their homes insulated better, global warming would be reduced
	Even if it cost me more, I would buy things for my home (like fridges and washing machines) that use less energy	If people got things for their homes (like fridges and washing machines) that used less energy, global warming would be reduced
Personal	Even if it meant that I didn’t always have the latest “gear” or fashion, I would be prepared to buy new things less often	If people were prepared to buy fewer new things and make do with the old ones, global warming would be reduced
	Even if I really liked meat, I would eat fewer meals with meat in them	If people eat less meat, global warming would be reduced
Communal	Even if I had to pay more taxes, I think there should be more trees planted in the world	If more trees were planted in the world, global warming would be reduced
	Even if it was more trouble for me, I would recycle things rather than just throw them away	If people recycled things more, global warming would be reduced
	Even if it was more expensive, I would buy food grown without the use of artificial fertilizers	If farmers stopped using artificial fertilisers with nitrogen in them, global warming would be reduced
Indirect actions		
Legislation	I would vote for a politician who said they would bring in laws to reduce global warming, even though it would stop me doing some of the things I enjoy	If politicians made the right kind of new laws, global warming would be reduced
Taxation	I would vote for a politician who said they would increase taxes to pay for reducing global warming, even though it meant me having less money to spend	If politicians made people pay more tax and spent the money on the right kind of things, global warming would be reduced
Co-operation	Even though it might mean some inconvenience to me (like changing my job), I would vote for a politician who said they would sign agreements with other countries on global warming	If there could be more agreement between different countries about not putting certain gases into the air, global warming would be reduced
Education	I would like to learn more about global warming, even though it would mean extra work for me	If people were taught more about it, global warming would be reduced
Unscientific		
	Even though it cost me money, I would get air conditioning in my home	If more people got air conditioning in their homes and offices, global warming would be reduced
	Even if it was more trouble for me, I would not drop litter in the streets	If people stopped dropping litter in the streets, global warming would be reduced
	Even if it was more trouble for me, I would not drop litter on the beach	If the pollution in the oceans of the world were cleaned up, global warming would be reduced
	Even if it was more expensive, I would buy food grown without the use of pesticides	If farmers stopped using pesticides on their crops, global warming would be reduced

In the questionnaire, items were arranged in random order within the sections, an in different orders in the two sections. Here the items have been grouped according to their focus of interest, and arranged in the ‘pairs’

APPENDIX 2: Wording and Available Responses of Final Four Items of the Questionnaire

Items	Available responses
How worried are you about what Global Warming might do to the environment?	I am very worried I am quite worried I am a little bit worried I am not worried at all
How much do you think you know about Global Warming?	I know a lot about global warming I know something about global warming I know a little about global warming I know almost nothing about global warming
How 'environmentally friendly' do you think you are? (How much do you think you 'take care of' the environment by the things you do?)	I am very environmentally friendly I am quite environmentally friendly I am a bit environmentally friendly I am not at all environmentally friendly
Do you think that Global Warming is really happening now?	I am sure global warming is happening I think global warming is happening I don't know whether global warming is happening or not I think global warming is not happening I am sure global warming is not happening

APPENDIX 3: Wording and Scoring of the Available Responses to the Items in the Two Main Sections of the Questionnaire

Available responses to items about students' <i>Believed Usefulness of Action</i>	Available responses to items about students' <i>Degree of Willingness to Act</i>	Scoring
by quite a lot	definitely	1.00
by a fair amount	almost certainly	0.75
by a small but useful amount	probably	0.50
by a very small amount - hardly noticeable	perhaps	0.25
by nothing at all really	probably not	0.00

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