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The views of teachers in England on an action-oriented climate change curriculum

Paul Howard-Jones^a , David Sands^a, Justin Dillon^b  and Finnian Fenton-Jones^c 

^aSchool of Education, University of Bristol, Bristol, UK; ^bGraduate School of Education, University of Exeter, Exeter, UK; ^cDepartment of Science Oldfield School, Bath, UK

ABSTRACT

To inform current debate around climate change education (CCE) in the school curriculum in England, we surveyed the views of primary and secondary teachers ($N=626$). In England, direct reference to climate change in the National Curriculum is confined to secondary Science and Geography but, unrelated to their subject area, teachers favoured a cross-curricular approach with most already communicating to their students about it. Feeling comfortable delivering CCE was correlated with reported resource availability, with most teachers considering only basic literacy was a greater funding priority. Teachers supported an action-based CCE curriculum including issues of global social justice, beginning in primary school with mitigation projects such as conservation, local tree-planting and family advocacy. Local campaigning (e.g. legal demonstration) was considered appropriate around the primary/secondary transition, with most supporting inclusion of civil disobedience but indicating this should begin at secondary school (11+ years). Results are compared with a 2018 poll of US teachers.

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Introduction

The UN Agenda 2030 Sustainable Development Goal (SDG) 13 “Take urgent action to combat climate change and its impacts” includes a target to improve education, although how the target might be met is not specified (Sustainable Development Solutions Network (SDSN) 2015; UNFCCC 2015). As part of an agenda for action, it can be argued that CCE should itself be action-oriented. Action-oriented CCE might confine itself to individual behaviour, as when students calculate and minimise their own carbon footprint. However, encouraging students to be agents of wider change within their communities has been argued as more effective in terms of mitigation (Kenis and Mathijs 2012; Trott 2019a). In this respect, educators have explored types of CCE involving a range of outward-facing activities, from communicating about climate change with friends and family (Valdez, Peterson, and Stevenson 2018), to collaborative projects in the community which may deepen understanding through involvement in civic action (Birmingham and Barton 2014). Indeed, the scope of societal change that might be addressed by CCE has been envisaged as broad, and to include climate-related issues of social justice at the level of groups, institutions, government and society. Over a decade ago, Kagawa and Selby argued for a ‘lived paradigm shift’ that was both local and global in its scope. They proposed

that no ethical and adequately responsive CCE could exist without global climate justice education (Kagawa and Selby 2009). It has since been advocated that CCE should address “people’s rights to be free of oppressions created by climate injustices, including being able to live lives they have good reason to imagine and choose, i.e. that will foster rather than inhibit sustainability, equity, and authenticity in their lives as well as those in their communities” (Reid 2019, 778). The social justice implications of climate change were also recognised by a group of educators surveyed in the UK (Howell and Allen 2019), where the 85 respondents rated social justice concerns as more motivating than biospheric concerns. Perhaps unsurprisingly then, some UK educators have argued that, as a “wicked” problem, climate change must be addressed in the curriculum by interdisciplinary frameworks of understanding that includes its ethical dimensions (Hawkey, James, and Tidmarsh 2019).

It is widely accepted that CCE is crucial to redirecting teaching and learning in the face of today’s climate emergency (Reid 2019). Much of what we know about effective CCE in schools has been derived from US contexts, with a recent review finding most of the published interventions eligible for inclusion originating there (Monroe et al. 2019). However, the contexts and challenges for furthering high quality CCE are likely to vary greatly across different nations and educational jurisdictions. For example, US research has often sought to identify and address ambivalent beliefs amongst teachers and students about human-induced climate change (e.g. Plutzer et al. 2016). These beliefs are thought to be related to the prevailing culture (Kunkle and Monroe 2019) whose diversity across nations was demonstrated by a recent poll in which 69% of Spanish respondents believed “the climate is changing and human activity is mainly responsible”, compared with 38% in the US (YouGov 2019b). Such differences in public attitudes predict great diversity in the opportunities afforded to, and the challenges faced by, those working to develop and implement effective CCE within different nations. However, some significant similarities do also exist between US and UK contexts. For, example, as in the US, a National Curriculum exists in England but is not universally followed. Since 2010, England has seen an increasing number of schools converting to academies (publicly funded schools which operate outside of local authority control) which are technically not required to follow the National Curriculum. Instead, these schools are required to deliver a broad and balanced curriculum and their students take the same examinations as state-funded schools which do not have academy status. Most schools in England are now academies (Department for Education, 2019) but the National Curriculum remains influential on their curriculum and mandatory for other types of school.

In the National Curriculum in England, a direct reference to climate change first appears in Science and Geography at Key Stage 3 (ages 11–14 years) (Department for Education (DfE) 2014). Coverage of climate change is also compulsory at Key Stage 4 (ages 14–16 years) in Science, and some students may also encounter it again in Geography (which is an elective subject). In Science, the National Curriculum in England requires students to learn about the potential effects and mitigation of human-generated greenhouse gases on the Earth’s climate, as well as to consider the evidence for other anthropogenic causes. In Geography, students must learn about “the change in climate from the Ice Age to the present” and “how human and physical processes interact to influence, and change landscapes, environments and the climate; and how human activity relies on effective functioning of natural systems” (Department for Education (DfE) 2014, 243). However, the National Curriculum in England does not currently require children to understand the broader impacts of climate change on the environment, economy and society, or to consider issues of social justice in relation to climate change. There is no mandatory requirement for any school students in England to understand or engage with the types of social action most likely to bring about societal change. This lack of emphasis on action is shared by other curricula around the world. For example, an analysis of curricula in Turkey and Bulgaria found that considerably more attention was paid to knowledge than to environmentally responsible behaviours (Erdogan, Kostova, and Marcinkowski 2009). Where other curricula do

approach behavioural change, these efforts may focus on low- or medium-impact individual climate actions such as recycling or changing lightbulbs, as was found to be the case in a review of Canadian science text books, with only infrequent mention of the behaviours that most reduce a person's carbon footprint, such as living car, flight, and meat-free (Wynes and Nicholas 2017).

In the US, discourse around the appropriateness of CCE has often focused on debate concerning the existence of anthropogenic climate change (e.g. Kagubare 2019). The presence, positioning and content of climate education in the English National Curriculum has also stirred political discussion. However, while this discussion may be inflamed by connections between CCE and ideas about social and political change, disputes around the science itself have featured only infrequently. The topic of climate change first appeared in the English National Curriculum in 1995. In 2011, Tim Oates, who led a review of the National Curriculum for the government, made it clear he wanted to "get back to the science in the science", stating that climate change should not be included in the curriculum (Shepherd 2011). In 2013, after accusations that the government was reducing climate change topics, the Department for Education felt required to publish a public statement which began "It is not true that climate change is being removed from the National Curriculum" and which went on to identify in both Science and Geography, across all age-groups from 5–16, where climate change should still be included by teachers (DfE, 2013). Alongside continuing suspicion around government intentions for CCE in England (Coughlan 2017) and pre-election attempts by opposition parties to capitalise on these concerns (Bloom 2019; Rayner 2019), there have also been well-publicised calls by students themselves for greater attention to it in their curriculum (Lewis et al. 2019).

Against this backdrop of political exchanges, the views expressed by English educators themselves can be diverse and strongly held. While some educators ask that policy-makers should withhold from putting climate change and "all society's problems on to schools" (Enser 2019), others believe climate change should be prioritised as part of comprehensive and radical efforts to reorganise society to mitigate and prepare for its catastrophic effects (Jones 2019). Debate around climate change curricula in the UK and internationally is likely to intensify in the run-up to the UK's hosting of COP26 (1-12 November, 2021) in Glasgow.

In the UK, there is evidence that teachers may already be supportive of increasing the presence of CCE in the curriculum. A 2019 poll, undertaken by Oxfam on the climate crisis, reported that 69% of UK teachers wished to see more teaching in schools about climate change, and 70% supported radical change in UK legislation to make the education system fit for the times in which we live (YouGov 2019c). However, the survey did not probe what types of "radical" change CCE teachers might consider appropriate at different stages in children's development. In particular, the extent of UK teachers' support for a broader framing of CCE as a cross-curricular area, encouraging social action and societal change, is unknown – and this framing may critically influence the effective contribution CCE could make towards mitigating climate change. In this paper, we report on a study that directly addresses this gap in our understanding.

We investigated the views of a sample of teachers in England about CCE in the curriculum, soliciting their opinions about the appropriateness of a selection of concepts and action-oriented approaches. Where possible and appropriate, we included statements derived from those presented to US teachers (NPR/IPSOS 2019). In this way, we sought to explore the views of teachers in England with respect to climate change in the curriculum and enable comparison with US contexts, where much of the international educational research effort has, so far, been situated. Specifically, in terms of research questions, we wished to know teachers' opinions regarding:

- i. When (if ever) should specific types of content be encountered in the curriculum;
- ii. Which subjects should be involved with CCE delivery;
- iii. The funding status that should be afforded CCE in relation to other curriculum areas; and we also wished to determine:

- iv. Their current engagement with students about climate change and
- v. How climate change belief, school encouragement and resource availability relate to how comfortable teachers feel delivering CCE.

Additionally, for the purposes of informing policy, we were interested to know whether differences existed regarding these issues between primary and secondary school teachers, and between the group of teachers who specialised in science or geography (where climate change is explicitly referred to in the national curriculum) and other teachers.

Methods

Bearing in mind the research questions and our desire to compare findings with those from a prior study carried out in the US, a survey was chosen as the most appropriate data collection technique. However, as in many other parts of the world, response rates to surveys in the UK have been falling and UK teachers' responsiveness to surveys has followed this trend (Knibbs and Stobart 2018). We wanted to avoid attempts to elicit responses from teachers between lessons or after school, which might lead to a low response rate compromising reliability and validity. Instead, we sought an opportunity to approach potential participants when they were settled in an environment conducive to reflection.

Participants and procedure

Permission was requested from leaders within five English academy chains to recruit participation of 661 teachers at professional development events being organised for January and February of 2020. A "chain" is a term used in the UK to refer to collaborative structures between local schools ranging from shared governance to partnership without formal accountability to other schools in the chain. The planned events were all focused on a topic (the Science of Learning) not directly related to climate change, reducing the likelihood of the event itself extraneously influencing teacher's responses. Attendance at these sessions is considered mandatory for all teaching staff.

At the beginning of the professional development event, the purpose of the research and what participation would entail was explained to the teachers both orally and using a written information sheet circulated alongside a copy of the survey. Teachers were asked whether they wished to participate and, if so, to complete the survey before the close of the event. Participants were assured that the survey was completely anonymous and that the findings would be used purely for research purposes. In line with standard ethical guidelines (BERA, 2018), researchers remained sensitive and open to the possibility that participants might wish to withdraw their consent after having begun to complete the survey. Accordingly, prior to collection of completed surveys at the end of the event, participants were reminded that their participation was entirely voluntary and that they might also, without consequence, retain or dispose of their surveys. The research received ethical approval according to the procedures of the University of Bristol Research Committee (application 98864).

Instrument

A copy of the survey is provided in Appendix 1. To support validity, particularly in regard to comparison with US data, questions drew heavily on the NPR/IPSOS survey carried out in the US (NPR/IPSOS 2019). The background information requested at the beginning of the survey did not include names, but respondents were asked about which stage of education they were involved with (primary (including early years) or secondary), their teaching experience (in years), subject specialism and year of birth (allowing the respondent's age to be estimated).

To gauge teachers' views on when specific types of content should first be introduced in the curriculum, we presented (in Question 1) a chart with a range of understandings and forms of participatory learning activities down one side and different stages of education across the top. Understandings included the science of climate change and its root causes, but also areas not currently covered in the National Curriculum: the broader impacts of climate change on environment, economy, society, and issues of global social justice related to climate change. Six types of participatory learning activities were presented, drawn from the literature reviewed above. Columns representing each stage of education were communicated (as they are defined in the UK) in terms of Early Years (< 5 years old), Key Stage 1 (5–7 years), Key Stage 2 (7–11 years), Key Stage 3 (11–14 years), Key Stage 4 (14–16), Key Stage 5 (16–18 years). We added an additional column of "never" to allow teachers to indicate any content they perceived as inappropriate at any stage. Question 1 asked teachers to identify on this chart when each type of content should first be encountered as part of a climate change curriculum.

To collect teachers' views on which subject area(s) should be involved in delivery of CCE, Question 2 presented respondents with the full range of subject areas (identified according to the National Curriculum in England) and asked them to circle those subjects through which CCE should be delivered.

To identify teachers' views on the status of CCE for funding in relation to some other curriculum areas, a question was adapted from the NPR/IPSOS poll (2019). The original question asked teachers to identify the worthiest (and second most worthy) subject area for additional resources when expanding the curriculum of their school, with options that included climate change but also STEM, basic literacy, financial, and sex education. In our survey, to encourage equitable reflection on each area, Question 3 asked respondents to rank all these areas in terms of their worthiness for additional resources.

To gauge teachers' current engagement with their students on climate change and to identify factors related to how comfortable they feel doing so, Question 4 asked respondents to indicate their agreement on a 5-point Likert scale (strongly disagree, etc.) to a set of 11 statements. Two of these statements (see [Table 4](#), statements 1–2) were reproduced from the NPR/IPSOS poll (2019) and help measure teachers' current engagement in a form that could be compared with US data.

To explore how a range of factors were related to how comfortable teachers felt delivering CCE, we collected responses to three categories of statement. The first of these related to their beliefs about climate change. US data suggests a teacher's knowledge content can influence the amount of time they devote to teaching about climate change (Plutzer and Hannah 2018). Therefore, we included five statements concerning climate change itself (see [Table 5](#), statements 3–7) adapted from questions in the NPR/IPSOS poll (2019) to assess the strength of each teachers' belief in ongoing anthropogenic climate change and the possibility of mitigative action. Secondly, UK research has identified that teachers' willingness towards curriculum innovation is influenced by the encouragement received from their school (Brundrett and Duncan 2015). Therefore, we included the statement "My school encourages us to discuss climate change in the classroom" from the NPR/IPSOS poll (2019) to allow measurement of perceived school-level support ([Table 5](#), statement 8). A teacher's resources are considered to significantly impact on engagement with their professional work (Hakanen, Bakker, and Schaufeli 2006) and so we included the statement from the NPR/IPSOS poll (2019): "I have the resources I need to answer students' questions about climate change" to provide measurement of teachers' perceived resource availability ([Table 5](#), statement 9). Finally, we included two further statements from the NPR/IPSOS poll (2019) about feeling comfortable delivering CCE (see [Table 5](#), statements 10, 11). The phrases were balanced, allowing a measure of teachers feeling "comfortable delivering CCE" to be formed from their combination that minimised bias due to respondents generally favouring low or high scores (see [Table 5](#), statements 10, 11). The face validity of this construct is supported by inspecting its similarity in wording to the component statements.

Analysis

In addition to graphical and descriptive analysis, various measures were obtained by combining a participant's responses to different statements and we compared these measures across groups. A general measure of "age preference" for each respondent was derived from Question 1 by scoring the age range indicated for each area of understanding (0=early years, 1=Key Stage 1, etc., 6=never) and summing responses over all statements in this section. McDonald's omega is reported as an indicator of reliability (McDonald 1999).

A measure of "preference for cross-curricularity" was derived from responses to Question 2 based on the number of subjects a participant indicated should include CCE. The percentage agreeing with statements in Question 4 were calculated on the basis of teachers who indicated "agree" or "strongly agree".

When analysing data from Question 4, a combined score for "Climate Change Belief" (out of a maximum of 25) was generated by adding scores for statements in this category together, all of which were stated positively and collectively reflect belief in anthropogenic climate change and the possibility of mitigative action. A combined score (out of a maximum of 10) was also derived for the extent to which a teacher felt "Comfortable delivering CCE" by adding the score for the statement 10 (Table 5) "I feel comfortable answering students' questions about climate change" to the reversed score for statement 11 "I would be personally uncomfortable if I had to teach about climate change".

McDonald's omega is reported as an indicator of reliability for our measure of the climate change belief of teachers.

Non-parametric tests (independent samples two-tailed Mann-Whitney U) were applied to detect differences between primary and secondary school teachers, and between the group of teachers who specialised in science or geography, and other teachers. Note that "primary" and "secondary" teacher in the context of this paper refer to teachers of children from 4–11 years and 11–18 years, respectively. Effect sizes for these comparisons were calculated using eta-squared, with typical values representing small, medium and large effect sizes as 0.01, 0.06 and 0.14, respectively (Fritz, Morris, and Richler 2012).

Associations of how comfortable teachers felt delivering CCE with their climate change belief, and with scores for school encouragement and resource availability (Question 4, statements 8 and 9, respectively) were tested using Spearman's rho, with typical values for small, medium and large effect sizes set at 0.1, 0.3 and 0.5 (Cohen 1992).

Findings

Demographics of sample

A total of 661 surveys were distributed, of which 35 were uncompleted or not returned, providing a 95% response rate. The sample ($N=626$) comprised 205 primary school teachers and 421 secondary school teachers, with an average age of 40 and a mean level of experience of 13 years. A breakdown of our sample in terms of the regional location of the event they were attending, the broad educational stage of their school (primary or secondary) and their self-reported specialism is provided in Table 1.

Views on where CCE should be included in the curriculum

To explore teachers' views on the inclusion and timing of different types of understanding and participation in the curriculum, graphical analyses were undertaken of the responses to Question 1 and these are displayed in Figure 1.

Our general measure of "age preference" for each respondent ($M=1.99$, $SD = 0.82$) indicated acceptable reliability according to McDonald's omega ($\omega = 0.88$). The average value of CCE age

Table 1. Teacher demographics.

Event	Region in England	Educational stage	Self-reporting as a science specialist	Self-reporting as a geography specialist	Self-reporting as other type of specialist	Unspecified	Total
1	Southwest	Primary	2	0	50	0	52
		Secondary	0	0	10	3	13
2	Northeast	Primary	4	2	41	0	47
		Secondary	4	5	16	0	25
3	West Midlands	Primary	0	0	0	0	0
		Secondary	40	19	190	10	259
4	Southwest	Primary	1	0	105	0	106
		Secondary	1	2	10	4	17
5	Southwest	Primary	0	0	0	0	0
		Secondary	15	9	70	13	107
	Total		67	37	492	30	626

preference for primary school teachers was lower ($M=1.48$, $SD = 0.73$) than for secondary school teachers ($M=2.24$, $SD = 0.75$). The effect was statistically significant ($U=64029$, $p < 0.001$), with a large effect size (eta squared = 0.22) suggesting that primary school teachers generally favoured earlier introduction of CCE into the curriculum.

The average value of CCE age preference for teachers whose subject area already explicitly refers to climate change in their curriculum (Science and Geography) was higher ($M=2.34$, $SD = 0.80$) than for other teachers ($M=1.92$, $SD = 0.81$). The effect was statistically significant ($U=32181$, $p < 0.001$), with a small to medium effect size (eta squared = 0.03) suggesting science and geography teachers generally favoured a later introduction of CCE into the curriculum.

Views on which subject area(s) should be involved in delivery of CCE

Table 2 shows the percentage of respondents favouring inclusion in each subject area based on responses to Question 2. The two most popular subjects for inclusion of CCE were Science and Geography, which are the two subjects in the National Curriculum where there is also already a direct reference to climate change. Based on our measure of “preference for cross-curricularity” obtained by calculating the number of subjects selected by each teacher ($M=6.25$, $SD = 3.16$), most teachers (51%) favoured a cross-curricular approach that involved six or more subjects delivering CCE.

We detected no differences between groups of teachers in respect of this preference for a cross-curricular approach. The average value of preference for cross-curricularity for primary school teachers was higher ($M=6.39$, $SD = 3.25$) than it was for secondary school teachers ($M=6.18$, $SD = 3.12$) but this difference was not statistically significant ($U=38,689$, $p=0.379$). The average value of preference for cross-curricularity for teachers whose subject area already explicitly refers to climate change in their curriculum (Science and Geography) was higher ($M=6.89$, $SD = 3.27$) than for other teachers ($M=6.12$, $SD = 3.13$) but this difference was also not statistically significant ($U=27184$, $p=0.133$).

CCE status for funding in relation to some other curriculum areas

Based on responses to Question 3, the percentage of teachers who placed each curriculum area first and second in their priority for additional resources is shown in Table 3. As a priority for allocating resources, teachers believe climate change is second only to basic literacy.

We detected no differences between groups of teachers in the generally high priority they placed on CCE for funding. The average value of funding priority (the order of ranking) for CCE for primary school teachers ($M=2.77$, $SD = 1.26$) was very similar to that for secondary school

teachers ($M=2.79$, $SD = 1.29$) and was not statistically significant ($U=25759$, $p=0.860$). The average value of funding priority for teachers whose subject area already explicitly refers to climate change in their curriculum (Science and Geography) was higher ($M=6.89$, $SD = 3.27$) than for other teachers ($M=6.12$, $SD = 3.13$) but this difference was also not statistically significant ($U=16801$, $p=0.249$).

Current engagement with students about climate change

Agreement with statements 1 and 2 in Table 4 provide a sense of ongoing engagement with CCE amongst teachers in England at the time of completing the survey in 2020, which seems considerably higher than that reported for US teachers in 2019.

Levels of a Agreement with other statements in Question 4 are displayed in Table 5.

Our general measure of “climate change belief” (out of a maximum of 25) for each respondent appeared generally high ($M=23.51$, $SD = 2.47$) and indicated acceptable reliability according to McDonald’s omega ($\omega = 0.79$). We detected no difference in the level of belief between groups of teachers. Belief amongst primary school teachers was higher ($M=23.73$, $SD = 2.11$)

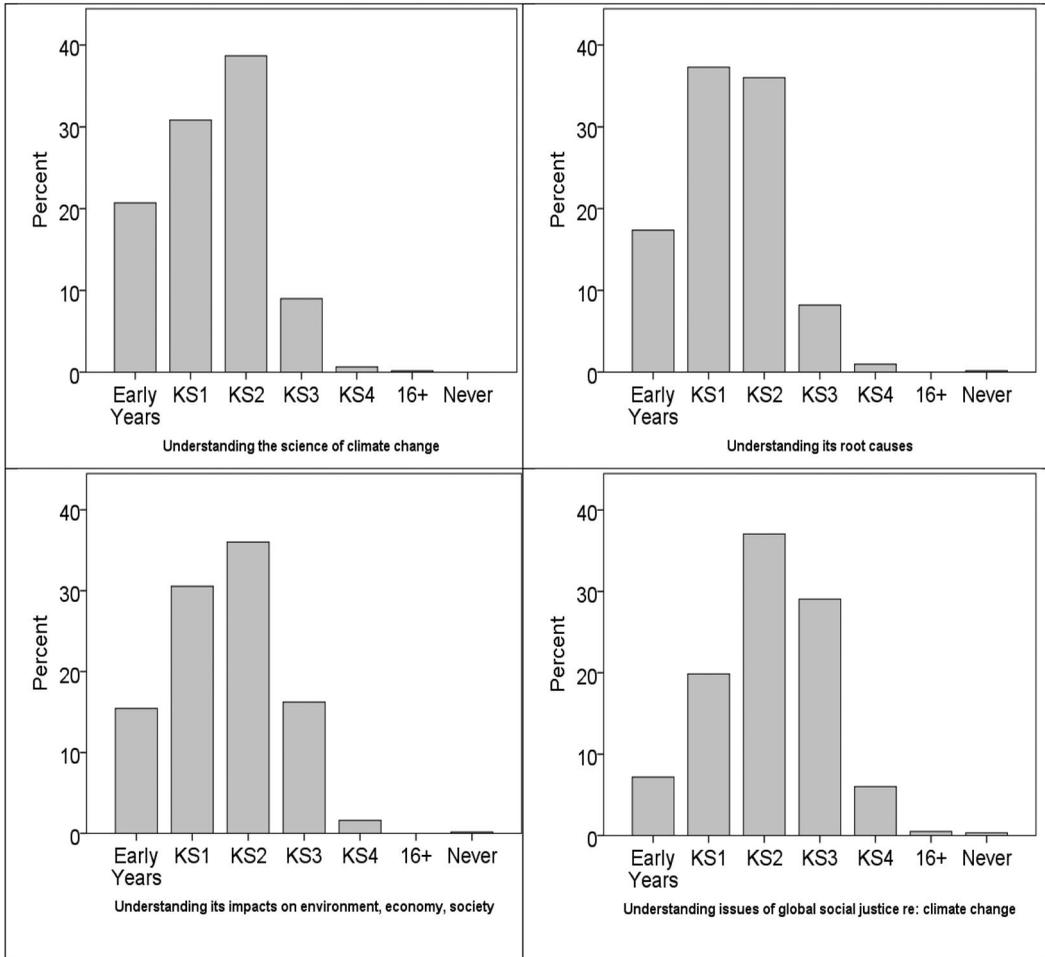


Figure 1. Distributions of teachers’ views regarding when (if ever) specific examples of understanding and participation should first be encountered in CCE.

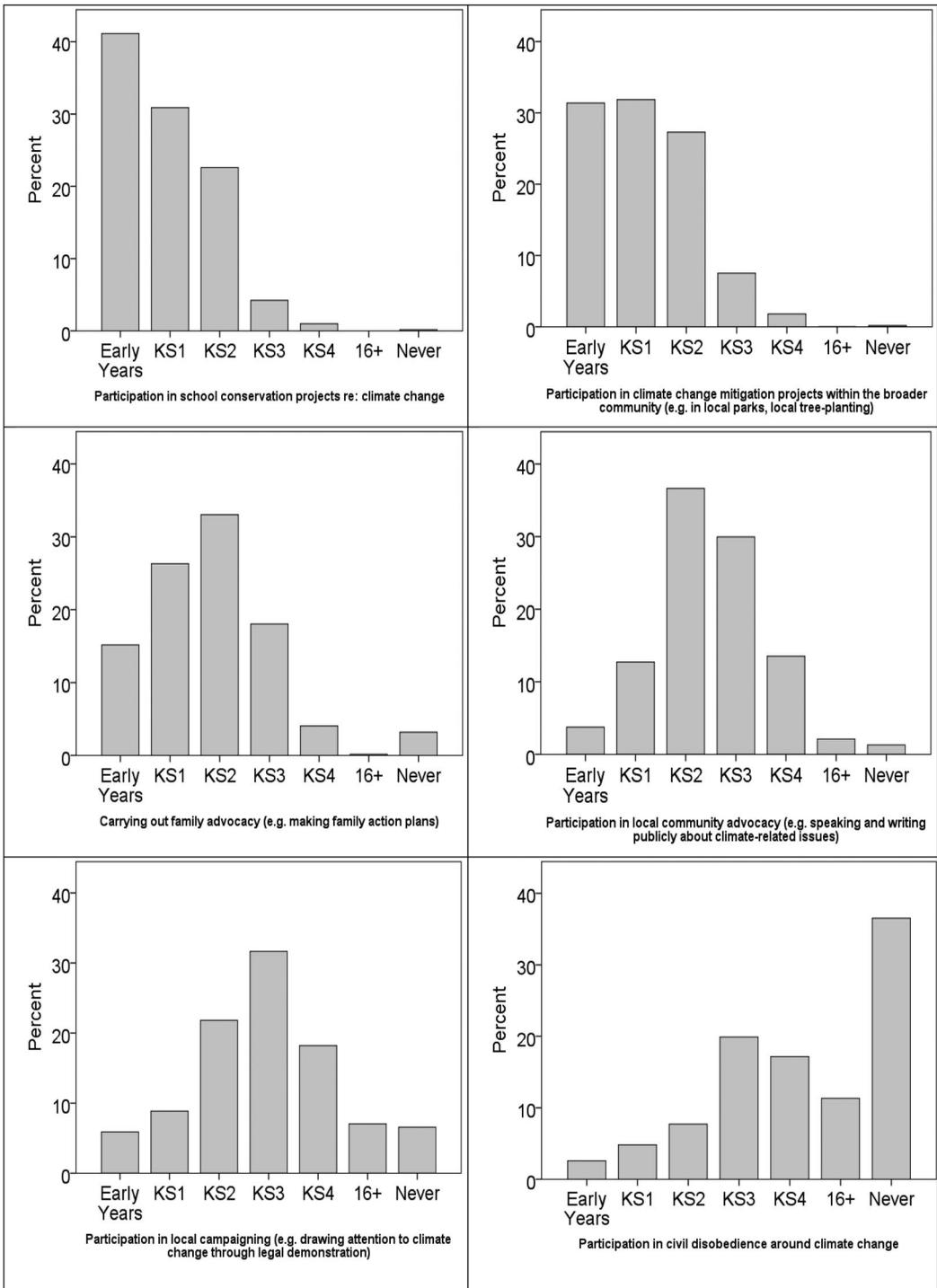


Figure 1. Continued.

Table 2. Percentage of teachers favouring the inclusion of CCE in each subject area.

Subject Area	% favouring inclusion of CCE in subject
Science	96.0
Geography	95.2
Citizenship	85.0
English	62.6
Design and Technology	54.6
History	54.3
Art	45.2
Mathematics	35.9
Computing	32.6
Foreign Languages	23.2
Music	21.1
Physical Education	18.9
Nowhere	0.0

Table 3. The relative priority teachers assigned to curriculum areas for allocating additional school funding.

	% UK teachers placing as 1 st priority	% US teachers placing as 1 st priority*	% UK teachers placing as 2 nd priority	% US teachers placing as 2 nd priority**
Basic literacy	42.2	23	17.7	29
Climate change	19.3	5	21.0	7
STEM	18.4	29	26.5	29
Finance	11.6	21	14.7	24
Sex	6.7	6	19.4	6
Other	1.8	2	0.6	4

Note: US data is provided from the NPR/IPSONS poll (2019) for convenient comparison.

*For 1st priority, the US survey also included "My school has plenty of resources to teach all subjects" and "don't know" which accounted for 9% and 3% of responses, which were not options on this UK survey.

**For 2nd priority, the US survey also included "don't know", which accounted for 2% of responses).

than for secondary school teachers ($M=23.46$, $SD = 2.37$) but this difference was not statistically significant ($U=38032$, $p=0.303$). The average belief of teachers whose subject area already explicitly refers to climate change in their curriculum (Science and Geography) was higher ($M=23.88$, $SD = 1.86$) than for other teachers ($M=23.48$, $SD = 2.36$) but this difference was also not statistically significant ($U=21873$, $p = .068$).

Based on responses to statement 8 "My school encourages us to discuss climate change in the classroom" ($M=3.52$, $SD = 1.11$), primary school teachers appeared to be receiving greater encouragement ($M=3.90$, $SD = 1.13$) than secondary school teachers ($M=3.28$, $SD = 1.12$). This difference was statistically significant ($U=23533$, $p<0.001$), with a medium to large effect size (eta squared = 0.11). Encouragement of teachers whose subject area already explicitly includes climate change in their curriculum (Science and Geography) was higher ($M=3.71$, $SD = 1.02$) than for other teachers ($M=3.48$, $SD = 1.13$) but this difference was not statistically significant ($U=21578$, $p = .208$).

Based on responses to statement 9: "I have the resources I need to answer students' questions about climate change" ($M=2.99$, $SD = 1.17$), we detected no differences in perceptions of the resource availability between primary and secondary teachers. Resourcing was lower for primary school teachers ($M=2.89$, $SD = 1.24$) than for secondary school teachers ($M=2.95$, $SD = 1.23$) but this difference was not statistically significant ($U=35161$, $p=0.184$). As might be expected, resource availability reported by teachers whose subject area already explicitly refers to climate change in their curriculum (Science and Geography) was higher ($M=3.96$, $SD = 0.98$) than for other teachers ($M=2.79$, $SD = 1.11$). This difference was statistically significant ($U=10653$, $p<0.001$), with a large effect size (eta squared = 0.12).

Table 4. Percentage agreement with statements indicating current engagement with students around climate change.

	UK Teachers (current study)				US Teachers	
	Primary	Secondary	Teachers specialising in either Geography or Science	Teachers not specialising in either Geography or Science	Overall	Overall
1. I currently teach (or talk to) my students about climate change	73.7	69.9	95.1	69.2	73.7	42
2. My students have brought up climate change in the classroom this year	71.1	68.9	86.1	69.1	72.0	41

Note: The figure for US teachers is taken from the NPR/IPSONS poll (2019).

Table 5. Percentage agreement with statements related to climate belief, school encouragement, resource availability and feeling comfortable delivering CCE.

Variable	Statements included in Question 4	UK Teachers (current study)	US Teachers
Climate change belief	3. Climate change is being caused by humans	97.4	39% (mostly or entirely by humans)
	4. The world's climate is changing	98.7	82%
	5. We could act to slow climate change	96.0	*
	6. We could act to lessen the effects of climate change	98.4	*
	7. Weather-related incidents are becoming more severe	93.7	62%
School encouragement	8. My school encourages us to discuss climate change in the classroom	57.9	37%
Resource availability	9. I have the resources I need to answer students' questions about climate change	40.0	51
Comfortable delivering CCE	10. I feel comfortable answering students' questions about climate change	75.1	71
	11. I would be personally uncomfortable if I had to teach about climate change	10.6	21

Note: US data is provided from the NPR/IPSONS poll (2019) for convenient comparison.

Combining scores for statements 10 and 11 provided a measure of teachers feeling comfortable to deliver CCE ($M=8.14$, $SD = 1.76$). We tested for a difference in feeling comfortable to deliver CCE between primary school teachers ($M=8.36$, $SD = 1.46$) and secondary school teachers ($M=8.03$, $SD = 1.88$) but the difference in mean values was not statistically significant ($U=34556$, $p=0.161$). As might be expected, however, teachers whose subject area already explicitly includes climate change in the National Curriculum (Science and Geography) did report they felt more comfortable delivering CCE ($M=9.35$, $SD = 0.96$) than other teachers ($M=7.89$, $SD = 1.79$). The difference was statistically significant ($U=9754$, $p<0.001$), with a large effect size (eta squared = 0.14).

Associations of feeling comfortable delivering CCE with belief, school encouragement and availability of resources

Scatter plots suggested associations between feeling comfortable delivering CCE and climate change belief, encouragement from school and resource availability (see [Figure 2](#)).

Resources emerged as the factor most clearly linked to teachers feeling comfortable when engaging with students about climate change. Small-to-medium positive correlations were found between feeling comfortable delivering CCE and belief about climate change ($r(601) = .267$,

$p < 0.001$), and between feeling comfortable delivering CCE and encouragement by teachers' schools ($r(594) = .218, p < 0.001$). A medium-to-large positive correlation was found between feeling comfortable delivering CCE and resources ($r(599) = .442, p < 0.001$).

Discussion

Despite the English National Curriculum making explicit mention of climate change in only two subjects, Science and Geography, most teachers (73.7%) in our diverse sample were already teaching the topic or talking to their students about it. This is a greater level of student-teacher interaction on this topic than the 42% reported in the US in 2018 and may relate to the higher prevalence of belief amongst our respondents in anthropogenic climate change and the possibility of mitigative action. The data may also reflect the high profile of climate change in the UK media leading up to our survey, including the recent involvement of many children in school strikes.

By supporting early introduction into the curriculum, teachers in England appear to afford climate change a level of precedence shared with literacy and numeracy, two other subjects of profound significance for economic and social well-being. In terms of students' understanding, most of our respondents (primary and secondary) judged that the science, root causes, broader impacts and the issues of social justice associated with climate change should be taught from primary school. However, this opinion contrasts with current mandatory provision in England which, like many other countries, does not refer directly to climate change at primary school. Even in countries where CCE is mandatory from an early age, teaching may remain focused on the transmission of scientific knowledge. For example, the curriculum in Singapore requires children to be introduced to global warming when at primary school (Chang and Pascua 2017) but, as in England, it only makes explicit reference to climate change in the Science and Geography curriculum, stopping short of explicit reference to related issues of global social justice. In England at least, this situation cannot be attributed to concerns over age-appropriateness of global social justice per se, since England's curriculum guidance for Citizenship acknowledges that, at KS2, children "develop their sense of social justice and moral responsibility and begin to understand that their own choices and behaviour can affect local, national or global issues and political and social institutions" (Department for Education (DfE) 2015). However, this guidance is non-statutory, does not include attainment targets for monitoring implementation and does not refer directly to climate change. At best, this suggests teaching about civic engagement with climate change might be tackled *only* if time and space allows (Chatzifotiou 2002). The breadth of understanding desired by our teachers reflects Hurd's conceptualisation of scientific literacy as "a civic competency required for rational thinking about science in relation to

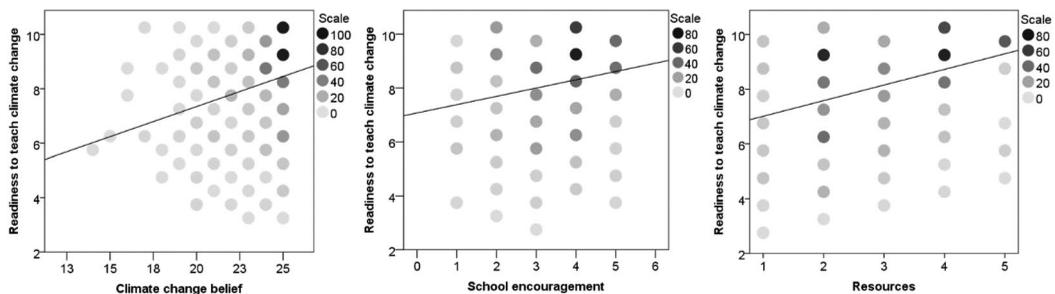


Figure 2. Scatter plots of feeling comfortable to deliver CCE against climate change belief, school encouragement (response to statement 8 in Table 5) and resource availability (response to statement 9 in Table 5).

Note: Shading represents the number of participants corresponding to each data point

personal, social, political, economic problems, and issues that one is likely to meet throughout life” (Hurd 1998). Most teachers in our sample appear to support the development of civic competency in relation to climate change and believe the fostering of such competency in the classroom should begin at an early age.

The support for inclusion of schoolyard mitigation projects and family-level advocacy is consistent with literature suggesting that primary school children are sufficiently developed for engaging in climate action, including private and public spheres as well as advocacy (e.g. Lewis, Mansfield, and Baudains 2014). In terms of students’ participation, the great majority of our respondents considered that climate-related conservation and mitigation projects within school and the local community should first be introduced in the Early Years and Key Stage 1 (up to 7 years). Some developmental evidence suggests effective CCE may benefit from a sound pre-school foundation. The very earliest educational experiences of children may be formative in their attitude to climate change, since culturally transmitted ways of looking at the world appear to develop early. For example, at around five years old, differences in attentional style develop (Duffy et al. 2009) that are associated with mindset (Arieli and Sagiv 2018) along an individualistic-collective scale. This mindset has been used to explain national differences in environmental approaches (Komatsu, Rappleye, and Silova 2019), predicting acceptance of the human causes of climate change in older children (Stevenson et al. 2014) and the likelihood of climate change action in young adults (Xiang et al. 2019).

Our results indicate that teachers in England do not consider climate change projects aimed at social change are too political for them to address, a potential concern suggested by Monroe et al. (2019). Regarding the introduction of participation in advocacy, there is a shift in the responses of our teachers towards a later age, compared to involvement in conservation and mitigation projects, although most still favour the introduction of family advocacy during primary school. Climate change is a politically polarised topic rooted in subcultures and tangled with conflicts of (often commercial) interest. It can be argued, therefore, that any curriculum promoting advocacy of climate change action requires sensitivity in its implementation to minimise exposing children (and their teachers) to situations of potential conflict. The idea that children’s school experiences can prompt intergenerational learning and overcome adult barriers to experiencing climate concern is supported by several US studies. Examples include children (11–14) interviewing their parents about climate change and indirectly raising the level of parental concern about the issue (Lawson et al. 2019), and children (aged 10–12 years) developing and implementing “family action plans” to engage in—and promote— active climate change mitigation at the household level (Trott 2019a, 2019b). Proponents of ‘children as messengers’ and actors of social change also point to the remediating effects of action (Sanson, Burke, and Van Hoorn 2018) to address the negative emotional response of children (Ojala 2012) in relation to climate change.

Our sample of teachers have proposed community advocacy at a point in children’s development that aligns feasibly with extant literature, with views concerning when children might take part in such activities falling in almost equal measure either side of the KS2/KS3 (primary/secondary) transition. Compared with family advocacy, children’s public expression of their views and opinions in local community advocacy requires a higher level of confidence, more sophisticated communication skills and a greater sense of perspective taking. It has been suggested that “small-scale actions at the level of the classroom, the school yard and the local environment” (Chawla and Cushing 2007, 438) are most appropriate in the primary school years, and that young children should not be burdened with having to consider distant environmental problems and institutions beyond their levels of direct experience and comprehension (Chawla and Cushing 2007; Sobel 1996). However, this directly experienced and comprehensible realm can still include local government, whose policy makers are often accessible and where overt change may be more likely and rapid than at national level. It has been demonstrated that children aged 10–12 years are capable of writing and delivering a public speech to local policy-makers and community members in a city council meeting, and so extend their action beyond ‘private

sphere' environmentalism (e.g. recycling and green consumerism) into a more public form of involvement (Trott 2019a, 2019b). This type of activity supports the development of "action competence" which is argued to be essential for liberally educated students who take responsibility for themselves and the democratic management of their society (Jensen and Schnack 1997). Such involvement in taking this kind of action may form part of a political model of environmental education that prepares students for a role in challenging big institutions like government and industry (Chawla and Cushing 2007; Dewey 1916).

UK media reports suggest opinion was divided regarding the appropriateness of the "school strikes" for climate that occurred in 2018-2020 (Mills 2019), but our data suggests a broad swathe of support amongst teachers in England for including such participation as part of children's learning. In our survey, when respondents were asked whether local campaigning should be included in the curriculum, the question was exemplified by reference to legal demonstration. Most of our respondents considered this should occur no earlier than KS3 (ages 11–13). Protest is considered an important tool for drawing attention to issues and achieving political change (UNICEF 2020) and the recent world-wide climate "school strikes" provided dramatic evidence of children's ability to mobilise at scale. These strikes raised global public awareness of the climate change emergency (Thackeray et al., 2020)¹ and an Australian study of 14-year olds suggests such protest can complement education in terms of increasing climate change awareness and climate-friendly behaviour (Deisenrieder et al. 2020). A surprisingly small minority (6.4%) of teachers in our sample considered that campaigning that might include legal demonstration should never appear in the school curriculum. These teachers may share concerns expressed by some UK headteachers in advance of a school climate strike, which included pupils being out of school during term-time, safeguarding issues, the disruption to the school of having to deal with unauthorised absences and pupils missing out on learning (Adams 2019). Indeed, although the fostering of children's active interest in social justice may provide overall benefit for a democratic society, the impacts on an individual actor of their protest can be more uncertain. Activism can be stressful and make some individuals vulnerable, by placing an undue burden on them to address systemic problems (Ballard and Ozer 2016; Kahne and Westheimer 2006). That said, a large study of adolescents and young adults with a mean age of 15 years (Ballard, Hoyt, and Pachucki 2019) has recently shown no association of activism with mental health, and a positive association with subsequent income and education level.

Our data appears to demonstrate considerable support among teachers in England for forms of participatory learning within CCE that push boundaries, some of which might be viewed as intentionally disruptive. Strikingly, just over half (54%) of our sample judged that participation in civil disobedience should be included in the school curriculum, while generally confining this participation to secondary school. Civil disobedience has been defined by Rawls (1999 [1971], 320) as "a public, nonviolent, conscientious yet political act contrary to law usually done with the aim of bringing about a change in the law or policies of the government". The Rawlsian view of civil disobedience requires publicity, non-evasiveness (i.e. the acceptance of legal sanctions), non-violence, and civility. Although it is a contested concept with a range of possible interpretations, much of the debate revolves around the term "civil" (Cidam et al. 2020; Delmas 2018). However, even if morally justifiable in the face of climate change, the idea of encouraging justifiable lawbreaking in a school curriculum raises ethical, legal and practical issues. Unsurprisingly, it is difficult to find examples where anything approaching such a radical curriculum has been attempted, although some have argued for it (e.g. Parkhouse 2017). Given the reference in previous survey statements to exemplars that involved enactment of learning (e.g. tree planting, making family action plans) it seems unlikely, but not impossible, that participants chose to interpret "participation" differently in the context of civil disobedience. It is also possible that teachers may interpret "disobedience" in relation to school-aged children in terms of the breaking of school rules (e.g. through unauthorised absence arising from attending a demonstration). It

is plausible that teachers might only want students to reflect upon civic duty as a rationale for breaking school rules, and the consequences for themselves and others of such actions.

Clearly, it would be possible for teachers to encourage discussion of how some approaches to such disobedience might be better than others, without necessarily sanctioning or authorising such behaviour. Indeed, it has been reported that behaviours teachers find most problematic tend to arise not from rule-breaking as such, but more from violating the *implicit* norms (e.g. the cultural values of respect, obedience, order, and discipline) (Sun and Shek 2012). Nevertheless, even allowing for these possibilities, the finding, as it stands, is both surprising and noteworthy. In the months leading up to data collection, students and teachers would have been exposed to significant media coverage regarding the civil disobedience of Extinction Rebellion, which garnered significant public support, as they attempted to “shut down London” in order to bring attention to climate change (YouGov 2019a). When cultural values and implicit norms move closer to accommodating justified disobedience, it becomes credible that educators might embrace a curriculum that supported older children in their approach to the “civil” breaking of school and societal rules, enabling this to be achieved in a courteous, respectful and safe manner.

The picture that emerges from our data is that of a teacher workforce with an interdisciplinary vision for CCE encompassing social justice issues and participation in social action, but in need of greater resourcing and support to achieve this vision, particularly for those who are not teaching science or geography. Many researchers have written in support of interdisciplinarity (e.g. Hawkey, James, and Tidmarsh 2019; Rousell and Cutter-Mackenzie-Knowles 2020; Schreiner, Henriksen, and Kirkeby Hansen 2005), and our teachers’ enthusiasm for it did not appear to depend on whether they specialised in a subject area currently charged with delivering CCE. Subject specialism did, however, impact on whether they felt comfortable delivering CCE, with only 32% of those teachers outside of the areas of science and geography feeling sufficiently resourced. This concern was despite almost two-thirds (65.7%) of these teachers already teaching (or talking to) their students about climate change with over half (55.1%) considering they were encouraged by their school to do so. Indeed, while climate change belief was high and support from schools moderate, adequacy of resourcing received the lowest score amongst factors explored for their association with how comfortable teachers felt delivering CCE. Figure 2 suggests association of feeling comfortable with all three factors, but only resourcing approached a large correlation. The finding that less than half (40%) of our teachers considered they had the resources they needed to answer students’ questions about climate change (compared with 51% reported in the US) supports the impression of an enthusiastic and ambitious workforce constrained by a lack of means. Respondents ranked the priority of CCE for additional resources highly in relation to other areas, with most (70.4%) placing it in their top three priorities. Even taking into account the differences in survey options offered to respondents that are noted in Table 4, the data suggests a clear difference in attitudes between teachers in England and those in the US. Almost 40% of our teachers in England placed climate in their top two priorities for funding, compared with 12% in the US. The support for prioritising the funding of CCE appeared homogenous across our sample. There were no primary/secondary differences detected and, despite STEM being provided as an alternative option for additional funding, there were no differences detectable between the group of science and geography specialists and other teachers. Although the potential importance of resourcing for furthering CCE in the UK was suggested by the fact that teachers feeling comfortable with teaching climate change was most strongly associated with resource availability, it is not possible from the current study to derive any detailed sense of what resources would be most valued by teachers or, indeed, what resources would be most effective in practice. These might include access to guidance and research, time for planning and cross-curricular collaboration, teaching resources or professional development.

Our study has several limitations worth noting. Firstly, teachers came from schools throughout three regions of England and might, therefore, not be considered representative of England

generally. However, we cannot identify any specific factors that might limit interpretation in this sense. By way of comparison, the US teachers who we compare our data with were drawn from 505 teachers registered on Ipsos' online panel. Sampling teachers' views during their professional development generated a high response that contributes to the reliability and validity of the study. However, this also limited us to using a quantitative survey that could be rapidly completed. This resulted in each construct being explored through responses to a limited number of statements, constraining interpretation of findings. In particular, it is not clear how teachers will have interpreted the term "resources". Based on common usage in schools, "resources" may refer to teaching resources enabling specific classroom activities such as worksheets and PowerPoint™ slides but, as suggested, it can be used more broadly to include, for example, access to information and supervisory support (Hakanen, Bakker, and Schaufeli 2006). Future research might valuably develop more sophisticated methods of measuring the constructs we have investigated in this study (e.g. using a greater range of survey items to measure the construct) and so reveal further insights at a greater level of granularity (e.g. in terms of a multidimensional profile of teacher's readiness to teach CCE).

In summary, we report very high levels of belief in anthropogenic climate change among a teacher workforce in England that, across subject areas, is already engaging with their students about climate change. Moreover, teachers in England support a broader envisioning of interdisciplinary CCE that includes social justice and participation in social action as part of the school curriculum. We have found teachers are currently constrained by under-resourcing and, to a lesser extent, by a lack of support from their schools but are, otherwise, ready and willing to move forward with radical, action-oriented CCE programmes that can help drive change rather than just respond to it.

Note

1. Based on opinions in the popular media Grant, M. (2019, March 16). Can we please stop garlanding children for being wrong? *Telegraph*. <https://www.telegraph.co.uk/news/2019/03/16/can-please-stop-garlanding-g-children-wrong/>, the UK public is not united in support of these demonstrations, although one regional council has sought to regulate the situation by granting authority for children to strike for 1 day a year Brooks, L. (2019, August 16). Edinburgh limits pupil climate strike approval to once a year. *The Guardian*. <https://www.theguardian.com/environment/2019/aug/16/edinburgh-limits-pupil-climate-strike-approval-to-once-a-year>

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ORCID

Paul Howard-Jones  <http://orcid.org/0000-0002-6894-8637>

Justin Dillon  <http://orcid.org/0000-0001-5154-8306>

Finnian Fenton-Jones  <http://orcid.org/0000-0002-0729-748X>

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Appendix 1. Copy of the climate change education survey that was used in the study

Climate change education survey

Primary including Early Years/SecondaryTeaching experience (years): ___ Specialism: ___ Year of Birth: ____

	EY	KS1	KS2	KS3	KS4	KS5	Inappropriate for school curriculum
Understanding the science of climate change							
Understanding its root causes							
Understanding its impacts on environment, economy, society							
Understanding issues of global social justice re: climate change							
Participation in school conservation projects re: climate change							
Participation in climate change mitigation projects within the broader community (e.g. in local parks, local tree-planting)							
Carrying out family advocacy (e.g. making family action plans)							
Participation in local community advocacy (e.g. speaking and writing publicly about climate-related issues)							
Participation in local campaigning (e.g. drawing attention to climate change through legal demonstration)							
Participation in civil disobedience around climate change							

1. When (if ever) should these **first be encountered** in climate change education?

2. Please **circle** the subjects through which climate change education should be delivered:

English	Maths	Science	Design & Tech	History	Geography	Art & design
Music	Citizenship	Computing	Physical Education	Foreign Languages	Never taught	

3. If you believe extra resources are needed to expand your school curriculum, **rank** the following subjects in order of their worthiness for additional resources (use each the numbers 1-6 once, where 1=most worthy, 6=least worthy):

STEM__Basic literacy__ Finance__Sex education__ Climate change__ Other ____

4. How much do you agree (or disagree) with the following statements (**tick one box opposite**)?

-
- Climate change is being caused by humans
 - The world's climate is changing
 - We could act to slow climate change
 - We could act to lessen the effects of climate change
 - Weather-related incidents are becoming more severe
 - My school encourages us to discuss climate change in the classroom
 - My students have brought up climate change in the classroom this year
 - I currently teach (or talk) to my students about climate change
 - I feel comfortable answering students' questions about climate change
 - I have the resources I need to answer students' questions about climate change
 - I would be personally uncomfortable if I had to teach about climate change
-

Strongly disagree

Somewhat disagree

Do not know

Somewhat agree

Strongly agree