Turkish School Students and Global Warming: Beliefs and Willingness to Act

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One aim of environmental education is to persuade people to act in more pro-environmental ways. However, there is not a linear relationship between environmental knowledge *in general* and a willingness to act pro-environmentally. This research explores, using a specially-devised questionnaire, Turkish school students' beliefs about the benefits of *specific* actions for reducing global warming (their *Believed Usefulness of Action*), their readiness to adopt them (their *Degree of Willingness to Act*), and the relationships between these. Students appear willing to take certain actions such as switching off un-used electrical items, but unwilling to undertake other actions such as increasing their use of public transport. Planting more trees was thought to be the most useful action, whereas few students appreciated the role that buying fewer new consumables might play. A novel index, the *Potential Effectiveness of Education*, was constructed to quantify the relationships between these two parameters for specific actions. For some actions, such as purchasing fewer new goods, there were stronger relationships between a belief in the effectiveness of an action in reducing global warming and the willingness to undertake it. Teaching about the benefits of such actions might be effective in terms of encouraging individuals to adopt them.

Keywords: Global Warming, Beliefs, Willingness to Act, Turkish School Students

INTRODUCTION

Fifteen years ago, it would have been prudent to discuss the exacerbation of the natural global warming effect of the atmosphere by anthropogenic pollutants in tentative terms. More recently, however, global warming has become considered by most authoritative sources to be not only a real phenomenon, but also one that is an increasing threat to the world's environmental, social (IPCC, 1997; 2001), political (Solana, 2008) and economic (Stern, 2006) stability. Although it is difficult

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to attribute any particular environmental event to global warming, it is becoming clear that we are already beginning to see some of its consequences (IPCC, 2007). Furthermore, there are some reports specifically about the effects of global warming on Turkey. It is anticipated that different regions, because of their characteristic geographic features, may be affected by global warming in different ways. For example, winter precipitation in western Turkey has decreased significantly whereas autumn precipitation has increased in the northern parts of central Anatolia, and while winter temperatures have shown a general tendency to decrease, there has been a widespread increase in summer temperatures in the western and southwestern parts of Turkey (Dalfes, Karaca and Şen, 2007). According to Harmancıoğlu *et al* (2007), significant downward trends in winter rainfall are likely to cause

serious water supply problems in the future, and the effects of climate change in each basin might be to aggravate existing water scarcity and allocation problems in Turkey. It is also possible that there will be health implications for Turkey in the event of a continuing increase in global warming. For example, increases in air temperature and rainfall, together with changes in the ecosystem, are significant factors in the emergence of *Leptospirosis*, a serious bacterial illness, even in metropolitan centers (Polat *et al*, 2007). Climate change could also result in serious social and economic consequences for Turkey. For example, there could be detrimental impacts on agricultural activities, resulting in reduced income and increased unemployment (Türkeş, 1996). In biological terms, such changes could also cause a decrease in forest areas and this, as elsewhere, would have negative impacts on biodiversity.

As well as predictions about how Turkey may be adversely affected by global warming, there is information about the contribution that Turkey makes to global warming. Between 1990 and 2004 Turkey's demands for general energy and electrical energy have increased at annual rates of 3.7% and 7.2% respectively

due to Turkey's progressive population growth and industrialization after the mid-1990s. As a consequence, during this period Turkey's total GHG emissions, excluding Land-Use Change and Forestry (LUCF), rose from 170 Tg to 297 Tg CO_2 eq. GHG emissions specifically from the energy sector rose from 132 Tg to 227 Tg CO_2 eq, making the energy sector the largest contributor of CO_2 emissions (77%). There have also been changes in terms of transportation, another major source of GHG. In 2005, Turkey was ranked among the lowest of the European and OECD countries in terms of car ownership, with an ownership rate of 143 per 1,000 habitants, (Ministry of Forestry and Environment [MEF], 2007). However, there are currently 5.4 million private cars on Turkey's roads and the domestic demand for motor vehicles continues to grow.

Turkey acceded to the United Nations Framework Convention on Climate Change (UNFCCC) in 2004 and became a party to the Kyoto Protocol in 2009. In addition, in 1999 the European Council at its meeting in Helsinki confirmed that Turkey was a candidate country destined to join the European Union (EU). Since that date, Turkey has been trying to align its environmental practices with those of the EU. In addition, Turkey acceded to the UNFCCC in 2004. Unfortunately, there are relatively few attempts in Turkey at this stage to reduce global warming, other than those imposed by international agreements. It is likely, however, that a significant contribution to the reduction in GHG emissions could be achieved by changes in the behaviour of individual citizens. At this point in Turkey's development, then, it becomes especially important to explore ways in which the knowledge, attitudes and, perhaps more specifically, the behaviour of individuals might be influenced in such a way as to reduce global warming.

Initially, 'information deficit' (Burgess, Harrison and Filius, 1998) models of behaviour change were based on an assumption that if people understood more about the actions that would cause, or avoid, environmental degradation, they would act in a rational manner and adopt environmentally sympathetic behaviour patterns. Some studies show a relatively direct relationship between a person's cognitive base about environmental problems and their willingness to act in such a way as to reduce these problems (Yencken, 2000). In many other cases, however, it seems that the relationship between knowledge and action is not robust (Rajecki, 1982; Hungerford and Volk, 1990; Posch, 1993; Kollmus and Agyeman, 2002); there is what has come to be known as a 'gap' between cognition and action (Kollmus and Agyeman, 2002). In part, this 'gap' exists because behaviour is influenced by a plethora of other factors, not just knowledge. A further cause of the 'gap' that has emerged as workers have attempted to generate

models of the incentives and disincentives to pro-environmental behaviour is that there are limitations in studying links between *broad* environmental attitudes and general potential behaviour patterns (Fishbein and Ajzen, 1975; Ajzen and Fishbein, 1980; Dietz, Stern and Guagnano, 1998; Stern, 1992, Bodur and Sarıgönüllü, 2005).

Given this, and the pressing need for changing behaviour to reduce the emissions of anthropogenic greenhouse gases, we have initiated an international study to explore the role that education about the usefulness of more specific pro-environmental actions might play in eliciting changes in behaviour. A questionnaire was designed which ensured a degree of 'measurement correspondence' (Kaiser, Wolfgang and Fuhrer, 1999) by covertly pairing items, first asking about intentions to undertake an action and then, separately, inquiring about the extent to which such an action was believed to be effective in reducing global warming. Using the responses, a series of novel indices were devised to explore the relationships between these two measures. Specifically, the study was directed to the following questions:

1. What do Turkish school students believe about the extents to which various actions might reduce global warming? We have termed this measure their *Believed Usefulness of Action.*
2. To what degrees do Turkish school students intend to undertake these actions? We have called this measure their *Degree of Willingness to Act.*
3. For a given cohort, 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.
4. What differences, if any, are there in the above measures and indices across the grades and between students of different genders?

METHODS

Questionnaire design

A closed-form questionnaire was used to investigate the opinions of the cohort of school students in the present study. The questionnaire was originally devised for use in the UK with English-speaking students. For use in the Turkish context, the questionnaire was translated into Turkish and then back-translated, independently by another person, into English. The back-translated version of the questionnaire was then compared to the original English version by native English speakers. Where inconsistencies were found they were corrected by iterative discussions between the English and Turkish researchers.

The questionnaire was arranged in two main sections, preceded by a coversheet that asked students to record their grade and gender. The first main section following the coversheet contained 20 items related to how willing students would be to undertake particular pro-environmental actions. This section was followed by a section that included 20 items about the same actions, asking how effective students believe these actions would be in diminishing global warming. The wording of the items in these sections of the questionnaire is shown in Table 1, although the pairing of the two sets of questions was not made explicit because they were in a different order in the two sections of the actual questionnaire. The final section of the questionnaire (Table 2) contained four items asking how worried the students were concerning the environmental impact of global warming, how much they considered they knew about global warming, how 'environmental friendly' they thought they were, and if they thought global warming is happening now.

Of the 20 actions raised in the questionnaire, 16 were those that are generally accepted as reducing global warming. Twelve of these items were direct actions, about energy generation, personal transport, food, consumption or recycling, and carbon dioxide removal by tree planting. A further four items related to indirect actions, concerning education about global warming and voting for environmentally friendly policies. The other four items in the questionnaire concerned misconceptions about global warming raised by students in previous studies (Boyes and Stanisstreet, 1993); these were included as distracters so that students would not think that all of the items should have positive answers. The responses to these distracter items are not discussed further here.

In addition to the pairing of questionnaire items, the wording of the available answers to the items in the two main sections were matched semantically (Table 3). A priori, other factors being equal, one might expect that the greater the perceived efficacy of a particular action, the more likely that action is to be undertaken. For instance, if a person thought that an action reduced global warming by *nothing at all really*, it would be understandable if the 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 intermediate positions on each scale were also designed to be semantically matched, and the scores allocated to the matched responses in the two main sections of the questionnaire were equivalent (Table 3).

Table 1. Wording of the questionnaire items*

Themes	Items about the *Believed Usefulness of Action*	Items about the *Degree of Willingness to Act*
Direct actions		
Transport (use)	If people didn't use their cars so much, 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
Transport (type)	If people had smaller cars that used less petrol or diesel, 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
Power generation (renewable)	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 the wind and waves and sun, I would be willing to pay more for electricity
Power generation (nuclear)	If more of our energy was produced from nuclear power stations, 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
The home (electricity use)	If people used less electricity in their homes, global warming would be reduced	To save electricity, I would switch things off at home when I didn't need them
The home (insulation)	If people got their homes insulated better, global warming would be reduced	Even though it cost me money, I would get extra insulation for my home
The home (consumer durables)	If people got things for their homes (like fridges and washing machines) that used less energy, 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
The home (consumables)	If people were prepared to buy fewer new things and make do with the old ones, 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
Environmentally-friendly (trees)	If more trees were planted in the world, global warming would be reduced	Even if I had to pay more taxes, I think there should be more trees planted in the world
Environmentally-friendly (recycle)	If people recycled things more, global warming would be reduced	Even if it was more trouble for me, I would recycle things rather than just throw them away
Food (Reducing meat)	If people eat less meat, global warming would be reduced	Even if I really liked meat, I would eat fewer meals with meat in them
Food (Reducing artificial fertilizers)	If farmers stopped using artificial fertilisers with nitrogen in them, global warming would be reduced	Even if it was more expensive, I would buy food grown without the use of artificial fertilisers
Indirect actions		
Environmental legislation	If politicians made the right kind of new laws, global warming would be reduced	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
Environmental taxation	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 increase taxes to pay for reducing global warming, even though it meant me having less money to spend
Environmental education	If people were taught more about it, global warming would be reduced	I would like to learn more about global warming, even though it would mean extra work for me
Environmental International cooperation	If there could be more agreement between different countries about not putting certain gases into the air, global warming would be reduced	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

* The main items of the questionnaire displayed so that the 'pairing' of the items can be seen.

Administration of questionnaire

The questionnaire was completed by 897 students in Grades 6 through 10 (Grade 6 n=146, Grade 7 n=185, Grade 8 n=147, Grade 9 n=208, Grade 10 n=211) in three randomly selected primary schools (Grades 6 through 8) and two secondary schools (Grades 9 and 10) in Kırşehir, a city in central Turkey with a population of about 100,000. Of these students, 435 (48%) were male and 462 (52%) were female. Questionnaires were completed individually under the supervision of students' usual classroom teachers in normal classroom conditions.

Table 2. Wording and available responses for the final four items of 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

Table 3. Wording of the permissible responses to the two sets of items

Believed Usefulness of Action If I thought an action would help global warming by…	Score	*Degree of Willingness to Act* Then I would…	Score
by quite a lot	1. 00	definitely do it	1. 00
by a fair amount	0. 75	almost certainly do it	0. 75
by a small but useful amount	0. 50	probably do it	0. 50
by a very small amount - hardly noticeable	0. 25	perhaps do it	0. 25
by nothing at all really	0. 00	probably not do it	0. 00

The wording of the permissible responses are displayed 'matched'. This 'matching' suggests the minimum action ('then I would') that might reasonably be expected for a given belief about the usefulness of that action. The figures show the scores assigned to the different responses; these enabled various coefficients to be constructed

Although the questionnaires were completed under examination conditions, no time limit was imposed and teachers assured the students that the results would be anonymous.

Analyses of data and construction of indices

The responses were encoded as shown in Table 3 and entered in to an SPSS data file for analysis. In the descriptions below, for clarity of presentation, the percentages students giving certain responses have been combined. Differences between the responses of male and female students, and between students in different grades were explored using Analysis of Covariance (ANCOVA) using the original, un-combined data. Following this, indices were constructed to give insight into the extent to which increasing the recognition of the efficacy of a specific action, through targeted environmental education, might persuade individuals within a cohort to be willing 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 1. There are inevitable drawbacks to using ordinal scales (Reid, 2006), but semantic matching of the responses ensures that linear regression is less sensitive to such limitations. 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, indicates the extent to which the 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.*

When the *Potential Effectiveness of Education* has been determined for a pair of questions, two other indices can be derived from the intercepts. The intercept when the *Believed Usefulness of Action* is zero shows the likely action of students who believed that such an action would be ineffective in reducing global warming. We designated this *Natural Willingness to Act.* In a complimentary fashion, the difference between the intercept when the *Believed Usefulness of Action* is at its
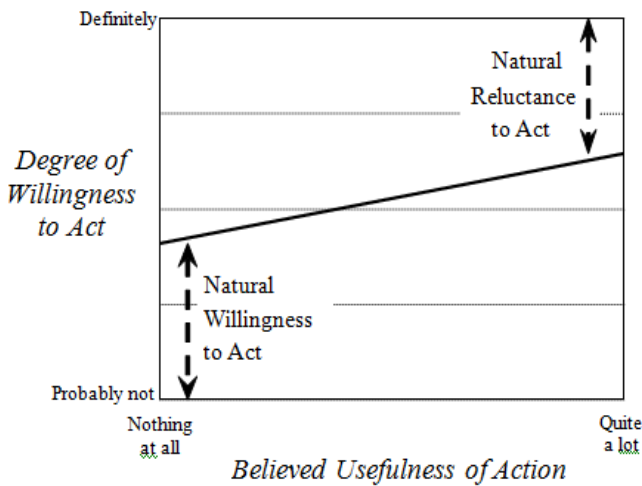
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Figure 1. Annotated graph to show the nature of the Potential Effectiveness of Education, Natural Willingness to Act and Natural Reluctance to Act

maximum 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*. In order to illustrate this further, these indices are shown in the exemplar graph in Figure 1.

Comparing the values of the *Potential Effectiveness of Education* for different actions highlights those actions for which education about their 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, another component 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. Hence, education might be most productive in population terms if directed at those actions that relatively few people are already willing to undertake. Therefore, a further index was calculated, which we termed the *Potential Usefulness of Education*, by multiplying the *Potential Effectiveness of Education* by the proportion of students who would 'probably not' or only 'perhaps' undertake the action.

RESULTS

Where statistically significant differences (p<0.05) between responses of male and female students are reported, those for the male students are given first. If statistically significant differences were found between different the responses of different grades, it is reported only when there was a generally consistent trend, up or down; here the percentages given are those for Grade 6, Grade 7, Grade 8, Grade 9 and Grade 10.

Students' beliefs about global warming

The final section of the questionnaire provided some background information about the beliefs of the students in the study cohort. Almost all of the students (93%) were either 'sure' or 'thought' that global warming was happening now. Furthermore, they were concerned about global warming, with almost all of them (92%) being either 'very worried' or 'quite worried' about the impacts of global warming on the environment. More females than males expressed this concern (88%, 95%). Students also believed themselves to be informed about global warming, with most of the students (88%) responding that they knew 'a lot' or 'something' about global warming. Approximately three quarters of the group (79%), thought themselves as 'very' or 'quite' environmentally friendly. As above, more females than males expressed this view (76%, 82%).

Students' Degree of Willingness to Act

Data from the responses to this section of the questionnaire are presented graphically in Figure 2. In the descriptions below, the figures given are the combined percentages for students who would 'definitely' or 'almost definitely' undertake the action. In terms of energy conservation, almost all of the students (90%) expressed a willingness to switch off un-used electrical appliances, and a high proportion were prepared to pay for low-energy domestic appliances (78%) or for the installation of thermal insulation (75%). Far fewer were willing to pay extra for electricity supplied from low-carbon sources such as nuclear generators (30%) or even renewable sources (38%). In terms of removal of carbon dioxide from the atmosphere, most students were willing to pay for planting of trees (89%). Although about three quarters of the students (71%) were prepared to recycle more, fewer than this (53%) were willing to adopt the complementary behaviour of purchasing fewer new fashion goods. When it came to food, just over half of the cohort (57%) would pay a price premium for foodstuffs grown without artificial fertilizers, but only about a third (32%) were willing to reduce the meat content of their diet. In the context of personal transport, just over half of the students (56%) would be prepared to use a smaller, more fuel-efficient car, but only about a third (34%) would be willing to use public transport more often. When it came to the indirect actions, most of the students (83%) reported that they would be willing to undertake further education about the environment. Fewer, however, would be prepared to vote for politicians who supported international environmental agreements (49%), further environmental legislation (48%) or taxation (47%).
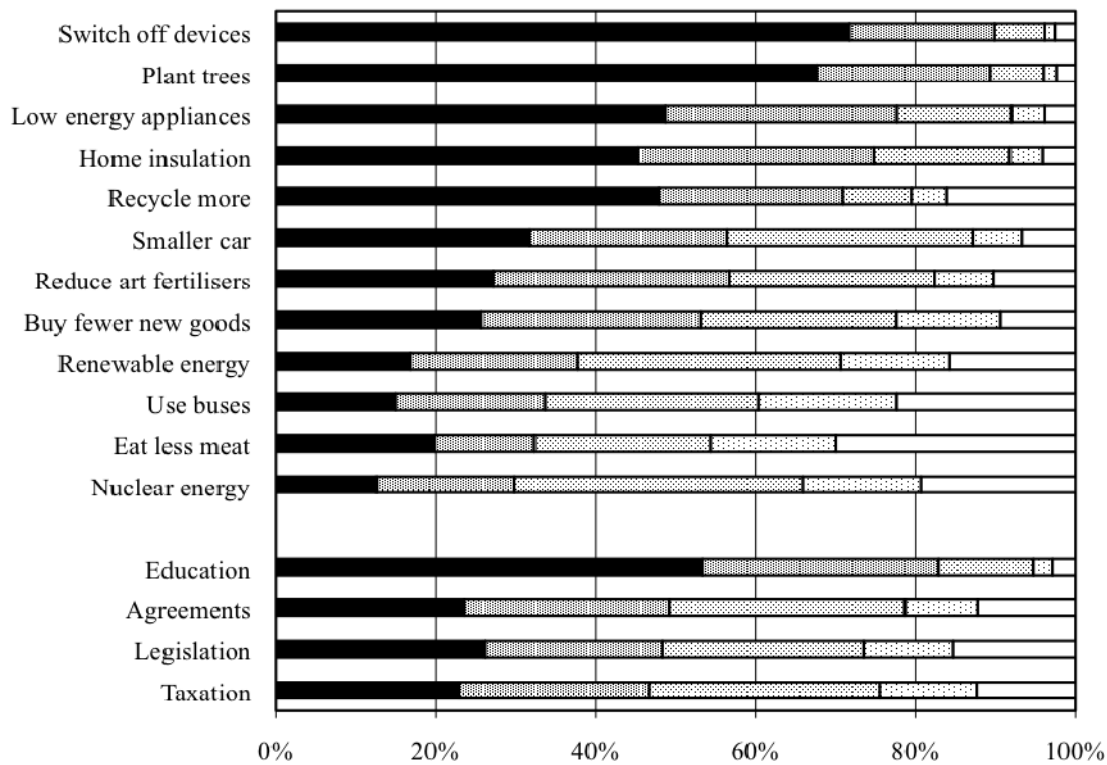
Figure 2. Turkish school students' *Degree of Willingness to Act* **to undertake different pro-environmental actions**

For each action, the darkest bar, to the left hand side, represents the percentages of students who would 'definitely' undertake the action; the next, slightly lighter bar those who would 'almost certainly' undertake the action; the next, lighter bar, those who would 'probably' undertake the action; the next bar those who would 'perhaps take the action; and the right hand, white bar, those who 'probably not' undertake the action. 'Direct' actions are in the upper section of the figure; 'indirect' actions are in the lower section. Within each section, actions are arranged in descending order of the combined percentages of students who would 'definitely' and 'almost certainly' take the action.

In some cases, the distribution of responses was statistically different between the male and female students. So, more of the boys were willing to pay a price premium for electricity from nuclear power stations (60%, 54%), and more of the male students were willing to buy energy-efficient domestic appliances (80%, 76%). In contrast, more of the female students were prepared to pay for tree planting (88%, 91%) or to reduce the meat content of their diet (28%, 37%). There were also some questionnaire items in which the responses differed significantly across the grades, and where there was a reasonably consistent trend. Thus, there was a decrease in the proportion of older students willing to pay for nuclear power generation (32%, 39%, 29%, 27%, 24%). In contrast, the percentage of students who expressed a willingness to recycle materials increased in the older students (64%, 67%, 67%, 72%, 82%). Amongst the indirect actions, fewer of the older students were willing to vote for politicians who supported international environmental agreements (61%, 56%, 50%, 41%, 33%).

Students' Believed Usefulness of Action

Data from the responses to this section of the questionnaire are presented graphically in Figure 3. In the descriptions below, the figures given are the combined percentages for students who believed that the action would diminish global warming 'by quite a bit' or 'by a fair amount'. The action thought by most students (85%) to reduce global warming was planting more trees. Although nearly three quarters of the students (70%) thought that recycling more materials could help to reduced global warming, less than half of this number (30%) appreciated the role than decreased consumption of new fashion goods could play. Many students appeared to realize the role that domestic energy conservation could play, with more than half appreciating that switching off un-used electrical devices (68%), using energy-efficient appliances (59%) or installing home insulation (57%) could reduce global warming. Approximately two thirds of the cohort (63%) were conscious that generating electricity from renewable sources could decrease global warming, although only about half (53%) identified the role that nuclear power could play in here. Over half of the students recognized that a change in personal transport habits could reduce global warming, either in terms of increased use of public as opposed to private transport (60%) or in terms of using smaller, more fuel-efficient cars (58%). About two thirds of the cohort (64%) thought that a decrease in the use of artificial fertilizers
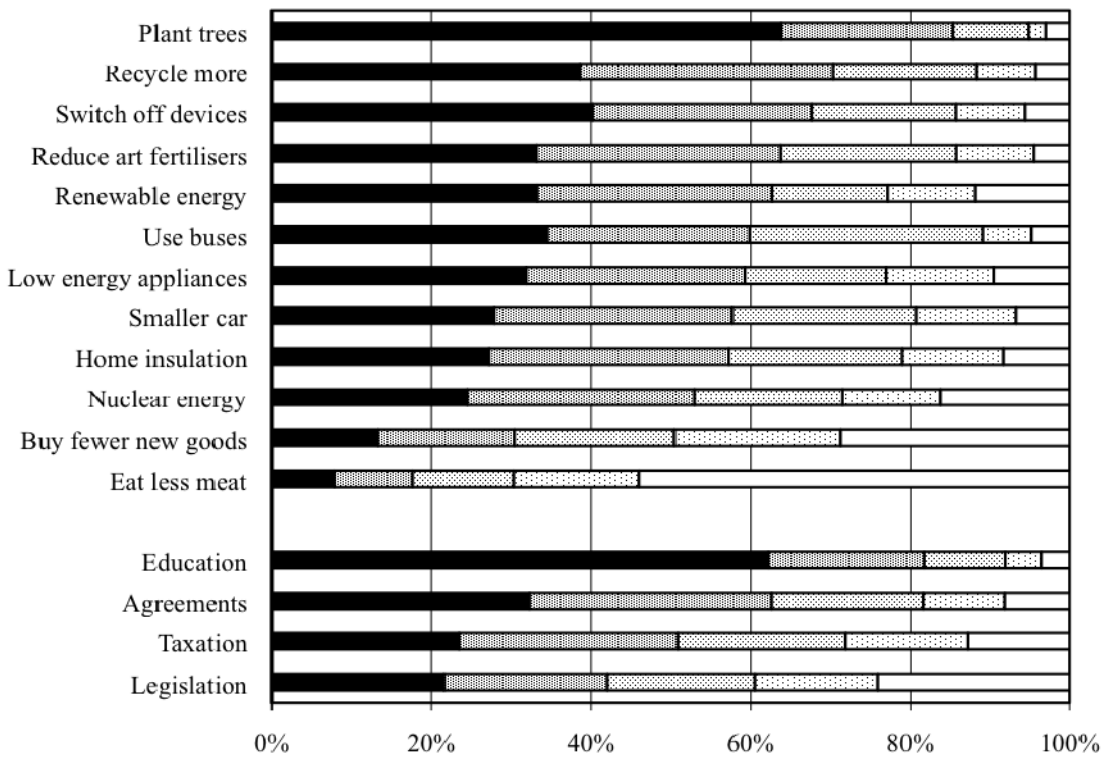
Figure 3. Turkish school students' *Believed Usefulness of Action* **of different pro-environmental actions**

For each action, the darkest bar, to the left hand side, represents the percentages of students who responded that the action would reduce global warming by 'quite a lot'; the next, slightly lighter bar those who believe it would reduce global warming by 'a fair amount'; the next, lighter bar, those who believe it would reduce global warming by a 'small but useful amount'; the next bar those who believe it would reduce global warming by 'a very small, hardly noticeable, amount'; and the right hand, white bar, those who believe the action would reduce global warming by 'nothing at all'. 'Direct' actions are in the upper section of the figure; 'indirect' actions are in the lower section. Within each section, actions are arranged in descending order of the combined percentages of students who responded that the action would reduce global warming by 'quite a lot' and by 'a fair amount'.

would reduce global warming, but very few students (18%) realized that a reduction in the amount of meat consumed could play a role in this. For the indirect actions, many students (82%) believed that environmental education could be useful in reducing global warming, and about two thirds (63%) thought that international agreements could be of use. Rather fewer, about half (51%) believed that taxation would be an effective instrument in alleviating global warming, and even fewer (42%) had faith in environmental legislation in this context.

As above, in some cases the distribution of responses was statistically different between the male and female students. Generally speaking, more of the female students thought that various actions could indeed reduce global warming. Thus, more of the female than male students believed that global warming could be ameliorated by energy generation from nuclear power (49%, 57%), improving house insulation (52%, 63%), using less electricity in the home (60%, 75%), reducing the use of artificial fertilizers (56%, 71%) and using more efficient domestic appliances (56%, 63%). More of the female students also believed that education could play a role here (79%, 85%). In contrast, more of the male students believed that buying fewer new fashion items (34%, 27%) or using renewable

energy generation (66%, 60%) would reduce global warming. There were also some cases of statistically significant and reasonably consistent trends in the responses of different grades. In all cases, the belief in the efficacy of actions actually decreased in the older students. Thus fewer of the older students believed that global warming could be reduced by smaller, more fuel efficient cars (65%, 61%, 60%, 53%, 53%), improved home insulation (66%, 60%, 56%, 57%, 49%), saving of electricity in the home (72%, 69%, 69%, 67%, 62%), buying fewer new fashion items (39%, 36%, 34%, 30%, 17%) or reducing meat consumption (24%, 23%, 22%, 19%, 5%).

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

The values of the three indices for each action are shown in Table 4. For some actions the values of the *Potential Effectiveness of Education* were low; that is, the slope of the line in the generic graph shown in Figure 1 was shallow. For example, increasing recycling (0.00), planting trees (0.08) and switching off un-used electrical appliances (0.09) fell into this category. Scrutiny of the data in Figure 1 shows that in these cases, this was because the *Natural Willingness to Act* was relatively high;

Table 4. Potential Effectiveness of Education, Natural Willingness to Act, Natural Reluctance to Act and Potential Usefulness of Education indices for Turkish school students

	Potential Effectiveness of Education (Slope of *Degree of Willingness to Act* plotted vv *Believed Usefulness of Action*)	Natural Willingness to Act (Intercept when *Believed Usefulness of Action* is at minimum)	Natural Reluctance to Act (Measurement between unity and the intercept when *Believed Usefulness of Action* is at maximum)	Potential Usefulness of Education (*Potential Effectiveness of Education x* proportion of 'perhaps do it' and 'probably not do it')
Direct actions				
Smaller cars	0.12	0.59	0.29	0.02
Nuclear energy	0.11	0.40	0.49	0.04
Home insulation	0.11	0.70	0.19	0.01
Switch off unused devices	0.09	0.82	0.09	0.00
Plant trees	0.08	0.81	0.11	0.00
Recycle more	0.00	0.71	0.29	0.00
Reduce artificial fertilisers	0.13	0.55	0.32	0.02
Buy fewer new goods	0.14	0.56	0.30	0.03
Renewable energy	0.11	0.46	0.43	0.03
Use buses	0.21	0.32	0.47	0.08
Eat less meat	0.22	0.39	0.39	0.10
Low energy appliances	0.13	0.70	0.17	0.01
Indirect actions				
Legislation	0.15	0.51	0.34	0.04
Taxation	0.20	0.46	0.34	0.05
Agreements	0.21	0.46	0.33	0.05
Education	0.21	0.65	0.14	0.01

even those students whose belief in the usefulness of these actions in terms of reducing global warming was low were willing to take these actions. For such actions, then, there is probably less benefit in additional education to convince students of their usefulness in reducing global warming; students either know this already or are willing to take the actions even if they do not. Increasing adoption of nuclear energy as a power source also had a relatively low *Potential Effectiveness of Education* value (0.11). In this case, however, the slope of the line was shallow because the *Natural Reluctance to Act* was high. Thus, even if students believed the adoption of more nuclear power would contribute to reducing global warming, they would not be prepared to support it; other disincentives are operating. It is likely, therefore, that education which concentrates on the benefits of nuclear power in terms of global warming would be ineffective. What is needed is to identify the disincentives, possibly concerns about environmental contamination, security and health issues, and address those.

For some actions, however, the value of the *Potential Effectiveness of Education* was relatively high; that is, the slope of the line in the graph of Figure 3 was comparatively steep. A willingness to reduce meat consumption (0.22) or use buses rather than private transport (0.21) were the actions with the highest values, although the values for buying fewer new goods (0.14), reducing the use of artificial fertilisers (0.13) and purchasing energy-efficient domestic goods (0.13) were also relatively high. In these cases, then, there is a correlation between a belief in the usefulness of the action and a willingness to undertake it, so education directed at informing students of the possible role of these actions in diminishing global warming might be effective in persuading young people to undertake them.

Potential Usefulness of Education

It could be argued 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 patterns, and which relatively few respondents are already willing to undertake, that is, where the prospective constituency for changing behaviour is large. A simple multiplication of the *Potential Effectiveness of Education* by the proportion of students in the lower two categories of the *Degree of Willingness to Act* produces a figure to indicate this, and these can be seen in Table 4. Because of the way in which this index is calculated, the values for the *Potential Usefulness of Education* are low. For example, a *Potential Usefulness of Education* value of 0.08 would be equivalent to an action with a *Potential Effectiveness of Education* of 0.2 which 40% of the students were unwilling to undertake. The findings of the present study show that pro-environmental actions which relatively few students were willing to undertake, and which are likely to be responsive to education were reducing the use of cars in favour of public transport and eating less meat.

DISCUSSION

The present study supports the idea that almost all of these students think that global warming is a real phenomenon; clearly, students do not need further persuading that the world is facing an environmental problem of unprecedented magnitude. Furthermore, almost all of the students had some degree of concern about global warming, although females express more anxiety than males. This may be an expression of the general finding that females are more concerned about environmental issues than males (Davidson and Freudenburg, 1996; Gardos and Dodd, 1995; Tikka, Kuitunen and Tynsys, 2000, Yilmaz, Boone and Andersen, 2004). Most of the group considered themselves to know at least something about global warming, although this self-assessment may conceal lacunae in understanding or misconceptions of which students themselves are unaware (Kılınç, Stanisstreet and Boyes, 2008). About three quarters of the students considered themselves generally 'environmentally friendly'. This finding may be associated with aspects of Turkish culture. Many studies have shown a widespread support for conservation of the environment among young people in Turkey (Tuncer, Ertepınar, Tekkaya and Sungur, 2005; Kılınç, Stanisstreet, and Boyes, 2008; Kılınç, Stanisstreet, Boyes, 2009; Alp, Ertepınar, Tekkaya, and Yılmaz, 2008; Kasapoglu and Turan, 2008). The ancient Turkish people regarded fire, soil, sky, moon, sun, stars, mountains, springs, trees, brooks, lakes, and some animals as sacred (Göka, 2008; Kalafat, 1995; Ögel, 2006; Özdemir, 2003). These ancient beliefs retained their influence even after Islam was adopted. Even today, for example, in some regions of Anatolia Turkish people plant trees in front of tombs, and some visit sacred trees and make wishes by tying something to the branches. With the coming of Islam, Turkish people faced some environmental ethics with which they were already acquainted. From an Islamic perspective, humans, although being at the top of creation, are only members of the community of nature. As such, humans have responsibilities towards the whole environment and, in a complementary fashion, nature's rights over humankind include the rights to protection from misuse, degradation and destruction (Al Damkhi, 2008). Accordingly, in the Ottoman Empire, there existed institutions for the protection of natural sites (Özdemir, 2003). It is not surprising, then, that when the Turkish republic replaced the Ottoman Empire in 1923 a number of organizations were interested in environmental issues.

The main section of the questionnaire revealed more detail about how this general sympathy for the environment might translate into a willingness to countenance undertaking more specific pro-environmental actions, their *Degree of Willingness to Act.*

There was little resistance to undertaking some actions such as switching off un-used electrical appliances or planting more trees. Presumably school students perceive such actions as being of little inconvenience or direct cost. In contrast, other actions such as using public rather than private transport, or supporting nuclear power generation were less acceptable. It is likely that the reasons that underpin these two examples are different; as such they illustrate two of the range of disincentives that may dissuade people from taking pro-environmental actions. For the former, personal inconvenience or institutional barriers such as a limited public transport system may be influential, whereas resistance to nuclear power may be based on a concern about potential environmental and health hazards (Komiya, Torii, Fujii, and Hayashizaki, 2008). For some of the actions there were differences in the responses of male and female students. More of the males were willing to countenance buying energy-efficient domestic goods and more were prepared to support the extended use of nuclear power. It is possible that the former might be attractive to males as 'technological solutions' to an environmental problem (Steger and Witt, 1989; Kollmuss and Agyeman, 2002), whereas the latter might suggest that males are less concerned about the potential hazards of nuclear power (Davidson and Freudenberg, 1996; Komiya, Torii, Fujii, and Hayashizaki, 2008). In contrast to this, more of the female students were willing to pay for tree planting, or to reduce the meat content of their diet. The former difference might suggest that females prefer to think in terms of biological or 'natural' solutions to environmental problems; the latter might reflect female's concern for their appearance, or for animal welfare.

The present findings also reveal the extent to which school students believe that different environmental actions are useful in reducing global warming, their *Believed Usefulness of Action.* Planting of more trees and switching off un-used electrical appliances were seen as useful by many students. This may be because they are proximally linked to the carbon dioxide, a greenhouse gas that is well known by students (Kılınç, Stanisstreet and Boyes, 2008). The effects of trees in absorbing atmospheric carbon dioxide is likely to be familiar to students, partly because of the publicity which has surrounded effects of large-scale destruction of rainforests, the 'lungs of the world', on atmospheric carbon dioxide. For the second action, switching off un-used domestic appliances, there is a fairly direct conceptual link between conserving energy and reducing carbon dioxide production. Even if students do not construct this link as a result of environmental courses in the Turkish formal education system, news and advertisements in Turkish popular media may have been influential (Oluk and Özalp, 2007). In contrast, fewer students appreciated the roles of eating less meat and

reducing general consumption by buying fewer new items in ameliorating global warming. The former of these actions involves reducing methane production by cattle, and methane is probably less well known as a greenhouse gas than carbon dioxide. The latter action is rather distal, requiring as it does an understanding of the energy required (and thus carbon dioxide produced) in the manufacture, packaging and transport of new goods. Such indirect links may be less readily brought to mind by students, perhaps because these links are not included in environmental courses and are not well publicised in the popular media in Turkey, or indeed many other countries.

This study is set in the context of the need to persuade individuals to adopt, to a greater extent, patterns of pro-environmental behaviour that will contribute to a reduction in greenhouse gas emission, and hence to a diminution in global warming. Decision-making is influenced by a plethora of affective or situational factors, such as: social norms (Barr, 2006; Cialdini, Reno and Kallgren, 1990; Corraliza and Berenguer, 2000), perceived self-efficacy (Devine-Wright, Devine-Wright and Flemming, 2004), pre-experiences (Mainteny, 2002; Carrus, Passafaro, and Bonnes, 2008), religion (Adelekan and Gradegesin, 2005), cultural traditions (Aytülkasapoğlu and Ecevit, 2002), family customs (Rajecki, 1982), risk perception (Lorenzoni *et al*, 2006, Sunblad, Biel, and Garling, 2007), self-construal (Arnocky, Stroinkand, and DeCicco, 2007), locus of control (Alp, Ertepınar, Tekkaya and Yılmaz, 2008), anticipated emotions (Carrus, Passafaro, and Bonnes, 2008) and empathy (Berenguer, 2007). All of these influence the extent to which a person will act in a pro-environmental ways. Perhaps most relevant to the present study is the finding that the extent to which he or she acts in a pro-environmental manner is affected by situational influences such as a person's belief in their own self-efficacy (Devine-Wright, Devine-Wright and Flemming, 2004; Laskova, 2007); if a student's belief in the efficacy of their action can be increased, there is an improved likelihood that they will undertake that action, and education may play a role in increasing such belief. A general environmental education policy has not been adopted so far for Turkish schools, but it is clear that environmental teaching is embedded many at different levels. In primary education (from Kindergarten to Grade 8), the courses *Life Knowledge* (from Grade 1 to 3), *Social Sciences* (from Grade 4 to 7) and *Science and Technology* (From Grade 4 to 8) all contain some elements of education about environmental issues. In a complementary manner, in secondary education some form of environmental education is included within *Biology* (from Grade 9 to 12), *Chemistry* (from Grade 9 to 12) and *Geography* (from Grade 9 to 12) courses.

Given that environmental education is embedded, to some extent at least, in the curriculum in Turkey, it is worth exploring the ways in which its effectiveness in terms of behaviour change might be optimised. Weber (2006), for example, proposes that, for action to follow information there must be a visceral as well as a rational concern. Such concern would develop naturally if people experienced directly the negative effects of global warming. In the present study, almost all of the students reported being either 'very worried' or 'quite worried' about the effect of global warming on the environment, suggesting some degree of concern. However, as Weber suggests, it is possible for the analytical and affective domains to become disengaged. Thus, the expression of worry in these students may reflect more of a cognitive than a visceral concern, since Turkish students will, as yet, have had little experience of adverse effects that can be definitely attributed to global warming. However, since a visceral concern may also arise as a consequence of "mental simulation of adverse consequences" (Weber, 2006, p104), it may be beneficial to illustrate to students some of the potential adverse effects that they might encounter, although this will be limited by an appropriate sensitivity to students' emotional vulnerabilities. However, inclusion of some affective components might counteract the fact that school students have a tendency to perceive the environmental as 'object' rather than in terms of 'relationship with people' (Sobel, 1996; Loughland *et al*, 2003; Wilson 2006; Littledyke 2008), and enable them to develop an affection for the environment coupled with a desire for its preservation (Stern, 2000).

Another means by which education might be made more effective in persuading individuals to adopt pro-environmental actions is to include elements of education for action (Lester, Ma, Lee and Lambert, 2006), because students appear more willing to take individual actions if their education incorporates active engagement in environmental activities (Chawla and Flanders Cushing, 2007; Mogensen and Nielsen, 2001). Environmental activism can also encourage a willingness to undertake communal environmental actions (Jenson, 2002; Lester, Ma, Lee and Lambert, 2006; Chawla and Flanders Cushing, 2007). It is helpful, then, that the educational system in Turkey has changed to incorporate modes of teaching that include action education. Beginning in the 2005-2006 academic year, the Turkish Ministry of Education decided to adopt a new, student-centered, constructivist approach to primary education. New constructivist programs were prepared and introduced to primary school teachers at the end of the 2004-2005 academic year, and teachers started to implement this program with students in Grades 1 through 6 in the following year. Following this, at the beginning of the 2007-2008 academic year, high school curricula were altered according to adopt a constructivist approach, starting with Grade 9. One of the aims of the new student-centered constructivist

structure in primary schools is to reach action-oriented educational goals. In the context of environmental education, this can involve students in preparing a project about the effects of global warming, participating in an environment club, recycling things at home, developing their skills of argumentation about global environmental problems with an emphasis on using renewable sources and warning about environmental degradation. In addition, the curriculum aims to teach information about the mechanism, reasons and consequences of environmental problems. However, the Turkish education system depends significantly on national examinations administered at different levels, and preparation for these examinations leads elementary (Alp, Ertepınar, Tekkaya and Yılmaz, 2008) and high school students to focus on rather shallow information about the mechanism and effects of environmental problems such as global warming and acid rain. An examination-driven education system such as this is ill-suited to producing behaviour change, including persuading students to adopt more pro-environmental behaviour (World Bank, 2005). If formal, school-based education is to contribute to adoption of actions to reduce global warming, this issue needs to be addressed with some urgency.

Another way in which environmental education might be made more effective in terms of leading to behaviour change is to increase the specificity of aspects of such education. The present study helps to distinguish those actions for which there is a stronger association between belief in effectiveness and willingness to act from those actions for which this relationship is weaker. Studies of this sort thus offer a guide to teacher practitioners and curriculum designers in terms of which pro-environmental actions could be targeted. Two of these are reducing the use of artificial fertilizers and lessening the meat content of the diet; teaching in these areas might focus on the production of nitrogen oxides and methane, and the contribution that these gases make to global warming. In addition, buying fewer new goods is an action that relatively few students linked with helping to reduce global warming, and for which the *Potential Effectiveness of Education* was relatively high. Teaching here might introduce students to the concept, at a simplified level, of life cycle analysis (Kirby, 2008), to show how production and transport of new goods, and disposal of discarded goods, all require energy and thus have a carbon cost. The present study also reveals those actions that might be less responsive to education, either because people are willing to do them anyway or because there is resistance to act even if the environmental advantages are known. In the case of the former, there are probably incentives other than environmental benefits. For example, reducing domestic electricity consumption by switching off un-used electrical appliances, using energy-efficient white goods such as refrigerators, or improving house insulation, all of which had relatively high values for their *Natural Willingness to Act* indices, will bring financial benefits to the individual or family as well as environmental benefits. In contrast, other actions had high values for their *Natural Reluctance to Act* indices. For example, it is probable that an apprehension of all things nuclear, with concomitant concerns about safety and health, are impinging on this attitude in the case of nuclear power. The final index derived for the present study, the *Potential Usefulness of Education*, is a combination of the *Potential Effectiveness of Education* and the potential constituency of students who might change their behaviours. Eating less meat and using public rather than private transport are the two actions that featured relatively high values for the *Potential Usefulness of Education*. Encouragingly, both of these actions are, to some extent at least, within the locus of control of students.

In all of this, it is likely that students will benefit from both teaching activities, and from positive encouragement that the pro-environmental actions discussed here really do contribute to reducing global warming. Without such re-enforcement, because students can see no perceptible environmental improvement resulting from their individual actions, which might be costly in terms of convenience, there is a danger of creating feelings of 'learned helplessness' (Nagel, 2005, Connell, Fien, Lee, Sykes and Yencken, 1999), with a subsequent abandonment of pro-environmental behaviours, even once they have been adopted.

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