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# **Global Warming Responses at the Primary Secondary Interface**

## **2. Potential Effectiveness of Education**

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**Abstract** In an earlier paper (Skamp, Boyes, & Stanisstreet, 2009b), students' beliefs and willingness to act in relation to 16 specific actions related to global warming were 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 were proffered for these differences. Using these data, a derived measure of the potential effectiveness of education in encouraging each of these pro-environmental actions to reduce global warming is reported. This measure, and other derived indices, suggests where education could be most effective in encouraging willingness to take pro-environmental actions to reduce global warming.

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### **Introduction**

Global warming is the major environmental crisis facing the world in the 21<sup>st</sup> Century. Authoritative sources now agree that it is an increasing threat to the world's environmental integrity, its social well-being (IPCC, 1997; 2001, 2007), its long-term economic stability (Stern, 2006) and its political security (Solana, 2008). Furthermore, it is believed that at this stage the effects of global warming cannot be eliminated, only contained (Orr, 2009). In view of these predictions, it is increasingly important to design and apply effective measures for reducing greenhouse gas emissions. In part, this will depend on central government policies; in part, it will require changes in the actions and behaviour of individual citizens, and it is likely that education will play some role in the latter.

Early "information deficit models" of individuals' behaviour change in an environmental context were based on the assumption that if people understood more about the environment and the actions that would cause, or avoid, environmental degradation, they would behave in a rational manner and adopt environmentally sympathetic behaviour patterns (Burgess, Harrison, & Filius, 1998). In other words,

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it was thought that there was a comparatively direct, positive relationship between a person's cognitive base about environmental problems and their willingness to act to reduce these problems. Some studies have shown that knowledge and behaviour are indeed linked (Mogensen & Nielsen, 2001; Yencken, Fien, & Sykes, 2000). In many other cases, however, it seems that the relationship between knowledge and action is not strong (Hungerford & Volk, 1990; Kollmus & Agyeman, 2002; Posch, 1993; Rajecski, 1982); there is what has come to be known as a "gap" between knowledge and action (Kollmus & Agyeman, 2002). This "gap" is partly due to the fact that behaviour is influenced by a plethora of other factors, not just knowledge (e.g., see Barr, 2006). For example, social norms can influence whether or not a person acts in an environmentally sympathetic fashion (Cialdini, Reno, & Kallgren, 1990). Alongside this, other beliefs, social pressures, educational background, and physical facilitators and inhibitors can synergistically influence whether a particular action is likely to be pursued (Barr, 2006; Corraliza & Berenguer, 2000; DECC, 2007). In addition, an individual's belief in their self-efficacy partly determines the extent to which they act in pro-environmental ways (Devine-Wright, Devine-Wright, & Fleming, 2004; Laskova, 2007).

Based mainly on studies of adults, Stern's (2000) value-belief-norm theory, in part, encompasses this multiplicity of variables. This theory argues that people need to value the environment for its own sake or for its benefits for society, understand environmental issues enough to appreciate the consequences for themselves and others, be convinced that they can effect change and believe that their society expects them to take action. Taking action consistent with values, beliefs and concerns can be strongly influenced by barriers such as governmental regulation, societal infrastructure, inconvenience and cost (Gardner & Stern, 2002). Chawla & Flanders Cushing's (2007) review of influences affecting young people's environmental actions can be superimposed on to the value-belief-norm theory and assist in interpreting the findings reported in this study. Childhood experiences of nature, influential family and significant other role models seem important, but three factors seem to give the best prediction of action: gender, socio-economic status and environmental attitudes and/or knowledge. As Chawla & Flanders Cushing comment: educators cannot change gender or socio-economic status but "can influence... students' opportunities to gain knowledge, form positive attitudes about the environment, and practice action skills" (p. 441). In this paper we identify those actions that can reduce global warming where we believe educators may have the most influence with middle-school age (11-14 years) students.

### *Research Questions*

An issue that has emerged as workers have attempted to generate models of the incentives and disincentives to pro-environmental behaviour is the apparent limitation in studying connections between *general* environmental attitudes and potential behaviour patterns (Ajzen & Fishbein, 1980; Dietz, Stern & Guagnano, 1998; Fishbein & Ajzen, 1975; Stern, 1992). Assuming an urgent need for a cutback in the emission of human-sourced greenhouse gases, we here explore the possible links between knowledge about the usefulness of *specific* pro-environmental actions, and potential changes in behaviour. The overall 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 primary students intend to undertake these actions? This we have called their *Degree of Willingness to Act*.
3. To what extent do their intended actions match their understanding? What is the discrepancy between students' *Believed Usefulness of Action* and their *Degree*

of *Willingness to Act*? In order to address this, we have constructed, for different actions, what we have termed the *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 points to the possible changes that may be wrought by increasing the belief that a specific action is useful, it provides what might be termed the *Potential Effectiveness of Education* for increasing pro-environmental behaviour.
5. What differences, if any, occur in the above measures and indices across the primary-secondary interface?

The first three and the last of these issues have been addressed in a previous publication (Skamp, Boyes, & Stanisstreet, 2009b). The results showed the way in which primary students’ beliefs about the usefulness of actions differs for different actions, and the variation in their intentions to take different actions. The findings also show that primary students have greater faith in the benefits of many actions than Grade 7 students, and that they are more willing to undertake these actions. Finally, despite these differences, the values of the *Environmental Friendliness Coefficients*, indicators of students’ environmental “responsiveness” for different actions, remain broadly similar for primary and Grade 7 students.

In the present paper we explore the fourth of the questions above. We examine the relationship between the *Believed Usefulness of Action* and the *Degree of Willingness to Act* for specific actions and thereby produce a series of indices which enable us to anticipate the extents to which increasing the belief that different specific actions are useful in the context of global warming might increase willingness to undertake those actions. Such information could enable environmental education to be targeted at those areas in which, in terms of changes in the practices of individuals, it is likely to be most effective.

## Methods

### *Study Cohort, Questionnaire Design and Initial Data Analysis*

Details of the study cohort, questionnaire design and administration, and initial data analyses are reported in Skamp, Boyes, & Stanisstreet (2009a). In brief, the study cohort comprised 283 Grade 6 students from five randomly selected primary schools and 130 Grade 7 students from two randomly selected secondary schools in NSW, Australia. The specially-designed questionnaire was in two main sections. The first asked students about the degree to which they would be willing to undertake certain pro-environmental actions, their *Degree of Willingness to Act*. The second main section probed students’ ideas about the extent to which they thought these same actions would be useful in reducing global warming, their *Believed Usefulness of Action*. An important feature of the questionnaire was that the responses to the items in the two sections of the questionnaire were semantically matched (Figure 1). For example, if a student believed that a particular action would help to reduce global warming by “quite a lot”, this was matched in the other section of the questionnaire to the response that they would “definitely” be willing to do it. Conversely, if a student believed that an action would reduce global warming “by nothing at all”, this was matched to the response in the other section that they would “probably not” do it. The intermediate responses were also designed to correspond semantically in a similar way. In order to allow some mathematical manipulations, the ways in which the responses to the two sections of the questionnaire were scored were matched numerically. For example, a “quite a lot” response was scored as 1, as was a “definitely” response in the other section

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

FIGURE 1: Wording and scoring of the available responses to items in the two main sections of the questionnaire

of the questionnaire. In a parallel manner, a “nothing at all response” and a “probably not” do it response scored zero.

### *Construction of the Indices*

The indices we wish to focus on here relate to the extent to which increasing understanding about the efficacy of a specific action might persuade individuals within a cohort to undertake that action. To obtain these indices for a particular action, student measures of the *Degree of Willingness to Act* were plotted against their value of the *Believed Usefulness of Action*, and the trend line was fitted. This produced a graph of the type shown in Figure 2. Semantic matching of the responses ensures that linear regression is less sensitive to the inevitable limitations of using ordinal scales. The slope of this type of graph signifies the extent to which the willingness of students to undertake an action depends on their belief in the usefulness of that action. The gradient, therefore, provides an indication of the extent to which willingness to undertake an action might be increased by persuading students of the environmental effectiveness of that action; we have termed this gradient the *Potential Effectiveness of Education*.

Once this index has been determined for a pair of questions, two other derived indices can be calculated from the intercepts. The intercept when the *Believed Usefulness of Action* is zero indicates the likely action of students who believed that such an action would be ineffective in reducing global warming. We designated this the *Natural Willingness to Act*. In a complimentary fashion, if one considers the intercept when the *Believed Usefulness of Action* is at its maximum, then the difference between this and unity is a measure of the extent to which students will not take action, even though they believe such action would be highly effective in reducing global warming. We designated this index the *Natural Reluctance to Act*. Figure 2 is annotated to show these three indices.

Comparing the values of the *Potential Effectiveness of Education* for different actions highlights those actions for which education about their potential effectiveness might be more likely to lead to behaviour change, and other actions where education will probably be less effective. On a population basis, however, there is another component that will influence the efficacy of education in terms of behaviour change, that is, the proportion of the population who are not already intending to take an action; education might be most productive in these terms if directed at those actions which relatively few of the population are already willing to undertake. Therefore, a fourth index was calculated, which we termed the *Potential Usefulness of Education*, by multiplying the

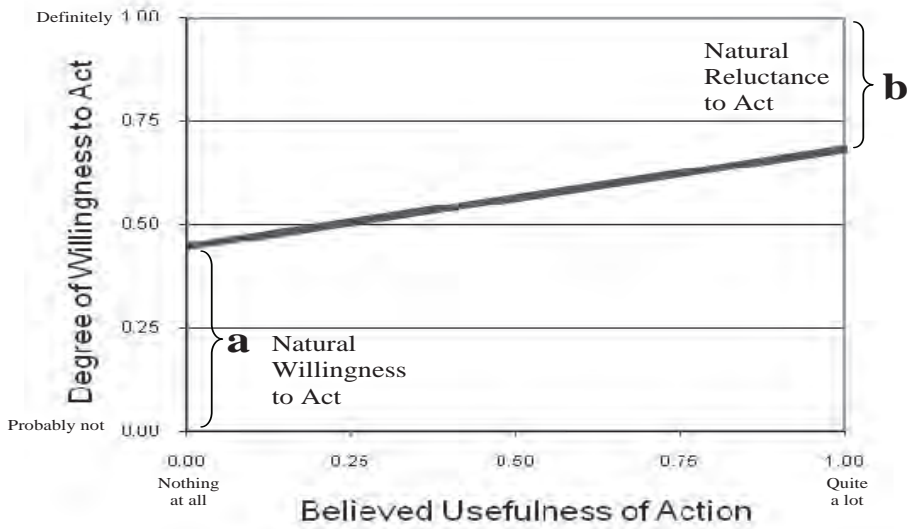


FIGURE 2: Annotated schematic regression plot for values of degree of willingness to act against believed usefulness of action. The straight line shows the way in which the degree of willingness to act (ordinate) increases as the believed usefulness of that action increases (abscissa).

*Potential Effectiveness of Education* by the proportion of students who would “probably not” or only “perhaps” undertake the action.

**Results**

*Potential Effectiveness of Education, Natural Willingness to Act and Natural Reluctance to Act*

Graphical examples of actual results from primary students are shown in Figure 3, and should be read in conjunction with the semantic scales of Figure 1. These three graphs have been selected to illustrate different categories of response. Actions such as switching off electrical items in the home when they are not being used showed a high level of *Natural Willingness to Act* (0.75 on a 0 to 1 scale) and a low *Natural Reluctance to Act* (0.10). As a consequence, the value for the *Potential Effectiveness of Education* was low (0.15 within a range of 0 to 1). This being the case, it could be argued that there is little opportunity to improve students’ intentions by enhancing their knowledge about the efficacy of such actions, since their intentions are already at a high level. Other actions about which similar conclusions could be drawn are recycling and supporting the planting of trees.

In contrast, some actions, such as being willing to pay a price premium for electricity generated by nuclear energy, showed a high level of *Natural Reluctance to Act* (0.63) and a low *Natural Willingness to Act* (0.27); that is, even if respondents did believe nuclear power generation to be effective in reducing global warming they were still disinclined to adopt it, perhaps because they feel that there were strong disincentives to do so. In such cases, the value for the *Potential Effectiveness of Education* was also low (in this instance, 0.10). So, simply increasing the view that nuclear power could

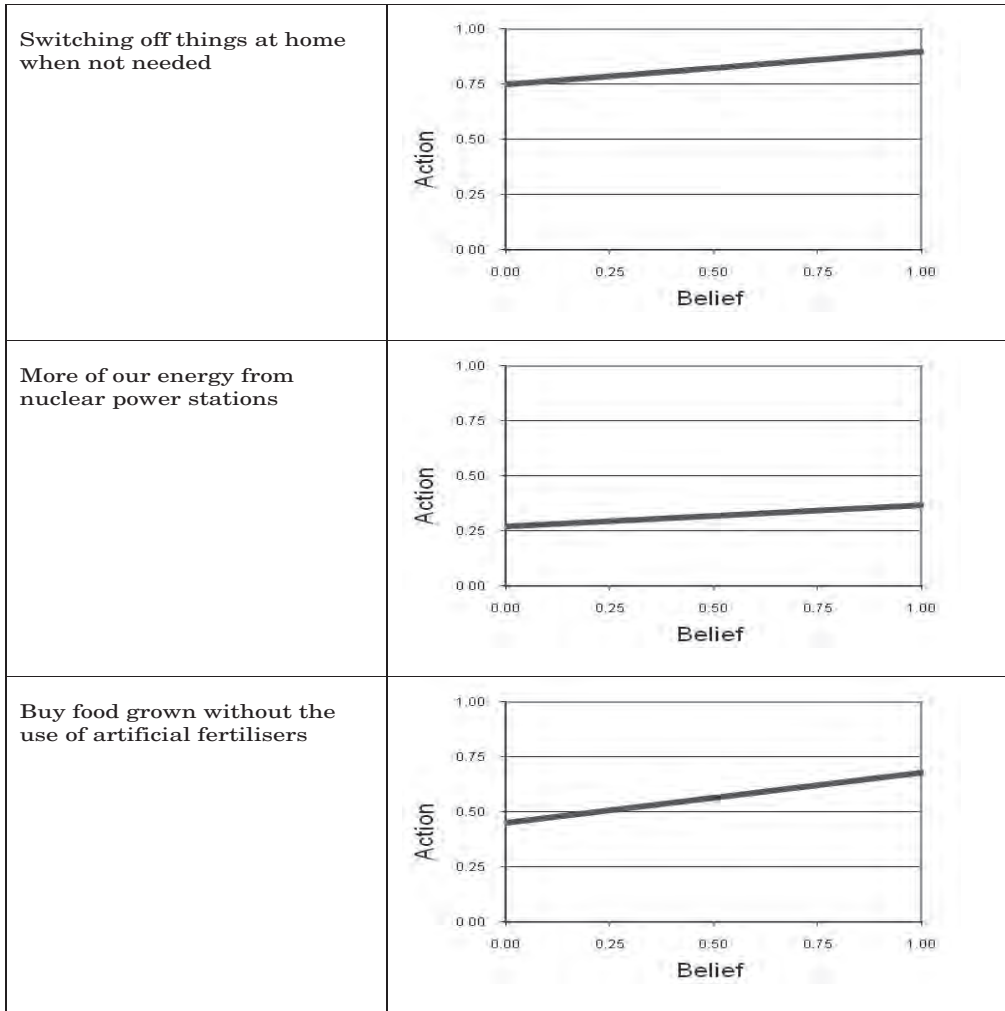


FIGURE 3: Examples of regression lines for degree of willingness to act against believed usefulness of action for Primary students

reduce global warming is likely to be relatively ineffective in extending its adoption. Another action with similar characteristics was using public transport.

Other types of actions showed a relatively low *Natural Willingness to Act* and a moderately low *Natural Reluctance to Act*. As a consequence, the slope of the line was fairly steep, that is, the value of the *Potential Effectiveness of Education* was relatively high. This indicates that an increased belief in the usefulness of that action might encourage a greater willingness to adopt it. Buying foods produced without the use of artificial fertiliser showed this type of relationship (0.23, 0.45, 0.32), as did the willingness to use energy-efficient domestic appliances (PEE 0.23; NWA 0.54, NRA 0.24) and purchasing insulation for the home (0.22, 0.43, 0.35).

Of particular interest were the indirect actions as they had relatively higher PEE values (Tax 0.18, Agreements 0.22, Laws 0.25 and Education 0.28) and relatively low NWAs (Tax 0.31, Agreements 0.31, Laws 0.38 and Education 0.41) suggesting that they

may be susceptible to school education but, apart from “education” (0.31), they also had higher NRA values (Tax 0.51, Agreements 0.48, Laws 0.38), indicating that they may be difficult to effect action changes based on beliefs. The complete set of values for the *Potential Effectiveness of Education*, the *Natural Willingness to Act* and the *Natural Reluctance to Act* of the 16 actions, for primary and grade 7 students are shown in Table 1, ranked, for each group of students, in order according to the magnitudes of the slopes.

Although ten (of 16) PEE values for grade 7 are lower than or the same as those for the primary students, none were statistically different, which initially suggests that the actions on which there could be an educational focus would be the same for both groups. Further, 14 of the 16 NWA values for grade 7 were less than the primary students, and 15 of the 16 NRA values for grade 7 were higher than the primary students. However, despite this apparent trend, only two values showed statistically significant differences (<0.05) between the grades. These were for the *Natural Willingness to Act* for using less electricity in homes (0.75 primary, 0.60 for Grade 7), and using public transport (0.37 for primary, 0.17 for Grade 7). In these cases, consistent with the non-significant values, primary students showed higher values of a natural willingness to take action than Grade 7 students, that is, they were more likely to take action even in the event of their not believing in its usefulness. In addition, more primary than Grade 7 students believed in the effectiveness of most actions, and more of them were willing to take action (Skamp, Boyes, & Stanisstreet, 2009b). These data suggest, despite the absence of statistical significance for individual actions, that primary students seem generally

TABLE 1: Values of natural willingness to act (NWA), the natural reluctance to act (NRA) and the values of the gradient indicating the potential effectiveness of education for primary and Grade 7 students

Action	Gradient	NWA	NRA	Action	Gradient	NWA	NRA
	(PEE)				(PEE)		
	Primary students				Grade 7 students		
Renewable	0.32	0.27	0.41	Energy efficient	0.37	0.44	0.19
Education	0.28	0.41	0.31	Laws	0.29	0.26	0.46
Fashion	0.27	0.33	0.40	Switch Off	0.24	0.60	0.16
Meat	0.26	0.32	0.42	Meat	0.24	0.26	0.50
Laws	0.25	0.38	0.38	Insulation	0.22	0.28	0.64
Energy efficient	0.23	0.54	0.24	Fashion	0.21	0.26	0.46
Fertiliser	0.23	0.45	0.32	Tax	0.20	0.22	0.59
Car small	0.23	0.38	0.39	Education	0.18	0.33	0.50
Insulation	0.22	0.43	0.35	Renewable	0.18	0.30	0.52
Agreements	0.22	0.31	0.48	Trees	0.15	0.43	0.42
Tax	0.18	0.31	0.51	Recycle	0.11	0.61	0.28
Switch Off	0.15	0.75	0.10	Public transport	0.08	0.17	0.76
Trees	0.15	0.63	0.22	Agreements	0.08	0.28	0.64
Recycle	0.10	0.72	0.18	Fertiliser	0.08	0.61	0.28
Nuclear	0.10	0.27	0.63	Car small	0.05	0.39	0.56
Public transport	0.05	0.37	0.58	Nuclear	0.04	0.22	0.74



to be more susceptible to “education”, in the sense that changing belief may have an effect on action, compared to grade 7. Particular examples would be purchasing smaller cars and paying more for renewable energy and fertiliser free food.

### *Potential Usefulness of Education*

We argue that education about global warming might be best targeted at those actions with both higher *Potential Effectiveness of Education*, indicating a strong potential for education to change behaviour, and which relatively few respondents are already willing to undertake, that is, where the prospective constituency for changing behaviour is large. This is illustrated in the scatter graph of Figure 4 in which the value for the *Potential Effectiveness of Education* for each of the 16 actions is plotted against the percentage of students who responded that they would “probably not” or “perhaps” take that action (Primary and Grade 7 combined). Actions to the left of this graph have a relatively low *Potential Effectiveness of Education*; it is possible that even if more people were convinced of the usefulness of such actions for reducing global warming, they would not be willing to undertake them. Actions which are to the bottom of this graph are those in which there are relatively few people who are not already willing to undertake the actions; here the constituency for changing behaviour is comparatively small. Given this, those actions positioned at the lower left-hand quadrant are those which may be unresponsive to education, but which are not a major problem in that most of the respondents were willing to undertake them anyway. Actions situated towards the lower, right-hand quadrant are those which might be responsive to education, but which, in the same way as the previous group, are not a major problem. Pro-environmental actions which are located towards the upper, left-hand quadrant are those which relatively few students were willing to undertake, but which are likely to be unresponsive to education. Finally, those actions positioned towards the upper, right-hand quadrant of Figure 4 are those which comparatively few students were willing to undertake at present, but for which education might be effective. Eating less meat, green taxes and the idea of making fashion items and consumer durables last longer were at the head of this group.

Figure 4 does not distinguish between primary and Grade 7, as there was no statistically significant difference between the PEE at each level. Comparing the positions on the scattergram of the values for primary and Grade 7 separately, however, shows a degree of consistent change. All movement is upwards, suggesting that for all actions a greater percentage of students in Grade 7 are less willing to take action. Ten out of the 16 move to the left, indicating a decrease in the *Potential Effectiveness of Education* between Primary and Grade 7.

Some of these changes are quite large. Big changes occur to the left (and upwards somewhat) for using smaller cars, supporting international agreements, eating fertiliser-free food, paying additional for energy from renewable resources, and possibly consistent with this trend, being willing to experience more education. This indicates that, for these issues, more students in Grade 7 are less willing to take action and, at the same time, education is becoming less effective. There were two strong movers to the right from Primary to Grade 7, using energy efficient household appliances and switching off unused appliances. Education may be more effective at Grade 7, but the numbers who are unwilling to take action are small anyway.

### **Discussion**

A majority of students in this study (although fewer of the Grade 7 students), thought that global warming was a real phenomenon, and many of them were concerned about its impact (Skamp, Boyes & Stanisstreet, 2009b). Given this, it might be thought that

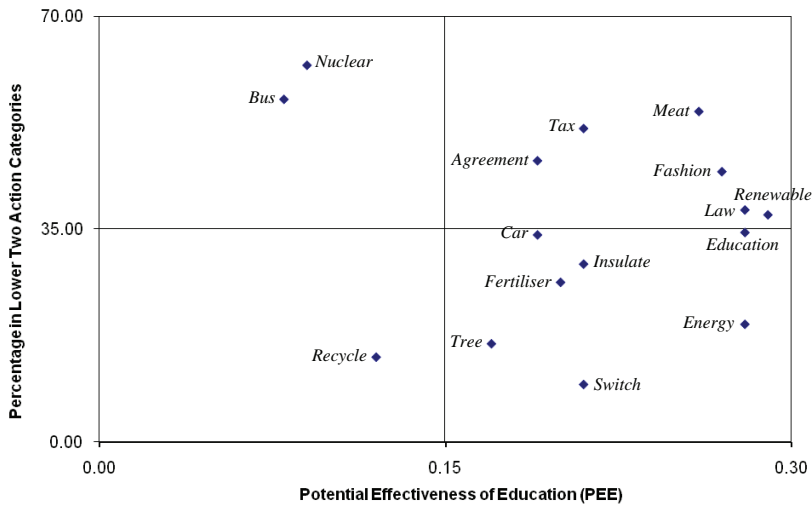


FIGURE 4: Scatter plot of the 16 issues of the questionnaire. The abscissa is the slope of the graphs from Figure 2 (PEE), and the ordinate shows the percentage of Primary and Grade 7 students in the bottom two categories of the 'willingness to act' variable, namely 'perhaps' or 'probably not'. Each point is a cohort measure for one issue (labelled).

such students would be prepared to be influenced by, and act upon, their understanding of behaviours that might contribute to a reduction in global warming. It is clear from the present study, however, that the intrinsic willingness of students to say that they will act in a more pro-environmental manner is dependent upon the nature of the behaviours that they are called upon to adopt (Skamp, Boyes & Stanisstreet, 2009b). Furthermore, the practical outcomes of education about the usefulness of different actions, termed here the *Potential Effectiveness of Education*, are not uniform.

For some of the actions raised by the questionnaire, students were willing to act even though they do not believe strongly that such actions will contribute to a reduction in global warming. The value-belief-norm theory and Chawla and Flanders Cushing's (2007) review helps in understanding this finding. Switching off un-used electrical appliances, recycling, and supporting the planting of trees all had high *Natural Willingness to Act* values as students probably appreciate the benefits for the environment, know enough about the consequences for the people that matter to them (e.g., their carers) and can see the impact of their own actions (e.g., recycling at school and at home; watching trees grow that they have planted at school). Further, barriers are minimal: these actions are often facilitated by local council infrastructure (e.g., recycling), openly supported by community and school environmental programs (planting trees), and are perceived as relatively uncstly in terms of finance and inconvenience (switching off lights).

In contrast, other actions were apparently refractory to the effects of persuading students that they were effective in ameliorating global warming, because they had a high *Natural Reluctance to Act*. Supporting the generation of electricity from nuclear sources was one such example. This might be due, in part, to a generalised concern about the safety of nuclear materials and its potential negative impact on the

environment, as well as Australian society's general reluctance to embrace nuclear power (Symon, 2008). For this issue, it might be advisable to concentrate education not on the efficacy of such actions in reducing global warming but on addressing instead the perceived dangers associated with nuclear power. Similarly, using public rather than private transport was another behaviour that showed a high *Natural Reluctance to Act*. Access to personal transport is clearly important to many students (Amarant, 2006; Rickinson, 2001), and the lack of convenient public transport infrastructure in all except major cities is a barrier to taking action. Very few community education programs have been effective in reducing private transport usage in Australia and elsewhere (Skamp, Bergmann, Taplin, & Cooke, 2007) - despite most students having a knowledge of the impact of transport on global warming emissions (Skamp, Boyes, & Stanisstreet, 2009b; also see Pruneau, Gravel, Bourque, & Langis, 2003).

Other actions also showed a relatively low *Natural Willingness to Act* and a fairly low *Natural Reluctance to Act*. As a consequence, the slope of the line was steep so that the *Potential Effectiveness of Education* was higher, indicating that an increased belief in the usefulness of that action might encourage a greater willingness to adopt it. The willingness to use energy-efficient domestic appliances, eat fertiliser free foods and install home insulation showed this type of relationship, especially for the primary students. In all these instances, less than half of these students strongly believed in the effectiveness of these actions in reducing global warming (Skamp, Boyes, & Stanisstreet, 2009b) hence there may be opportunity to convince a wider population of students. The relative lower NRA values, which suggest that education may be effective, may be because these students do not foresee barriers to implementing these benefits for their families. The higher NRA values for the grade 7 students for two of these actions, which showed a consistent trend across all the actions, may be related to an increased focus on self rather than others and the environment as students get older, as has been reported in some studies (see Jenkins & Pell, 2006). Here, then, are opportunities for education for action and behaviour change; investment in education about these actions might pay dividends in practical terms.

Most of the actions in this survey study focussed on private actions but the indirect actions related to political, and it could be inferred, collective actions. All these actions (changing laws, taxes and international agreements) had relatively high PEE values for primary students and, except for international agreements, grade 7 (i.e., >0.20), and relatively low NWA values (i.e., 0.2 to 0.4), suggesting changing beliefs through education may be possible but they had relatively high NRA values (0.4 to 0.6). These high NRA values are consistent with the views of Canadian 13-14 year olds, who, even after an extensive school intervention did not believe that collective action could reduce global warming; many felt powerlessness in relation to the scope of the issue (Pruneau et al., 2003). These high NRA values, we have inferred, suggest that education may have little impact. With these indirect actions, however, it may be, as Chawla & Flanders Cushing (2007) indicate, due to the lack of political education occurring in the school curriculum; they also provide numerous suggestions for addressing this critical area by preparing students for political action. This is not beyond the competence of upper primary students (see Jenson, 2002; Jenson & Schnack, 2006; Sobel, 1996) and case studies are available (Smith & Cuppitt, 2007).

The final index that was produced from these data was the *Potential Usefulness of Education*, which takes into account the size of the potential constituency that might be available for adopting any particular action. Although the nature of the calculation meant that the figures produced were of small magnitude, eating less meat, supporting green taxes and not buying the latest fashion item were actions that had relatively high *Potential Usefulness of Education* indices. Two of these may be appropriate topics

for environmental education at the primary level. Focussing on eating less meat could be useful for a range of reasons. Firstly, although the chemistry of methane is beyond the scope of primary students, the notion that carbon dioxide is not the only greenhouse gas, and that global warming is produced by a variety of pollutants in addition to the well-known carbon dioxide (Maslin, 2004) may be comprehensible to them if various teaching strategies are used (Skamp, 2008). Thus, students might be encouraged to consider that not only does global warming have an array of effects (Preston in Skamp, 2008), it also has a diversity of causes. Secondly, adoption of a diet with a lower meat content might well find a ready acceptance with some students whose focus is not so much on environmental concerns, but more on animal welfare (e.g., see Sobel, 1996). Thirdly, the content of students' diet might be at least partly within the locus of control of the students themselves. On a pragmatic level, this means that students might well be able to take such action. In general terms, successful adoption of one such behaviour, made more meaningful by the knowledge that it will indeed help in the struggle to reduce global warming, might contribute to students "unlearning" of their perceived helplessness (Nagel, 2005). Through systemic thinking tasks (Sterling, 2004; Wylie, Sheehy, McGuinness, & Orchard, 1998), primary students could start to appreciate the impact of consumerism on the release of greenhouse gases and perhaps see the value in resisting the temptation to acquire the latest fashion items. In so doing, these topics might encourage students to appreciate that other individual actions, although making a small contribution to the reduction of anthropogenic greenhouse gases, are of consequence, particularly when practised by an increasing numbers of individuals.

## Conclusion

These findings are based on the assumption that willingness to take action is dependent upon a range of antecedent variables and that the interrelatedness between these variables and taking action is complex. Two such variables are gender and socio-economic status (Chawla & Flanders Cushing, 2007). The influence of gender on beliefs and willingness to act was reported in Skamp, Boyes, and Stanisstreet (2009a). Socio-economic status as a variable was not included; it has been reported that students from disadvantaged communities may show more concern about environmental matters (Rickinson, 2001) and be more willing to take pro-environmental actions to save or earn money (Chawla & Flanders Cushing, 2007). Another variable that cannot be overlooked is "beliefs", as Pruneau et al. (2003) especially argue in the case of climate change. Further, although "education" has not been articulated, it has been assumed that environmental education teaching and experiences have the potential to effect change in willingness to take pro-environmental action (see Chawla & Flanders Cushing, 2007; Mogensen & Nielsen, 2001) including in relation to global warming (Pruneau et al., 2003). It is acknowledged though that, at times, the effect of school EE experiences can be ineffective and problematic (Rickinson, 2001).

We have argued that certain pro-environmental actions to reduce global warming are more susceptible to (school and other) education than others. To effect changes, even in the identified areas will, however, not be straightforward as there are many complexities in understanding students' environmental learning (Rickinson & Lundolm, 2008). Further, student decision-making about controversial issues is rarely simply a case of weighing up the pros and the cons; many other factors are involved (Collucci-Gray, Camina, Barbiero, & Gray, 2005). Even so, this study provides some direction for environmental educators.

Statistically it was not possible to clearly differentiate if "educational" emphases on particular actions should differ between primary and grade 7, but there is the suggestion in these data that there is an increase in a natural tendency towards reluctance to act

in the secondary students. This is consistent with what we have argued in Skamp, Boyes, & Stanisstreet (2009b) where various ways of understanding reported primary secondary differences were proposed. It does imply that the task may be more difficult at the secondary level.

*Keywords:* Global warming; environmental education; primary students' beliefs; primary students' actions; primary-secondary interface.

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