A longitudinal study of upper secondary school students’ values and beliefs regarding policy responses to climate change

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ABSTRACT

This article explores changes of environmental values and beliefs among secondary school business and economics students regarding government and market solutions to climate change. The quantitative study is longitudinal and a survey was administrated to students at two occasions including 212 participants in the first measurement. Results show a small significant increase in importance for altruistic, biospheric and egoistic value orientations at average. At an individual level, there are substantial movements over time. Nearly two-thirds of the students changed the strength of their value orientations over time. Taxes and legislation were regarded as the most effective solutions to climate change, however there was a decrease in seeing market prices as important mechanisms for change. Analysis suggested no direct relationship between change in environmental value orientation and change in norms. However indirect associations were mediated by changing beliefs in the efficacy of education and information and the efficacy of tax policies. For example, students who became more egoistic and more convinced about the efficacy of tax were less likely than others to be willing to take personal actions.

1. Introduction

This study responds to a call (Stern \textit{2000}, 408) to examine beliefs about the efficacy of personal actions and the efficacy of government policies in relation to climate change. Moreover, we focus on whether one element of social science education in one European country appears to make any difference to beliefs about the efficacy of personal and government actions or change value positions which may frame those beliefs and motivate personal actions or support for government actions in response to the challenges raised by climate change. The challenge of climate change has been described in terms of large-scale collective action (IPCC \textit{2007}; Mansbridge \textit{2014}). If so, there may be a valuable role for social science education, particularly in the later years of compulsory school. However, the existing evidence base on the role of social science education in relation to beliefs about responses to environmental problems is sparse. This study extends the small evidence base (Ignell, Davies, and Lundholm \textit{2017}) on change and stability in...
students’ value orientations and beliefs about government and market interventions to climate change within a specific curriculum of upper secondary school.

The study uses the Values-Beliefs-Norms model developed by Stern and colleagues (Stern and Dietz 1994; Stern, Dietz, and Guagnano 1998; Stern et al. 1999; Stern 2000). This model develops the analysis pioneered by Schwartz and colleagues (Schwartz and Bilsky 1987, 1990; Schwartz, 1992, 1994) showing how value orientations frame perceptions of desirable states and behaviours. We chose this framework for the design of our research for three reasons. First, this model offers a way of examining relationships between students’ values, beliefs and norms. This comprehensive scope is congruent with the aims of the social science curriculum and also with evidence of the importance of ‘warm conceptual change’ that is relevant to understanding the challenges faced by teachers of social science. Second, the model has been widely referenced (eg Onur, Sahin, and Tekkaya 2012; Whitley et al. 2016) and there is also a substantial body of evidence on change and stability over time in value orientations. However, there are important gaps in knowledge about change over time in beliefs and norms and relationships between change in the three parts of the model. Third, the model explicitly includes two constructs ‘beliefs about ability to reduce threats’ (to the environment) and ‘support for, or participation in, public actions’ which we believe have great salience for the role of social science education in relation to climate change. A key question for the contribution of social science education in this sphere is: ‘how do collective actions affect the likelihood of climate change and adverse effects arising from climate change?’ Answers to this question carry implications for citizens’ support for, or opposition towards, alternative collective actions. Our work extends the research programme of the VBN model by focusing on the neglected area of the role of social science education in relation to students’ beliefs about options in public economic policy.

We first summarise the theoretical and empirical background to this study. This section concludes by presenting the research questions that framed our research design. We then describe and justify our research design and implementation in a section titled ‘method’. This is followed by a results section which is divided into change in values, beliefs and norms, in line with the VBN model. We conclude with some observations about the contribution of this research and implications for teaching and learning in business and economic education.

2. Background

This research accepts a theory of values and beliefs developed by Schwartz (2012). Dispositions (eg towards actions on climate change) are shaped by (i) underlying value orientations and (ii) beliefs. We also accept that beliefs about the efficacy of actions are shaped by value orientations and a normalizing effect of experience (Davies et al. 2002; Davies and Lundholm 2012).

2.1. Students’ environmental value orientations

Research on environmental values (Stern 2000; De Groot and Steg 2007, 2008) has been largely framed by the work of Schwartz and colleagues. Schwartz et al. (2001) identified three value orientations: egoistic, altruistic and biospheric. Egoistic values encourage individuals to care for environments from which they derive personal benefit and to oppose ‘pro-environmental’ actions they perceive as damaging their personal interest. Altruistic values encourage support for ‘pro-environmental actions’ which an individual believes will have net benefit for humanity, regardless of their calculation of personal net benefit. Biospheric values treat physical environments as having intrinsic worth, regardless of any calculation of net benefit for humanity. Individuals may embrace several value orientations to different degrees. Strength of commitment to each value orientation may also be associated with socio-cultural contexts and may also
change over time (Stern and Dietz 1994; Dietz, Fitzgerald, and Shwom 2005; Pettersson and Esmer 2008).

Research has suggested that adolescence is a critical period in terms of value formation and environmental sensitivity, followed by stability in values in adulthood (Rokeach 1973; Chawla 1999; Hofmann-Towfigh 2007; Vecchione et al. 2016). As adolescents start to distance themselves from their parents, their value orientations (including those bearing on economic inequality) become more open to change (Bogt et al. 2001). Nonetheless, even dramatic events may have a short-lived impact on underlying value orientations. Verkasalo, Goodwin, and Bezmenova (2006) found a short-lived increase in the value that 16–17 year-olds in Finland placed on the safety and stability of society following the terrorist attacks in USA 2001.

2.2. Students’ beliefs regarding climate change policies

The study is guided by the ‘value-beliefs-norms’ model, reproduced in Figure 1 and developed by Stern and colleagues (Stern and Dietz 1994; Stern, Dietz, and Guagnano 1998; Stern et al. 1999; Stern 2000). This positions beliefs as a mediating element between value orientations and the stance which individuals adopt towards environmental problems (‘attitude objects’, Schwartz 2012, 16). The model distinguishes between beliefs about the adverse consequences (AC) of a particular environmental problem and beliefs about the perceived ability of an action to reduce a threat (AR). AR beliefs are about cause and effect (Schwartz 2012). The literature is clear that AC beliefs are framed by value orientations. For example, an individual may believe that one adverse consequence of climate change will be a rise in sea level. However, the extent to which they perceive this consequence as ‘adverse’ will depend on the way in which they value consequences of a rise in sea level. The value, which a student in Europe places on loss of life and hardship in Bangladesh following a rise in sea levels, will depend on their value orientation.

However, research in environmental education has not been principally concerned with AR beliefs (Levy and Zint 2013): what can be done to address the problem? One approach to this
question has been to help students to valuate evidence regarding human behaviour contributing to climate change. This has been the route followed by previous research which has tended to focus on school students’ conceptions of the physical causes of climate change (Shepardson et al. 2012; Liarakou, Athanasiadis, and Gavrilakis 2011). However, identifying a problem is not the same as exploring what can be done about it. Social science education is concerned with the options open for individuals and societies in the ways in which they define and respond to problems like climate change. We concentrate on (AR) beliefs about the consequences for climate change of actions taken by consumers (in choice of what to buy) and governments (in relation to tax, subsidies, regulation and information). Strong biospheric and especially strong altruistic values might be expected to encourage a stronger preference for collective than individual choices. Strong egoistical values might be expected to encourage a preference for individual choice. There has been relatively little research on students’ beliefs and education about how individual, market and government agency can make a difference (Chawla and Cushing 2007; Lundholm and Plummer 2010; Levy and Zint 2013).

2.3. Business-economic education, environmental values and beliefs

There is a well-established association between studying undergraduate economics and relatively high egoistic value orientation that is also associated with relatively negative dispositions towards personal pro-environmental action (Tikka, Kuitunen, and Tynys 2000; Gandal et al. 2005; Harring, Torbjörnsson, and Lundholm 2018). To some extent, these associations are the result of selection bias (who chooses to study economics). However, there is also some evidence (Krishnan 2008) of an association between studying economics and falling support for self-transcendent values and rising support for self-enhancement values. However, assessment of progress in economics and business education focuses on change in belief about how the world works (Davies and Brant 2005). Very little research has, so far, examined whether this focus is associated with impact on dispositions towards the economics of actions in response to climate change. Harring, Davies, and Lundholm (2017) found that whilst economics undergraduates improved their understanding of markets and market-based government intervention, these improvements were not associated at individual student level with an increase in support for use of market-based government interventions. This study adds to research knowledge by examining change in the value orientations and beliefs of students in their final two years of secondary school.

2.4. Research questions

Since we are interested in the role of education in developing students’ thinking and norms we concentrate on change. The VBN model focuses attention on three different kinds of change:

1. Do altruistic, biospheric and egoistic values change over one year and if so how do they change?
2. Do beliefs and personal norms change over a year and if so how do they change?
3. Is there change in relationships between value orientations, beliefs and personal norms regarding solutions to climate change?

The study aimed to answer these questions in the context of upper secondary students studying economics and business in Sweden.
3. Method

3.1. Research design

Previous qualitative (e.g., Ignell, Davies, and Lundholm 2013) and quantitative (e.g., Sinatra et al. 2012) research provides a basis for the design of items that may be used to gather data from samples that are large enough to offer some evidence of the changes highlighted in the research questions. This section describes and justifies the design, implementation, and analysis of a survey used to gather evidence of change over a one-year period in the values, beliefs, and norms of upper secondary school students in Sweden. We refer to the first data collection as T1 and the second data collection as T2. The rationale for focusing on this age group is that previous research has suggested that adolescent students at this age are more prone than adults to changing their stance on societal issues and the social science curriculum in Sweden aims to develop more informed and socially aware reasoning. The research followed ethical guidelines regarding consent; the de-identifying of participants, disclosure, and data security (Gustafsson, Hermerén, and Petersson 2011). This section explains the design of the survey instrument, the sampling, and implementation of the survey, and the analysis of the data.

3.2. Instruments

The survey included three instruments, each of which was designed to capture one of three elements of the model: value orientations (Appendix A), beliefs, and norms (Appendices B and C). Each instrument was pre-tested with students in other schools to check for readability and clarity (van Widenfelt et al. 2005).

We used 13 items to measure value orientations (see Appendix A). These items were validated through an international study by De Groot and Steg (2007). The items had been developed through a sustained programme of research (e.g., Schwartz and Bilsky, 1987, 1990; Stern, Dietz, and Guagnano 1998, Stern et al. 1999). Following De Groot and Steg (2007), participants were asked to rate value orientations on a 9-point scale ranging from opposed to my value (1) to the most important value (7). The second section of the survey used 9 items focused on beliefs about the efficacy of different forms of collective social action that might offer ways to reduce greenhouse gas emissions. This part of the survey (Appendix B) breaks new ground but the items were based on evidence from a series of studies that have investigated beliefs about public policies. Vedung (1998) distinguished between policies acting through markets, regulation and information. Amadeo et al. (2002) and Ignell, Davies, and Lundholm (2013) found differences among upper secondary students’ beliefs about the efficacy of different forms of collective social action that might offer ways to reduce greenhouse gas emissions. This part of the survey (Appendix B) breaks new ground but the items were based on evidence from a series of studies that have investigated beliefs about public policies. Vedung (1998) distinguished between policies acting through markets, regulation and information. Amadeo et al. (2002) and Ignell, Davies, and Lundholm (2013) found differences among upper secondary students’ beliefs about the efficacy of price changes and market interventions upon environmental problems. Based on these studies we devised items to capture evidence of belief in the efficacy of market forces (B3, B4, B6), education and information (B1, B2, B7); government intervention in markets through taxes and subsidies (B5, B8); government regulation (B9). Participants were asked to respond using a 5-point scale ranging from most negative to the statement (1) to fully positive to the statement (4) with the additional option of no opinion (which was scored 2.5). The third instrument (11 items) in the survey measured behavioural norms (Appendix C). Our intention in this section was to capture evidence of readiness to (i) adjust personal consumption patterns (in a similar fashion to items used by Sinatra et al. 2012), (ii) support policy changes that would affect all consumers (adapting items from Amnä et al. 2010), and (iii) ascribe responsibility for environmental action to public and private organisations (Ojala 2005).

To establish the justification for grouping items into categories we conducted a factor analysis on each of the three instruments. There is a well-established basis for the items used to capture value orientations. Nonetheless, we used factor analysis on these items to check the performance of these items with our sample. Exploratory factor analysis (EFA) was used with the items on
beliefs and norms to investigate the justification for grouping items. We included responses from T1 and T2 in the EFA giving a total sample of 212, satisfying conventional views of adequate sample size for EFA (eg Henson and Roberts 2006). We used Maximum Likelihood extraction with Direct Oblimin rotation. Items loading less than .40 were excluded and factors were identified with eigenvalues higher than 1. Whilst there is debate (Pett, Lackey, and Sullivan 2003; Costello and Osborne 2005; Beavers et al. 2013) about the criteria that should be used in choosing the number of factors, we judged that this criterion yielded meaningful categories that were sensibly related to the items. Multiple-loading items were allocated according to reliability scores and a judgement about consistency between the categories and items. KMO-value was acceptable in each case (value orientations, 0.79; beliefs: 0.77; norms, 0.77).

Table 1 presents the results of our factor analysis on the value orientation items and compares these with the categorisation of items by De Groot and Steg (2007, 2008). Our analysis supported the conventional three-factor solution (accounting for 57% of variation in the data) but our data did not fully support the allocation of items suggested in earlier research. Only two items in our analysis loaded on to the egoistic factor, restricting this to a ‘power’ perspective. Material gain was more associated with altruistic orientations, perhaps reflecting a traditional view of Scandinavian society as more collective than, for example, the US and the UK. The Cronbach alphas were satisfactory, although the two item factor (egoistic) was a little below the normal benchmark for ‘good’ reliability (George and Mallery 2003).

| Item | Allocation of item by De Groot and Steg (2007, 2008) | Biospheric | Egoistic | Altruistic |
|------|-------------------------------------------------|------------|----------|------------|
| 1. Equality (equal opportunity for all) | Altruistic | .46       | .64      | .70        |
| 2. Respecting the earth (harmony with other species) | Biospheric | .82       |          |            |
| 3. Social power (control over others, dominance) | Egoistic |          | .80      |            |
| 4. Unity with nature (fitting into nature) | Biospheric | .58       |          |            |
| 5. A world at peace (free of war and conflict) | Altruistic |          | .55      |            |
| 6. Wealth (material possessions, money) | Egoistic |          | .61      |            |
| 7. Authority (the right to lead or command) | Egoistic |          | .69      |            |
| 8. Social justice (correcting injustice, care for the weak) | Altruistic |          | .58      |            |
| 9. Protecting the environment (preserving nature) | Biospheric |          | .84      |            |
| 10. Influential (having an impact on people and events) | Egoistic |          | .50      |            |
| 11. Helpful (working for the welfare of others) | Altruistic |          | .52      |            |
| 12. Preventing pollution (protection of natural resources) | Biospheric |          | .78      |            |
| 13. Ambitious (hard working, aspiring) | Egoistic |          | .51      |            |

Table 1. Factors extracted on value orientations.

N = 212
Extraction Method: Maximum Likelihood
Rotation Method: Oblimin with Kaiser Normalization

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The EFA on the belief items (Table 2) suggested three categories accounting for 67% of the variation in the data. This categorisation was consistent with our interpretation of previous research.

EFA on norms (Table 3) suggested four categories accounting for 61% of the variation in the data. The categorisation supported differentiation between person action as consumers (whilst differentiating between willingness to forgo consumption and willingness to pay more), support for government action affecting all consumers and scribing responsibility for action to public and private organisations.

3.3. Sample and missing data

The survey gathered information on students’ characteristics, interests and intentions as well as value orientations, beliefs and norms. The surveys took students about 30 minutes to complete and were administered as class activities by one of the researchers. Data were gathered from 212 17-year-old students in 9 schools at time 1 (T1) and showed 4% incomplete values. The convenience sample included five urban and four non-urban secondary schools within 2 hours travel by train from Stockholm. All students were following a programme in business economics and international economics in line with the country’s National Curriculum (introduced in 2000). This programme accounted for 15% of students’ study time (National Agency of Education, Sweden 2000). They were also studying other courses, for example, in civics, science and geography that were compulsory in social science programmes. At T1 the students had already completed the following proportions of study time in different subjects at basic level; Business; 90%, Science; 68%, Civics; 85% and Geography; 46%. Two schools did not participate in the second year of the study (T2). Although 182 students, at age 18, participated in T2, the number of students participating in both years was 142.

The attrition between T1 and T2 created potential bias in the comparison. This was evaluated by comparing characteristics of students who provided data at T1 and T2 with characteristics of students who only participated in T1. Illustrative results are presented in Table 4. Data on other characteristics, value orientations, beliefs and norms, for which there was no significant difference included in Table 4. We found a significance difference in only three of the student

| Table 2. Factors extracted on beliefs. |
|-----------------------------------------|
| **Market prices** | **Education and information** | **Tax and legislation** |
| Cronbach alpha | 0.75 | 0.74 | 0.73 |
| 1. Organisations like WWF inform on climate change | 0.89 | 0.71 |
| 2. Consumers get education in greenhouse gases | 0.73 |
| 3. Consumers buy less beef burgers | 0.97 |
| 4. The amount of beef burgers in the market reduces | 0.49 |
| 5. Producers get subsidies to become more environmental friendly | 0.40 |
| 6. Prices for beef burgers increase | 0.62 |
| 7. Media highlight impact generated by greenhouse gases | 0.87 |
| 8. Increased tax on greenhouse gases emissions |
| 9. Laws are initiated for allowed greenhouse gas emissions |

Extraction Method: Maximum Likelihood with Direct Oblimin rotation and Kaiser Normalization. N = 212.
characteristics and neither of these was significantly associated with norms (as shown by analysis reported later).

We concentrate on reporting complete case analyses of the data. Our data set showed 9% incomplete values at T1 and 4% incomplete values at T2 of the 142 participants. Therefore we also carried out robustness checks using data generated by multiple imputation (De Waal, Pannekoek, and Scholtus 2011).

3.4. Data analysis

All data analyses were conducted using SPSS (version 21.0). We analysed change in value orientations, beliefs and norms through paired sample t-tests and also examined correlations between changes in factors. In analysing change in value orientation we also used a K-means cluster analysis to allocate students into three clusters and we examined change between clusters.

Table 3. Factors extracted on personal norms.

| Cronbach alpha | N1 Change consumption | N2 Pay higher price | N3 Support taxes | N4 Government and business responsibility |
|----------------|------------------------|---------------------|-----------------|------------------------------------------|
| N1             | .77                    | .45                 | .84             | .72                                      |
| 1. I am willing to pay a cost for negative environmental impact goods I buy generate and thereby pay a higher price. |                        |                    |                               |
| 2. I am willing to support political proposals on increased CO₂ tax for car petrol. |                        |                    | .87                                      |
| 3. I am willing to support political proposals on increased CO₂ tax for flight gas. |                        |                    | .67                                      |
| 4. I am willing to pay (details removed for review) extra for a beef burger to compensate for the GHG emissions. |                        |                    | .46                                      |
| 5. I am willing to give up holiday flights to reduce GHG emissions. |                        |                    | .97                                      |
| 6. I am willing to give up holiday by car to reduce GHG emissions. |                        |                    | .51                                      |
| 7. Food prices should be higher if the products generate GHG emissions. |                        |                    | .82                                      |
| 8. Prices on clothes should be higher if they generate GHG emissions. |                        |                    | 1.00                                     |
| 9. Prices on travel tickets should be higher if they generate GHG emission. |                        |                    | .60                                      |
| 10. The governments should solve environmental issues. |                        |                    | .78                                      |
| 11. The private companies should solve environmental issues. |                        |                    | .76                                      |

Extraction Method: Maximum Likelihood with Direct Oblimin rotation and Kaiser Normalization. N = 212.
The VBN model suggests that norms will be shaped by beliefs and value orientations. To examine the associations we conducted linear regressions (OLS):

\[ N_j = f(S_j, V_j, B_j, V_jB_j) \] \[ \Delta N_j = f(S_j, \Delta V_j, \Delta B_j, \Delta V_j\Delta B_j) \] \[ \] \[ (1) \]

Where \( i \) refers to students, \( N_j \) is a vector of norms (our data identified two norms for personal action and two norms for regarding support for government policies), \( S_j \) is a vector of student characteristics (including home background, student interests and study), \( V_j \) is a vector of value orientations (biospheric, egoistic, altruistic), \( B_j \) is a vector of beliefs (about the efficacy of prices, taxes, education and information), \( V_jB_j \) and \( \Delta V_j\Delta B_j \) are interaction terms between each value orientation and each belief.

First we examined the relationships between norms, value orientations and beliefs at T1 (Eq. 1). We then carried out a difference-in-difference analysis (Eq. 2) to see if change in norms was associated either with change in value orientation or change in belief. The vectors \( V_j \) and \( B_j \) capture direct associations between norms and each of the value orientations and beliefs. The vectors \( V_jB_j \) and \( \Delta V_j\Delta B_j \) capture mediation of value orientations through beliefs.

4. Results

4.1. Change in value orientations

Table 5 shows the change in average value orientations between T1 and T2. The table shows the results using the allocation of items in De Groot and Steg (2007, 2008) as well as using the allocation of items based on the EFA in this study. The strength with which individuals declared their value orientations increased, with a modest effect size in each case when value orientations were measured using the EFA in this study. The imputed data confirmed this result. When using De Groot and Steg’s (2007, 2008) categorisation, there was no change in the average strength of orientation towards biospheric values.

Figure 2 presents the results of a K-means cluster analysis at T1 with three clusters specified. The cluster pattern for T2 was more or less identical. The number of students in the ‘weak values’ cluster halved from 34 at T1 to 17 at T2. The number of students espousing low egotistical
values (Cluster 2) remained constant (48 at T1 and 50 at T2). The number espousing strong values (Cluster 3) rose from 48 at T1 to 70 at T2. However, individual movement between T1 and T2 was more volatile. Only 40% of students belonged to the same cluster in T2 that they had belonged to in T1. A quarter of the students changed membership between clusters 2 and 3 and students in cluster 1 at T1 were as likely to switch in T2 to cluster 2 as to cluster 3. There was a fairly strong positive correlation between an increase in strength of orientation towards biospheric and altruistic values (0.5, \(p < .001\)) and a weak positive correlation between increasing strength of orientation towards egoistic and altruistic values (0.29, \(p = .001\)). There was no indication of a general tendency for increasing orientation towards one set of values being associated with a general tendency for a decrease in orientation towards another set of values.

### 4.2. Change in beliefs about the efficacy of personal and policy actions

At T1 students in our sample expressed stronger belief in education and information than in markets or governments as ways of combating climate change. Moreover, their belief in the efficacy of markets reduced between T1 and T2 whilst belief in the efficacy of education, information, tax and legislation held steady (Table 6). A robustness check with imputed data showed identical effect sizes. Efficacy beliefs tended to change in the same direction. The correlation coefficients (\(r\)) between each belief category were roughly 0.25 in each case, with \(p\) values acceptable at the .05 after a Bonferroni correction.

### 4.3. Change in norms

On average, there was no change in norms (Table 7). However, this does not preclude change at the individual level. Change between T1 and T2 in dispositions towards willingness to refrain from consumption, accept higher prices and accept higher taxes were all moderately positively correlated (\(r\) between 0.3 and 0.5). However, change in a disposition towards expecting...
government or business to take responsibility for climate change was not correlated at all with change in willingness to accept higher taxes or willingness to reduce consumption. There was a weak ($r = -0.2$) suggestion of a negative correlation between change regarding climate change as the responsibility of government and business and willingness to accept higher prices, but after a Bonferroni correction this was not significant at the 0.05 level.

5. Association between norms, beliefs and value orientations

We first examined associations between value orientation, beliefs and norms at T1. The results of an OLS regression (using Eq. 1) are presented in Table 8. We did test model specifications that included a wider range of student characteristics (including parents’ characteristics, students’ interests and participation in discussions on the economy and the environment), but we restrict Table 8 to those background variables that were significantly associated with at least one of our measures of norms. We also tested for the full range of interaction terms, but report a model which only includes those interactions were significant at the 5% level in the full specification. We found fewer associations than we expected given the predictions of the model. Orientation towards biospheric values at T1 was positively associated with willingness to take personal actions, but not with support for government action. Perhaps surprisingly, egoistic orientation was also associated with support for higher prices and more reluctance to declare that response to climate change was the responsibility of government and business. Beliefs in the efficacy of tax changes (and to a modest degree, belief in the efficacy of price changes) were positively associated with willingness to support tax changes to combat climate change. Females were more likely to be willing to pay higher prices. There was some indication of a selection bias effect in the associations between completing a business course (before T1) and unwillingness to pay higher prices and belief that response to climate change was not a responsibility for the individual.

Results of a difference in difference linear regression (Eq. 2) on norms are presented in Table 9. Change in norms was not associated directly with change in value orientations but was associated with mediation of value orientation change through belief change. The results also show a direct association between a change in belief about the efficacy of tax changes and a change in willingness to support tax increases and willingness to accept higher prices in order to combat climate change. We found no associations between student background, characteristics or interests and change in norms (either with or without the inclusion of value orientation or beliefs in the model).

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Table 6. Change in beliefs about the efficacy of actions between T1 and T2.

| Action                      | Mean at T1 | Mean difference | Effect size $^\dagger$ | $p$   | $n$  |
|-----------------------------|------------|-----------------|------------------------|-------|------|
| Market prices               | 2.44       | $-0.16$         | $-0.21$                | 0.05  | 127  |
| Education/information       | 2.78       | $-0.05$         | $-0.07$                | 0.47  | 132  |
| Tax and legislation         | 3.02       | $-0.03$         | $-0.04$                | 0.67  | 137  |

$^\dagger$Mean for factor divided by number of items to allow comparison between factors.

Table 7. Change in norms.

| Norms                                | Mean at T1 | Mean difference | Effect size $^\dagger$ | $p$   | $n$  |
|--------------------------------------|------------|-----------------|------------------------|-------|------|
| Change consumption                   | 1.94       | $0.06$          | $0.07$                 | 0.48  | 135  |
| Pay higher price                     | 2.26       | $0.08$          | $0.11$                 | 0.22  | 126  |
| Support higher taxes                 | 2.44       | $0.00$          | $0.00$                 | 0.96  | 127  |
| Government and business responsibility| 2.97       | $-0.03$         | $0.04$                 | 0.66  | 131  |
Table 8. Factors associated at T1 with norms between the first and second survey (dispositions towards personal and policy action on climate change).

| Factor                                      | Change in consumption | Change in price | Change in tax | Government and business responsibility |
|---------------------------------------------|-----------------------|-----------------|---------------|----------------------------------------|
| Sex (Female =1)                             | -.01 (p=.94)          | 1.36 (p=.01)    | .06 (p=.73)   | -.05 (p=.73)                           |
| Completed Business course                   | -.46 (p=.15)          | -.65 (p=.01)    | -.41 (p=.20)  | .50 (p=.03)                            |
| Orientation towards                        |                       |                 |               |                                        |
| Biospheric values                           | .21 (p=.02)           | .21 (p=.01)     | .08 (p=.34)   | -.02 (p=.73)                           |
| Egoistic values                             | .33 (p=.13)           | .33 (p=.05)     | .16 (p=.43)   | -.34 (p=.03)                           |
| Altruistic values                           | -.41 (p=.19)          | .23 (p=.36)     | -.28 (p=.35)  | -.52 (p=.03)                           |
| Belief in efficacy of                       |                       |                 |               |                                        |
| Price                                       | .11 (p=.35)           | .03 (p=.74)     | .20 (p=.07)   | .16 (p=.06)                            |
| Education/info                              | -.26 (p=.61)          | .51 (p=.20)     | -.28 (p=.56)  | -1.02 (p=.01)                          |
| Tax                                         | -.06 (p=.64)          | .05 (p=.59)     | .32 (p=.01)   | .012 (p=.89)                           |
| Interactions                                |                       |                 |               |                                        |
| egoistic * education/ info                  | -.05 (p=.07)          | -.04 (p=.04)    | -.02 (p=.35)  | .04 (p=.02)                            |
| altruistic * education/ info                | .04 (p=.28)           | -.03 (p=.35)    | .04 (p=.29)   | .06 (p=.02)                            |
| Constant                                    | 2.6 (p=.06)           | .21 (p=.85)     | 1.70 (p=.20)  | 2.057 (p=.001)                        |
| \(R^2\)                                     | .12                   | .29             | .24           | .17                                    |
| \(n\)                                       | 117                   | 115             | 115           | 118                                    |

\(*\)Norm values calculated at ‘per item level’ to help comparison.

Table 9. Factors associated with a change in norms (dispositions towards personal and policy action on climate change).

| Change in orientation towards | Change in consumption | Change in price | Change in tax | Government and business responsibility |
|------------------------------|-----------------------|-----------------|---------------|----------------------------------------|
| Biospheric values            | .04 (p=.58)           | .01 (p=.88)     | .15 (p=.09)   | -.002 (p=.97)                         |
| Egoistic values              | -.05 (p=.26)          | -.03 (p=.38)    | -.05 (p=.32)  | .02 (p=.66)                          |
| Altruistic values            | -.11 (p=.16)          | .08 (p=.26)     | -.09 (p=.30)  | 0 (p=.16)                           |
| Change in belief in efficacy of |                     |                 |               |                                        |
| Price                        | -.03 (p=.75)          | -.05 (p=.46)    | -.05 (p=.65)  | .07 (p=.40)                          |
| Education/info               | .16 (p=.16)           | .07 (p=.49)     | .18 (p=.16)   | -.02 (p=.82)                         |
| Tax                          | .07 (p=.44)           | .17 (p=.04)     | .41 (p=.001)  | .05 (p=.55)                          |
| Interactions                 |                       |                 |               |                                        |
| Biospheric and education/info | -.22 (p=.01)          | -.11 (p=.18)    | .03 (p=.77)   | -.02 (p=.77)                         |
| Egoistic and education/info  | .11 (p=.03)           | -.01 (p=.83)    | .08 (p=.15)   | -.09 (p=.05)                         |
| Egoistic and tax             | -.12 (p=.00)          | -.10 (p=.01)    | -.06 (p=.19)  | .04 (p=.29)                          |
| Constant                     | .19 (p=.03)           | .14 (p=.05)     | .02 (p=.85)   | .02 (p=.80)                          |
| \(R^2\)                      | .23                   | .18             | .30           | .15                                    |
| \(n\)                        | 106                   | 106             | 108           | 109                                    |

6. Conclusion

We conclude with a review of the answers our results provide to our research questions, some observations on limitations of the study and some cautious implications for practice and research.

6.1. Do altruistic, biospheric and egoistic values change over one year and if so how do they change?

We found, on average, a meaningful strengthening of commitment to each value orientation. Moreover, there was a strong positive correlation between increases in orientations towards biospheric and altruistic values. Volatility in students’ relative positioning in value orientations (as observed through cluster analysis) suggests some scope for education in the formation of young adults’ value orientations. Previous research (eg Rokeach 1973; Chawla 1999; Hofmann-Towfigh 2007; Vecchione et al. 2016) has noted that adolescence is a critical period in value formation. In that context, the changes in value orientation observed in the 17–18-year-olds in this study may
be viewed as unsurprising. Measurement of value change may be affected by choice of instrument. We used the instrument developed by De Groot and Steg (2007, 2008). Although an EFA of the data in this study broadly supported their categorisation our data suggested a different distribution of items to categories implying an association between commitment to equality and biospheric values orientation and an association between altruistic values and commitment to wealth, influence and ambition. One possible interpretation is that particular value orientations coalesce in different ways in different societies as suggested, for example, by Stern and Dietz (1994), Dietz, Fitzgerald, and Shwom (2005) and Pettersson and Esmer (2008).

6.2. Do beliefs and personal norms change over a year and if so how do they change?

We found a modest reduction (effect size of .2) in average belief in the efficacy of prices as a tool to combat climate change. Although there was no change in average norms, there appeared to be individual level change. There is evidence here of modest change in beliefs that provides scope for an effect of education on what students believe about possible collective action in response to the challenge of climate change. The positive correlation between change in dispositions towards changes in personal consumption, willingness to accept higher prices and willingness to accept higher taxes suggests that for some students these dispositions strengthened whilst for others these dispositions weakened. If movements in opposite directions cancel out it places a question mark over the role of education in this process. Of course, this does not tell us what education could achieve, since a different curriculum and different teaching could yield other outcomes.

This study has added to knowledge on the role of social science beliefs in relation to the stance adopted by individuals towards action on climate change. The majority of previous research has focused on beliefs about the extent to which human activity is causing climate change (eg Liarakou, Athanasiadis, and Gavrilakis 2011; Shepardson et al. 2012). This is largely the domain of physical science. Social science is concerned with the question of how human activity, especially collective human activity, might be changed. The existing body of knowledge on this social science dimension of beliefs about responses to climate change is fairly small (Lundholm and Davies 2013), and this study breaks new ground by offering a new categorisation of relevant beliefs and by examining change in these beliefs during upper secondary school. The study examines these beliefs in the context of students’ value orientations and their norms for action (VBN theory). This theory suggests that education could affect individual responses to the challenge of climate change by changing students’ beliefs about the efficacy of personal and policy actions that are mediated by socio-economic systems. In democratic societies, this could encourage a different approach to framing policy as well as strengthening or weakening the application of particular policies (Davies 2006).

6.3. Is there change in relationships between value orientations, beliefs and personal norms regarding solutions to climate change?

Our main evidence regarding potential for the influence of education on students’ personal norms regarding action on climate change comes from regression analyses. We found out that orientation towards biospheric values was positively associated with willingness to reduce personal consumption and to accept higher prices. Interestingly we found a positive association at T1 between belief in the efficacy of the price mechanism, the likelihood of support for tax rises (that would work through the price mechanism) and the likelihood that a student would regard action on climate change as a responsibility of government (supporting the results of Harring, Davies, and Lundholm 2017). We also found evidence of indirect associations between value orientations and norms, mediated by beliefs as anticipated by the VBN model. The difference-in-
difference analysis suggested no direct relationship between change in value orientation and change in norms. We did, however, find indirect associations mediated by changing beliefs in the efficacy of education and information and the efficacy of tax policies. For example, students who became more egoistic and more convinced about the efficacy of tax were less likely than others to be willing to take personal actions. Belief in the efficacy of taxation was directly associated with change in norms: it was positively correlated with change in readiness to accept higher taxes and with change in readiness to accept higher prices. Given that expenditure taxes which raise prices form a major part of tax policy opportunities, this consistency is encouraging.

The study extends previous research by examining change over a 1 year period in adolescence following the well-established VBN model (De Groot and Steg 2007, 2008). As far as we are aware, the relationships we have examined between changes in beliefs about the efficacy of price, taxation and government regulatory mechanisms and climate change have not been previously analysed in the published literature. The theoretical strength of the VBN model depends on its capacity to help us understand changes in learners’ positions, since these changes provide a stronger basis for causal claims than associations at one point in time. Moreover, understanding change is critical for educational interventions. The Swedish secondary curriculum for social science (in common with curricula in other countries) presumes that education had helped students to develop a more sophisticated set of beliefs about how collective action can address social dilemmas. However, the efficacy of education in this endeavour depends not only on how clearly teachers identify and challenge students’ everyday thinking, but also on relationships between beliefs, value orientations and norms for action.

6.4. Limitations

Our sample is small. A larger sample could allow detection of more fine-grained relationships and could detect associations which might be attributable to the subjects studied. A sample drawn from different schools might have yielded different results, since we do not know how variation in teaching (let alone variation in the curriculum) would affect change in the final years of secondary schooling. The design of our study concentrates on identifying patterns and associations, although the difference-in-difference analysis goes some way towards isolating associations that can be more plausibly regarded as showing causation. The effects of curriculum choice are not usually amenable to experimental design so this form of analysis is likely to remain a valuable source of evidence.

6.5. Implications

Our study suggests that although the positions adopted by senior secondary school students towards addressing climate are in a state of flux, the current impact of teaching in Swedish schools is hard to detect. One interpretation is that the declared aims of the social science curriculum are not really being met and that opportunities are being missed. An alternative interpretation is that the social science curriculum should not be seeking to coerce students into particular standpoints. Whichever interpretation is adopted, the evidence of this study suggests that teaching would benefit from a stronger alignment between general curriculum aims and understanding of the scope for social science education to change beliefs, value orientations and norms for action. The VBN model provides a useful model for guiding this endeavour. One important theme for social science education is achieving greater clarity about the range of beliefs that students hold regarding forms that collective action may take: how these forms of collective action operate and the grounds for believing that they might address the challenges posed by climate change. This research identified differences between the students in their beliefs about the relative efficacy of relying on market forces, expecting governments to
intervene in markets through taxes and subsidies, expecting governments to intervene through regulation and believing that governments and organisation should shoulder responsibility for action independently of citizens’ actions. Whilst this provides an agenda for curriculum design and for teaching, we need to know more about students’ reasoning about the efficacy of these different options and how teaching can affect the quality of this reasoning. Further longitudinal studies, particularly those that compare alternative curricular and approaches to teaching are needed to inform practice in social science education.

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Appendix A

Please indicate how important each value is for you by putting a circle around the number. The higher the number, the more important the value is to you. Try to distinguish as much as possible between the values by using different numbers.

Use the rating scale below:

0 the value is not at all important to you
3 the value is important.
6 the value is very important.
-1 the value is opposed to the principle that guide you.
7 is for rating a value of supreme importance in your life and you can chose at maximum two such values (7).
### Appendix B

In the following part the assumptions focuses solutions to the problem with increased greenhouse gases (GHG). To what extent do the following descriptions help to solve the problem?

Options: Not at all; To a minor extent; Fairly much; A lot; Don’t know;

1. Organizations like details removed for review and WWF inform on climate change.
2. Consumers get education in greenhouse gases.
3. Consumers buy less beef burgers.
4. The amount of beef burgers in the market reduces.
5. Producers get subsidies to become more environmental friendly.
6. Prices for beef burgers increases.
7. Media highlight impact generated by greenhouse gases.
8. Increased tax on greenhouse gases emissions.
9. Laws are initiated for allowable greenhouse gas emissions.

### Appendix C

Statements will be presented in the following part, to what level do you agree with the statements?

Options: Totally disagree; Partly disagree; Partly agree; Fully agree

1. I am willing to pay a cost for negative environmental impact goods buy generate and thereby pay a higher price.
2. I am willing to support political proposals on increased CO2 tax for car petrol.
3. I am willing to support political proposals on increased CO2 tax for flight gas.
4. I am willing to pay (details removed for review) extra for a beef burger to compensate for the GHG-emissions.
5. I am willing to give up holiday flights to reduce GHG emissions.
6. I am willing to give up holiday trips by car to reduce GHG emissions.
7. Food prices should be higher if the products generate GHG emissions.
8. Prices on clothes should be higher if they generate GHG emissions.
9. Prices on travel tickets should be higher if they generate GHG emission.
10. The government should solve environmental issues.
11. The private companies that should solve environmental issues.

| Statement                                                                 | Not at all | To a minor extent | Fairly much | A lot | Don’t know |
|---------------------------------------------------------------------------|------------|-------------------|-------------|-------|------------|
| Equality (equal opportunity for all)                                      | -1         | 0                 | 1           | 2     | 3          | 4           | 5 | 6 | 7 |
| Respecting the earth (harmony with other species)                         | -1         | 0                 | 1           | 2     | 3          | 4           | 5 | 6 | 7 |
| Social power (control over others, dominance)                             | -1         | 0                 | 1           | 2     | 3          | 4           | 5 | 6 | 7 |
| Unity with nature (fitting into nature)                                   | -1         | 0                 | 1           | 2     | 3          | 4           | 5 | 6 | 7 |
| A world at peace (free of war and conflict)                              | -1         | 0                 | 1           | 2     | 3          | 4           | 5 | 6 | 7 |
| Wealth (material possessions, money)                                      | -1         | 0                 | 1           | 2     | 3          | 4           | 5 | 6 | 7 |
| Authority (the right to lead or command)                                  | -1         | 0                 | 1           | 2     | 3          | 4           | 5 | 6 | 7 |
| Social justice (correcting injustice, care for the weak)                  | -1         | 0                 | 1           | 2     | 3          | 4           | 5 | 6 | 7 |
| Protecting the environment (preserving nature)                            | -1         | 0                 | 1           | 2     | 3          | 4           | 5 | 6 | 7 |
| Influential (having an impact on people and events)                       | -1         | 0                 | 1           | 2     | 3          | 4           | 5 | 6 | 7 |
| Helpful (working for the welfare of others)                               | -1         | 0                 | 1           | 2     | 3          | 4           | 5 | 6 | 7 |
| Preventing pollution (protection of natural resources)                    | -1         | 0                 | 1           | 2     | 3          | 4           | 5 | 6 | 7 |
| Ambitious (hard-working, aspiring)                                        | -1         | 0                 | 1           | 2     | 3          | 4           | 5 | 6 | 7 |