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# Senior secondary Indian students' views about global warming, and their implications for education

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**Abstract**
*For individuals to make informed lifestyle choices that may help to reduce global warming, they need some understanding of this phenomenon and the factors that contribute to it. However, there is a 'gap' between knowledge about global warming and willingness to take personal action. So, although education may be effective in enhancing student knowledge, the extent to which that knowledge leads to action is unclear. In order to explore this a 44-item questionnaire was designed to determine senior secondary students' views about how useful various specific actions in reducing global warming might be, and their willingness to undertake these various actions. The findings gave insight into the extent to which these two parameters might be linked. The instrument was administered to students in Grade 12 (n=268) from four large schools in New Delhi, India. The findings indicated that this cohort of Indian students exhibited high levels of concern about global warming and a willingness to act to reduce it. These findings are tentatively compared with those younger students (Grade 6-10) within the same schools, and with those from two similar survey studies conducted in Western contexts (Spain and Australia). Implications for the role of environmental education in behaviour change are discussed.*
***Keywords:*** Global warming; India; attitude; behaviour; student

## Introduction

Recent events in the Gulf of Mexico with the major drilling accident and subsequent oil leak (Guardian Newspaper, April, 2010), have highlighted the dramatic impact that human activity can have, not only ecologically, but also socially and economically. However, such acute but relatively short term events may ultimately appear trivial if the worst-case predictions about global warming and associated climate change materialise. Certainly global warming and climate change are now considered by many to represent the greatest anthropogenic threat to our planet (IPCC, 2007; Stern, 2007, inter alia). Furthermore, recent research has suggested that specific recent extreme weather events can indeed be linked to anthropogenic global warming (Min et al, 2011; Pall et al, 2011). Thus, the need to reduce global warming is both important and urgent.

**Theoretical considerations**

Skamp, Boyes, and Stanisstreet (2007) argue that reducing greenhouse gas emissions is not only a government, corporate, and community responsibility, but also an individual responsibility. According to Jensen (2002) the key to effecting change in individual behaviour is an informed citizenry, since awareness of an environmental issue is precondition to taking environmental action. So, if individuals are going to make informed lifestyle choices that may help to reduce global warming, they need some understanding of this phenomenon, the factors that contribute to it and what practical actions can be taken to reduce it. As a consequence, a crucial part of any integrated approach to ameliorating climate change must be education, both formal and non-formal. There has, however, been much argument about what form of environmental education best leads to environmentally sympathetic behaviour. Early attempts to determine this centred on 'information deficit' models (Burgess, Harrison & Filius, 1998). These assumed that people had a deficiency of knowledge about environmental concerns, and if this was addressed they might be expected to adopt pro-environmental behaviour patterns. This thinking assumed direct relationships between an individual's cognitive base about environmental problems, a positive attitude towards the environment, and a tendency to act in an environmentally-sympathetic manner.

However, these assumptions that knowledge of the environment would produce more favourable environmental behaviour on the part of individuals proved difficult to establish. While some studies have indicated that there is such a link (Yencken, 2000), many others have suggested that this link is often tenuous (Hungerford & Volk, 1990, inter alia) and that in fact there can be a 'gap' between cognition and action (Kollmus & Agyeman, 2002). The weakness of the link between knowledge and behaviour in relation to the environment may be due to the many factors that bear upon environmental behaviour (Rodriguez, Boyes & Stanisstreet, 2010). Moreover, previous studies have been rather general in their approach to the environment, dealing with a broad range of issues rather than having a single focus (Yencken, Fein & Sykes, 2000, inter alia).

This 'gap' between knowledge and action (Rajecki, 1982) suggests that simply imparting environmental knowledge does not necessarily influence attitudes and behaviours and, as such, is insufficient on its own to bring about positive environmental impacts (see eg Fien, 1993; Connell, Fien, Lee, Sykes & Yencken, 1999; Elliott, 1999 & Jensen, 2002). Even worse, there is a risk that too much exposure to issues as daunting as global warming may lead to feelings of helplessness and demotivation to act for change (Kefford, 2006) something Connell et al (1999) have termed, 'action paralysis'. There is also the danger that constant contact with this important issue may produce children who are desensitized to it (Nicholson-Cole, 2005). Despite this, Kelsey (2003) argues that the assumption that knowledge about the environment will lead to behavioural change is maintained today in programs delivered through the mass media as public education about environmental issues.

Clearly, as efforts to reduce global warming must inevitably involve individuals in taking positive environmental actions, it is important to explore the nature of the 'gap' between knowledge and action, and ways in which it might be addressed. There have been a number of attempts to develop pro-environmental behaviour models. However, as Rodriguez, Boyes and Stanisstreet (2010) point out, the plethora of factors that interact with environmental knowledge, and the interactions between those factors mean that any reasonably complete model of environmentally sympathetic behaviour is likely to be so complex that it will fail to indicate which factors influence whether or not a person acts in a pro-environmental manner. Furthermore, it has become clear as researchers have attempted to generate models of the

drivers of environmentally sympathetic behaviour that there are limitations in studying links between environmental attitudes in general (in other words across a wide range of environmental issues) and potential behaviour patterns (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980; Dietz, Stern & Guagnano, 1998; Stern, 1992).

In order to address these problems Boyes, Skamp and Stanisstreet (2008) developed a survey instrument that questions respondents about their intentions to undertake specific environmental behaviours and their beliefs about the possible effects of these particular actions on one environmental problem namely global warming. To date this instrument has been administered to secondary students in a number of countries including Australia (Boyes, Skamp & Stanisstreet, 2008) and Spain (Rodriguez, Boyes & Stanisstreet, 2010). The Australian study indicated that the degree to which secondary students were willing to act in a pro-environmental way was in certain cases greater than might be expected from the extent to which they believed the actions might be useful. However, these cases generally involved actions with little inconvenience, such as switching off electrical appliances. In other cases, such as using public transport or buying a smaller car, although the students believed these actions to be effective their willingness to act appeared less than might be expected from this belief; this mismatch is probably due to perceived personal inconvenience. In Spain, a parallel cohort of secondary students provided similar findings. Students expressed a willingness to undertake some actions even if they did not believe that such behaviours would be particularly effective in reducing global warming, perhaps because the actions are of minor cost in terms of finance, convenience or personal comfort. On the other hand, students appeared unwilling to undertake other actions even if they believed that they were effective in reducing global warming. This was despite the fact that many of them appeared to be seriously concerned about global warming (Rodriguez, Boyes & Stanisstreet, 2010). As with the Australian cohort, this may have been because these latter actions were perceived as costly in terms of personal behaviour. This led the researchers to surmise that it may not be the optimum strategy to expend financial resources and curriculum time attempting to persuade students of the efficacy of these two types of action, because in one case students are already willing to undertake them, and in the other students are unwilling to undertake them despite a belief in their usefulness. In a further study, Chokker, Dua, Taylor, Boyes and Stanisstreet (2011) employed the same instrument with secondary students (grades 6-10) in New Dehli India and found that levels of concern about global warming were higher and willingness to act to remediate it was stronger than was apparent with the western cohorts.

The present research builds on the last of these studies by employing the instrument with senior India secondary students in Grade 12 (the final year of secondary school) from the same New Delhi schools. Of particular interest was to determine if the pro-environmental attitudes exhibited by junior secondary students persisted in their senior secondary counterparts. The specific intention of the study was to address following questions:

(1) To what extent do Grade 12 students in Delhi intend to undertake specific actions to conserve the environment?

(2) To what extent do the students believe that such actions would be effective in reducing global warming?

(3) What relationships exist between the students' willingness to undertake specific actions and their belief about the usefulness of such actions?

(4) To what extent do the attitudinal trends found amongst younger students in Delhi continue into their final year of secondary school?

## Methodology

### *Study cohort and context*

The questionnaire was administered to 268 secondary students in Grade 12 (ages 17-18 years) from four large English medium public schools in New Delhi. Grade 12 was considered an important cohort as these students are young adults who are making decisions that have environmental implications. The sample comprised 143 (54%) males and 123 (46%) females. The schools drew largely from middle and upper middle class families and charged fees of Rs 2,300 – 3,000 or approximately US$ 48-60 per month (the average annual per capita income for Delhi is Rs 66,500, approximately US$1,400) (www.expressindia.com). All four schools were engaged in significant levels of non-formal environmental education and each had established 'Eco Clubs'. Furthermore, there was evidence of environmental awareness in the many displays present in the schools' corridors and in the activities organized to observe Earth Day, which occurred, coincidently, at the time of data capture.

New Delhi, the city where all of the schools were located, has an estimated population of 14 million people. It is a city where environmental issues can be quite confronting. For example, litter, particularly in the form of plastic waste, is an extremely visible form of pollution in the streets. In terms of transport-sourced pollution, rapid economic growth has led to a surge in the ownership of private vehicles, with an estimated one thousand vehicles being added to Delhi's roads almost every day (Sarabhai & Chhokar, 2009). There is now chronic traffic congestion and significant air pollution, despite government attempts to control vehicle emissions and provide more effective public transport through the construction of a metro (mass transit) system.

## The questionnaire

A novel, closed-form questionnaire was devised by an international research team, and was originally used in Australia (Boyes, Skamp & Stanisstreet, 2009) and the UK (Boyes & Stanisstreet, 2011). The questionnaire was designed to investigate students' willingness to undertake certain specific pro-environmental actions and, separately, their beliefs in the efficacy of these same actions in reducing global warming. In this way relationships between these two parameters could be explored. The questionnaire was organised in two main sections, fronted by a coversheet that asked students to record their grade and gender. The items in the questionnaire were centred on a number of themes such as energy generation, personal transport, domestic energy usage, personal and communal actions, and 'indirect' actions such as voting for pro-environmental policies.

The first major section of the questionnaire asked students how willing they would be to undertake specific pro-environmental actions (Table 1) or, in the words of the introduction to the questionnaire, about "things you might do for the sake of the environment and future of the Earth". At this point in the questionnaire, there was no mention of global warming. An example of the wording of the items in this section of the questionnaire would be 'Even if it was not as fast or luxurious, I would try to get a car that uses less petrol or diesel'. The five possible responses to these items were 'definitely', 'almost certainly', 'probably', 'perhaps' and 'probably not'; these responses were scored as shown in the right hand side of Table 2. Analysis of the responses to items in this section of the questionnaire gave a measure of was designated students' Degree of Willingness to Act.

The second main section of the questionnaire contained items asking how effective students believed the same actions would be in reducing global warming (Table 1). Although the items in the two main sections were paired, they were in different orders so that this was not immediately obvious to the respondents. The item paired to the one above was 'If people had smaller cars that used less petrol or diesel, global warming would be reduced'; other items in the second main section of the questionnaire took a similar form. The possible responses to these items were 'by quite a lot', 'by a fair amount', 'by a small but useful amount', 'by a very small amount - hardly noticeable' and 'by nothing at all really'. These responses were designed to match semantically the responses to items in the first main section of the questionnaire, to provide a degree of 'measurement correspondence' (Kaiser, Wolfgang & Fuhrer, 1999). Thus, a priori, one might expect that the greater the perceived efficacy of a particular action, the more likely that action is to be undertaken, other factors being equal. For instance, if a person thought that an action reduced global warming 'by nothing at all really', it would be reasonable if that individual said that they would 'probably not' undertake it. On the other hand, if an action was considered to help to reduce global warming 'by quite a lot', it might be expected that people would 'definitely' undertake it. The way in which these responses were scored is shown on the left side of Table 2. Analysis of the responses to items in this second section of the questionnaire gave a measure of what was termed students' Believed Usefulness of Action.

The final section of the questionnaire contained four items. One item explored how worried the students were about the environmental impact of global warming, with the four possible responses 'very worried', 'quite worried', 'a little bit worried' and 'not at all worried'. The second item in this section asked students how much they considered they knew about global warming, with 'a lot', 'something', 'a little' and 'almost nothing' as the four available responses. The third item asked students how 'environmental friendly' they perceived themselves to be; here the four allowable responses were 'very', 'quite', 'a bit' and 'not at all'. The final item explored whether students thought global warming is happening now; here there were five possible responses: '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' and 'I am sure global warming is not happening'.

The questionnaire was adapted prior to its use in the Indian context. It was examined by two academics, both of whom had been teachers in India, for content validity. On the basis of their feedback, minor changes were made to a few items. The instrument was administered in routine Grade 12 classes by their teachers, and students were assured that the results would be anonymous.

## Data Analysis

### *Degree of Willingness to Act and Believed Usefulness of Action*

Once completed, the questionnaires were numbered, and the responses were scored and entered onto an SPSS data file for analysis. In order to quantify students' Degree of Willingness to Act and Believed Usefulness of Action, percentages of students showing the different responses to the various items were determined, and differences between the distributions of responses between male and female students were explored using Chi squared analysis. In addition, the data were manipulated in various ways to calculate novel indices to provide and indication of the quantitative relationships between the various parameters, as described below.

**Table 1.** Wording of the survey items in the two main sections of the survey

| ***Degree of Willingness to Act*** (How likely is student to undertake action?) | ***Believed Usefulness of Action*** (To what extent would action ameliorate global warming) |
|---|---|
| **'Direct' Actions** | |
| Even if it was not as fast or luxurious, I would try to get a car that uses less petrol or less diesel | If people had smaller cars that used less petrol or less diesel, 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 |
| Even though it cost me money, I would make changes to my home to stop so much heat escaping | If people made changes to their homes to stop so much heat escaping, Global Warming would be reduced |
| 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 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 fertilisers | If farmers stopped using artificial fertilisers with nitrogen in them, Global Warming would be reduced |
| 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 |
| 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 |
| 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 I really liked meat, I would eat fewer meals with meat in them | If people eat less meat, 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 |
| **'Indirect' Actions** | |
| I would vote for a politician who said they would bring in laws to help the environment, even though it might stop me doing some of the things I really enjoy | If politicians made the right kind of new laws, Global Warming would be reduced |
| I would vote for a politician who said they would increase taxes to pay for things that would help the environment, 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 |
| I would vote for a politician who said they would sign agreements with other countries to help the environment, even though I might have to change the way I live | If there could be more agreements between different countries about not putting certain gases into the air, Global Warming would be reduced |
| I would like to learn more about helping the environment, even though it would mean extra work for me | If people were taught more about it, Global Warming would be reduced |

**Table 2**. Wording and scoring of the responses

| ***Degree of Willingness to Act*** (how likely is student to undertake action?) | | ***Believed Usefulness of Action*** (to what extent would action ameliorate global warming?) | |
|---|---|---|---|
| **Semantic descriptor** | **Score** | **Semantic descriptor** | **Score** |
| Definitely | 1.00 | By quite a lot | 1.00 |
| Almost certainly | 0.75 | By a fair amount | 0.75 |
| Probably | 0.50 | By a small but useful amount | 0.50 |
| Perhaps | 0.25 | By a small amount – hardly noticeable | 0.25 |
| Probably not | 0.00 | By nothing at all really | 0.00 |

Here the items in the two main sections of the survey have been arranged in their pairs, to demonstrate the ways in which they correspond. In the actual survey the items within each

section were in random order, apart from the last four items, those about voting and education.

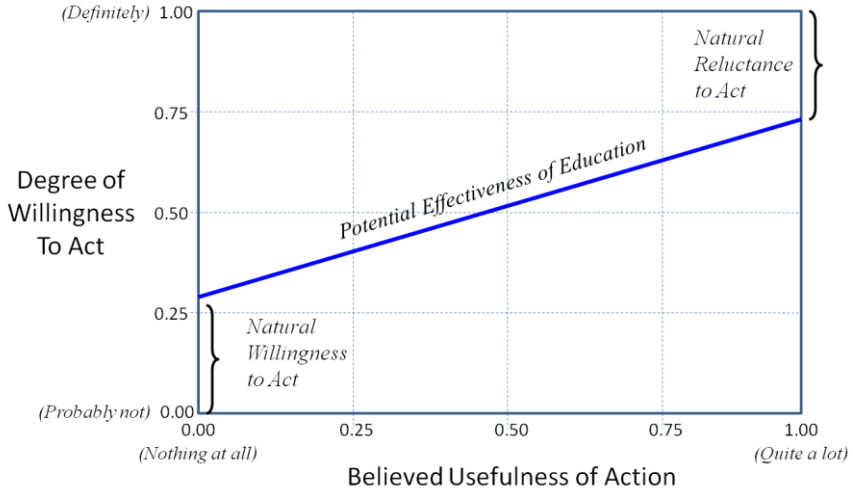
**Environmental Friendliness Coefficient**

Subtracting the Believed Usefulness of Action score from the Degree of Willingness to Act score (Table 2) for a pair of items provides an index, the Environmental Friendliness Coefficient that can have a theoretical value between -1 and +1. As the responses to the two sets of items had been semantically matched, the Environmental Friendliness Coefficient indices provide, for each pair of items and for each student, a measure of the alignment or discrepancy between the extent to which a student believes an action would alleviate global warming and their willingness to take that particular action. Thus, values close to zero indicate that the willingness of the student to take action is more or less consistent with their belief about the effectiveness of that action. A value above zero indicates that students' willingness to undertake an action is greater than might be considered justified by their level of belief in the usefulness of that action; a value of less than zero suggests the opposite.

Potential Efficiency of Education, Natural Willingness to Act and Natural Resistance to Act

Additional indices were constructed by plotting the measures of the Degree of Willingness to Act for a particular action against the value of the Believed Usefulness of Action for that action and fitting the regression line (Figure 1 shows a generic example). We designated the gradient of the regression line the Potential Effectiveness of Education; the magnitude of this index indicates the extent to which increasing the appreciation of the usefulness of a specific action in reducing global warming, for example through targeted environmental education, might persuade students to be willing to undertake that action. Two other indices can be taken from the intercepts of the graph shown in Figure 1. The intercept when the Believed Usefulness of Action is zero shows the probable action of students who believed that such an action would be ineffective in reducing global warming; we termed this the Natural Willingness to Act. In a complementary fashion, the difference between unity and the value of the intercept when the Believed Usefulness of Action is maximum indicates the extent to which students will not take action, even though they believe such action would be highly useful in reducing global warming. We called this index the Natural Resistance to Act.

**Figure 1**.Schematic plot of values for *Degree of Willingness to Act* against *Believed Usefulness of Action*.



**Findings**

The following section deals mainly with the findings from this Grade 12 study. However, a study using the same instrument with younger students (Grades 6-10) in the same four New Delhi schools had previously been reported by Chhokar et al (2011), and throughout this section some tested, though tentative, comparisons are made with the results from that study. All tests, whether for these grade differences, or for gender differences at Grade 12, use 2 x 2 Chi Squared tests, the categories for which will be described below. Only differences where $p<0.05$ will be reported.

**Students' self perceptions**

The responses to the final four items of the survey provided some background information about the views of the Grade 12 Indian students. The majority of these students (90%) believed that global warming is actually happening at the present time. They also exhibited high levels of concern about global warming, with 82% reporting that they were either 'very worried' or 'quite worried' about the issue. The majority of the students also reported a high level of knowledge about global warming, with 82% claiming to know 'a lot' or 'something' about this issue. Finally, almost three quarters (72%) claimed to be 'very' or 'quite' environmentally friendly.

**Differences between the responses of different subsets of students**

There were no statistically significant differences between the responses of the male and female students for these four items. However, there appeared to be a difference between the present cohort and their younger counterparts in that more of the latter (89% compared with 82%) were concerned about global warming.

**Students' Degree of Willingness to Act**

In the descriptions below, the figures given are the combined percentages of students who reported that they would 'definitely' or 'almost certainly' undertake the action. In general, this Grade 12 cohort of students appeared willing to take certain 'direct' actions to reduce greenhouse gas emissions. In particular, almost all of the students (94%) indicated they would switch off electrical appliances at home, while many (84%) claimed they would pay more for low energy domestic goods. Furthermore, about three quarters indicated they would pay more for the planting of trees (78%) or claimed they would pay for home insulation (70%). About two thirds of the students were willing to increase their recycling (61%), to pay more for food grown without the use of artificial fertilisers (61%). Almost as many were willing to use a smaller, more fuel-efficient car (56%) or pay a price premium for electricity from renewable sources (52%). Less than half of the cohort expressed a willingness to use public transport (48%), buy new fashion items less frequently (45%) or pay extra for nuclear-generated electricity (38%). Some of the indirect actions were supported by the majority of students. These were agreeing to further environmental education (73%), and voting for environmental legislation (72%) and for international agreements (61%).

**Differences between the responses of different subsets of students**

There were statistically significant differences in the responses of the male and female students to three of the items in this section of the survey. Here, the figures given first are those for the male students, followed by those for the females. The items that showed such differences were those concerning the planting of trees (73%, 84%), the use of public rather than private transport (41%, 54%) and supporting international agreements (55%, 68%). So, in each case more females were willing to undertake or support the actions than were males.

On many items this cohort of older students appeared to be less willing to take environmentally friendly actions than their younger counterparts. In the following description, the percentages shown first are those for students in Grade 6-10 (Chhokar et al, 2011) followed by those in Grade 12. Thus, while the proportions of students willing to undertake actions with a low personal effort or cost, such as switching off electrical devices at home, were indistinguishable (93%, 94%), on other issues younger students indicated a greater willingness to act in favour of the environment. For example, more of the younger students indicated a willingness to buy a more fuel efficient car (68%, 56%); use public transport (58%, 48%); pay more for nuclear generated electricity (49%, 38%), recycle materials (74%, 61%), buy fewer fashion goods (55%, 45%), or use their vote to influence international agreements (71%, 61%) or environmental taxes (61%, 48%). The one exception to this trend was for buying more efficient home appliances where more of the older students seemed willing to take this action (77%, 84%).

**Students' Believed Usefulness of Action**

The percentages given in the descriptions below are the combined percentages of students who believed that an action would reduce global warming by 'quite a lot' or 'a fair amount'. The direct actions perceived to be the most effective at reducing global warming were planting trees (88%) and using public rather than private transport (81%). About two-thirds of the students believed that generating electricity from renewable sources (68%), switching off un-used electrical appliances at home (66%), recycling more material (64%) and using a small, more fuel-efficient vehicle (60%) would contribute to a reduction in global warming, whereas about half thought that using energy-efficient domestic goods (54%) or generating electricity from nuclear sources (51%) would do this. Rather fewer students – less than half – appreciated that buying fewer new fashion items (43%), growing food without artificial fertilisers (41%), installing home insulation (36%) or eating less meat (34%) could also play a part in reducing global warming. Increasing environmental education (76%) and voting for international agreements (72%) were perceived to be the most useful of the indirect actions. Rather fewer of the students thought that voting for environmental legislation (59%) or taxation (53%) was useful in this context.

**Differences between the responses of different subsets of students**

There were statistically significant differences in the responses of the male and female students to four of the items in this section of the survey; in each case more of the female students than males believed that the action would reduce global warming. Here, as previously, the percentages for male students are given first, followed by those for female students. Thus, more females thought that using renewable energy (61%, 77%), using a smaller car (53%, 67%), growing food without artificial fertilisers (33%, 50%) and voting for international agreements (64%, 82%) would reduce global warming.

It was interesting to note that the ranking of these beliefs about the usefulness of actions by the Grade 12 students followed extremely closely that for Grade 6-10 students (Chhokar et al, 2011), although the level of that belief was consistently lower for the older students.

**Students' Environmental Friendliness Coefficients**

The mean Environmental Friendliness Coefficients for each action are presented in Table 3.

**Table 3**. Grade 12 Indian students' *Environmental Friendliness Coefficient*, *Potential Efficiency of Education*, *Natural Willingness to Act* and *Natural Resistance to Act*.

| | *Environmental Friendliness Coefficient* | *Potential Efficiency of Education* | *Natural Willingness to Act* | *Natural Resistance to Act* |
|---|---|---|---|---|
| **Direct actions** | | | | |
| Get smaller car – use less fuel | 0.01 | 0.11 | 0.50 | 0.39 |
| Pay more for nuclear power | -0.11 | 0.16 | 0.30 | 0.55 |
| Pay for home insulation | 0.27 | 0.09 | 0.68 | 0.23 |
| Switch off electrical un-used devices | 0.24 | 0.08 | 0.89 | 0.03 |
| Pay more for tree planting | -0.04 | 0.08 | 0.71 | 0.21 |
| Recycle things more | 0.01 | 0.17 | 0.51 | 0.33 |
| Pay for food grown with no artificial fertilisers | 0.14 | 0.13 | 0.56 | 0.31 |
| Buy new things less often | 0.05 | 0.14 | 0.39 | 0.46 |
| Pay more for renewable electricity | -0.11 | 0.19 | 0.40 | 0.42 |
| Try to use buses and trains rather than cars | -0.23 | 0.19 | 0.33 | 0.48 |
| Eat fewer meals with meat in them | 0.21 | -0.06 | 0.59 | 0.47 |
| Buy more energy-efficient domestic devices | 0.19 | 0.06 | 0.81 | 0.13 |
| **Indirect actions** | | | | |
| Vote for more environmental laws | 0.09 | 0.11 | 0.66 | 0.23 |
| Vote for more environmental taxes | -0.03 | 0.16 | 0.40 | 0.44 |
| Vote for more international agreements | -0.05 | 0.23 | 0.44 | 0.33 |
| Would like to learn more | -0.01 | 0.24 | 0.55 | 0.21 |

For some actions the *Environmental Friendliness Coefficients* showed relatively high positive values. Paying for home insulation (0.27), switching off un-used electrical items (0.24) and eating less meat (0.21) were examples. Students are more willing to undertake these actions, then, than their belief in the efficacy might warrant. This might be because actions that are relatively undemanding, such as switching off devices, or actions that would not impact directly on the students, such as eating meat as they already do not eat meat or eat it only very rarely, are more readily accepted. Other actions, such as using public transport, showed negative values (-0.23). In this case, although students believe the action will reduce global warming, they are still not prepared to undertake it. This may be because such actions are demanding in terms of personal inconvenience or cost.

**Differences between the responses of different subsets of students**

Using a t-test, small but significant differences in the values of the *Environmental Friendliness Coefficient* for male and female students were noticed for three of the 16 issues. These were the use of home insulation (male = 0.20, female = 0.29), using less electricity in the home (0.19, 0.26), and planting trees (-0.09, 0.00). For these actions, then, males seemed less willing to act than their beliefs in the effectiveness of the action might warrant, where, again, males lagged behind what they believed to be right. When the present Grade 12 group was compared with students in Grades 6-10 a small number of stronger differences were noticed. Here, Grade 12 students were more willing to act in relation to their beliefs than their younger counterparts: this applied to installing home insulation (Grades 6-10 = 0.17, Grade 12 = 0.27), using less electricity (0.16, 0.24), eating less meat (0.07, 0.21) and purchasing more efficient appliances (0.11, 0.19). Although these were the only statistically significant differences, it was generally true that older students seemed to be more willing, in relation to their beliefs, than younger children – with the possible exception of using public transport.

**Students' Potential Efficiency of Education, Natural Willingness to Act and Natural Resistance to Act**

The values of Students' Potential Efficiency of Education, Natural Willingness to Act and Natural Resistance to Act for the various actions are presented in Table 3. Some actions showed high values for the Potential Effectiveness of Education; examples were using public rather than private transport (0.19) and paying a price premium for renewable energy (0.19). Convincing more students of the usefulness of such actions in reducing global warming might well increase the proportion of students willing to adopt them. In contrast, other actions showed low values of the Potential Effectiveness of Education. In some cases this was because the Natural Willingness to Act was high; switching off unused electrical items was an example of such an action. For such actions, education may be less effective because students are prepared to take the action anyway, irrespective of their beliefs of its impact on global warming. In other cases the Potential Effectiveness of Education was low because the Natural Resistance to Act was high; the willingness to buy new fashion items less often was an example of this. Here, education to attempt to persuade students of the environmental usefulness of the action might be less effective in terms of action because there is a high innate resistance to change the behaviour.

Comparison of the values of the Potential Effectiveness of Education for different actions provides an indication of those actions for which education might be effective in terms of behaviour change. Figure 2 presents a scattergraph that provides a visual representation of how responsive overall each action is likely to be to education on a population basis

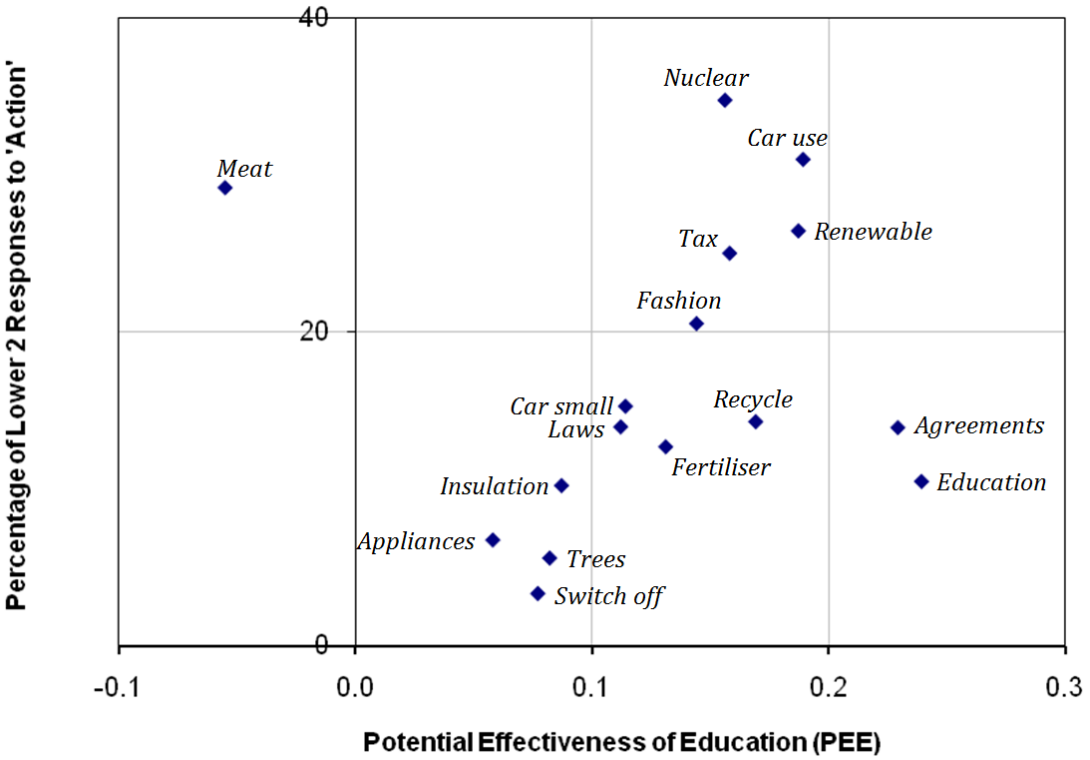



**Figure 2.** Scattergraph of the *Potential Effectiveness of Education* plotted against the combined percentages of students who would 'probably not' or only 'perhaps' undertake the action.

Actions to the left of the graph are those with a relatively low Potential Effectiveness of Education suggesting that even if more people were convinced, through education, of the usefulness of such actions for reducing global warming, they would not be willing to

undertake them. Actions that lie towards the bottom of the graph are those that most individuals are already willing to undertake; here the cohort for having their behaviour changed is relatively small. Thus, in Figure 2, actions to the bottom left and right section of the graph are those that students are relatively willing to undertake already. Actions to the top left are those that fewer students are willing to undertake at present, but that are unlikely to be responsive to education. Actions to the top right of the graph, however, are those that relatively few students are willing to undertake at present, but for which education might be effective (because their Potential Effectiveness of Education values are higher). These actions are concerned with, amongst other things, the purchase of smaller cars and generation of power from renewable resources, suggesting that education about these issues might be effective on a population basis, since these are actions that command relatively little support at present, but for which support might be increased by teaching about their efficacy in reducing global warming.

## Cluster analysis

Finally, the responses to the 32 questionnaire items were subjected to hierarchical cluster analysis. The resulting dendrogram indicated that there were two clusters of students. Cluster Group 1 contained 94 students; Cluster Group 2 contained 128 students (46 of the 268 students could not be included because of missing data). So that the characteristics of the two groups could be compared, the responses of students from these two cluster groups were compared using Chi squared analysis (Tables 4 and 5). There was no difference in the proportions of male and female students in the two groups. There were, however, statistically significant differences between the responses of students in the two groups to many of the items concerning the Degree of Willingness to Act and the Believed Usefulness of Action.

**Table 4.** Responses of student in the two cluster groups to items concerning the *Degree of Willingness to Act* and the *Believed Usefulness of Action*.

| | *Degree of Willingness to Act* | | *Believed Usefulness of Action* | |
|---|---|---|---|---|
| | Cluster Group 1 (% 'definitely' + 'almost certainly') | Cluster Group 2 (% 'definitely' + 'almost certainly') | Cluster Group 1 (% 'quite a lot' + 'a fair amount) | Cluster Group 2 (% 'quite a lot' + 'a fair amount) |
| **Direct actions** | | | | |
| Get smaller car – use less fuel | 77 | 43 | 77 | 47 |
| Pay more for nuclear power | | | 61 | 45 |
| Pay for home insulation | | | 46 | 27 |
| Switch off electrical un-used devices | 99 | 90 | 80 | 55 |
| Pay more for tree planting | 89 | 71 | 98 | 85 |
| Recycle things more | 81 | 45 | 76 | 56 |
| Pay for food grown with no artificial fertilisers | 78 | 52 | 54 | 31 |
| Buy new things less often | 63 | 32 | 62 | 27 |
| Pay more for renewable electricity | 67 | 43 | 88 | 56 |
| Try to use buses and trains rather than cars | 66 | 34 | 90 | 75 |
| Eat fewer meals with meat in them | 83 | 39 | 44 | 21 |
| Buy more energy-efficient domestic devices | | | 76 | 42 |
| **Indirect actions** | | | | |
| Vote for more environmental laws | 89 | 63 | 75 | 48 |
| Vote for more environmental taxes | 63 | 41 | 72 | 38 |
| Vote for more international agreements | 78 | 52 | 94 | 61 |
| Would like to learn more | 95 | 62 | 92 | 68 |

Only statistically significant differences ($p<0.05$, Chi squared) are shown.

Thus, students in Cluster Group 1 indicated a greater willingness to take pro-environmental actions than did students in Cluster Group 2 (Table 4). More of the students in Cluster Group

1 than Group 2 also recognised that the various proposed actions would help to reduce global warming (Table 4). This greater willingness to undertake pro-environmental actions and greater belief in their efficacy in reducing global warming appeared to be associated with a stronger belief that global warming was indeed happening and a greater level of concern about it (Table 5). Thus, this cohort appeared to contain two covert subgroups of students characterised by their beliefs about global warming and their willingness to undertake environmentally sympathetic actions.

**Table 5.** Responses of student in the two cluster groups to items concerning students' views about global warming.

| | Student attitudes | |
|---|---|---|
| | Cluster Group 1 (%) | Cluster Group 2 (%) |
| Are 'very' or 'quite' worried about global warming | 97 | 70 |
| Think they know 'a lot' or 'something' about global warming | 94 | 74 |
| Consider themselves 'very' or 'quite' environmentally friendly | 83 | 63 |
| Are 'sure' or 'think' global warming is really happening | 99 | 84 |

Only statistically significant differences ($p<0.05$, Chi squared) are shown.

## Discussion and Conclusion

This study, like any other, has a number of limitations. For example, gaining any absolute measure of attitudes or intentions is problematic (Reid, 2006), although the questionnaire used in the present study was designed to allow responses by students about different actions, and by students from different subsets about the same action to be compared in a quantitative manner. A further limitation is that a statement of an intention to act does not necessarily mean that the individual will indeed take the action; it is unlikely, however, that an individual who states an intention not to take an action will then take it, unless circumstances change.

Despite these limitations, it is apparent that the majority of the students in this Grade 12 cohort from Delhi believed that global warming is a real phenomenon, and most were concerned about its environmental consequences. The extent to which they were prepared to take pro-environmental actions varied for different actions. One overall trend consistent with previous studies using the same instrument was a greater willingness to undertake actions that might be considered to involve limited personal effort (such as switching off electrical appliances) as opposed to actions that might be considered more demanding in terms of cost or convenience (such as using public rather than personal transport). This was despite these students acknowledging that actions involving a greater personal effort were often the most effective in combating global warming. This was also evident amongst secondary students in western contexts, for example, Australia (Skamp, Boyes, & Stanisstreet, 2007), Spain (Rodriguez, Boyes & Stanisstreet, 2010) and the UK (Boyes & Stanisstreet, 2011) and amongst younger Indian secondary students (11-16 year olds) in the same context as the present cohort (Chhokar et al, 2011).

The findings for some items need to be treated tentatively due to the socio-cultural context of the study. Issues such as home insulation in relation to energy consumption receive very little attention either in the media or in schools in India. This is possibly because home insulation is perceived as a cold climate activity. Furthermore, the issue of eating meat is clearly complicated by cultural issues, because most of the participants in this study were Hindu. However it was decided to retain the items related to home insulation and eating meat, as the first was simply knowledge based and, while the second related to behaviour, a significant number of north Indians (including Hindus) do eat meat and this trend is growing as living standards rise (The Hindu, 2004).

Although this Grade 12 cohort of students reported a willingness to take some pro-environmental actions, younger students from the same socio-economic background appeared even more willing than their older counterparts (Chhokar et al, 2011). A number of factors may be responsible for the reduction in willingness to act as students get older. One such factor may be that by Grade 12, students have had more exposure to global environmental problems and may be beginning to develop a sense of 'action paralysis' and consequent feelings of disempowerment (Jensen, 2002), as has been reported for secondary students in the UK (Uzzell, Rutland & Whistance, 1995) and Australia (Connell et al., 1999). In addition, it may that in older students a form of 'environmental fatigue', analogous to 'compassion fatigue' is beginning to set in (Gallup, 2009; Ker, 2009). Finally, the fact that older students are closer to the point in their lives when actions such as tax payments and car purchase are becoming more of a reality than they are for younger students, and it may be that the imminence of a costly or demanding action may reduce their willingness to indicate that they will actually undertake it. Interestingly, there was a considerable reduction in the willingness to pay more for nuclear power between the 10-16 year old Indian students (49%) (Chhokar et al, 2011), and the 17-18 year old group (38%). In addition to the reasons above, this trend may have occurred because older students are more aware of the potential environmental or health impacts (Driver, Stanisstreet & Boyes, 2010).

Despite an indication that the older students were less willing to take action than younger students from the same educational context and similar backgrounds, they did appear more willing to act than secondary students in western countries. For example, on items that might be considered to involve a high personal effort or cost such as using public transport, using a smaller car or buying fewer new goods, approximately half of the Indian cohort recorded a willingness to act. These were markedly higher proportions than those for UK students, where only about a fifth of students were willing to undertake these actions (Boyes & Stanisstreet, 2011), and for Australian students, where no more than a third of the students were willing to undertake such actions. While comparisons across very different contexts and cultures can be treated only tentatively, the differences between these cohorts may reflect the high profile given to the environment in the Indian schools in this study. At present, the state government of Delhi has provided funding to all secondary schools to establish Eco-clubs, with each school receiving Rs 10,000 (approximately US$205) annually, and these funds have to be properly accounted for in an end-of-year report before the release of another grant. The findings of this research and that of the previous study with younger students (Chhokar et al, 2011) suggest that this funding initiative may be paying some dividends in terms of at least intention to adopt some pro-environmental actions. Another factor may be the fact that environmental problems are very evident in Delhi, providing a form of experiential learning about the reality and imminence of environmental degradation. Such factors may combine to focus these students' attention more sharply on the future than might be the case in other contexts, although it must be hoped that the up-coming generation of young adults more widely will be ready to take action to reduce global warming before its most undesirable consequences are actually occurring.

**Educational implications**

The scatter graph in Figure 2 suggests that for many actions increasing education may have only limited impact. This is because the students are either already willing to undertake these actions or they are unwilling to undertake these actions even though they are aware that they could contribute towards remediating global warming. The latter may be the result of the perceived personal cost or inconvenience of the actions. However, some actions showed

somewhat higher values for the Potential Effectiveness of Education and also had a fair proportion of students currently unwilling to take action. Examples of these were using public rather than private transport and paying a price premium for renewable or nuclear energy. Convincing more students of the usefulness of such actions in reducing global warming could well increase the proportion of students willing to adopt them and these might be areas where curriculum developers and teachers might consider more input

Furthermore, the cluster analysis (Table 5) indicated a link between belief that global warming was indeed happening, a greater level of concern about it and a willingness to undertake pro-environmental actions. Thus, if educators were to give global warming and its potential consequences a stronger focus across the curriculum it might lead to behavioural change. There is however a risk that in doing this, educators find themselves being criticized for 'frightening' students and actually provide 'ammunition' to those who oppose education about global warming and climate change, something that has happened recently in Australia (see 'Australian children are being terrified by climate change lessons' The Daily Telegraph 9 July, 2011). The findings from cluster analysis also draw attention to the idea that any particular teaching group may not comprise a uniform array of students. Not only are there variations between individuals, but there might also be covert sub-groups of students who differ in terms of their environmental attitudes. Given this, it might be worth exploring the possible benefits of peer-to-peer discussion, although this would need to be guided by teachers to avoid the generation or re-enforcement of misconceptions.

Finally, all of the schools in the study had very active Eco or Environmental Clubs that organised displays around the schools and events such as Earth Day presentation. The positive impact that such non-formal clubs can have across a wide range of international contexts has been reported by Taylor, Littledyke, Eames and Coll (2009). Certainly it is possible that the activity of the Eco Clubs in the schools in this study had a positive impact on students understanding of global warming, its causes and actions to remediate it. The possible benefits of such school-based but non-curriculum environmental education might be a fruitful area for researchers in the Indian context, and instruments of the type employed in the present study might enable such studies to have a quantitative aspect.

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