

RESEARCH ARTICLE

Wanting to be part of change but feeling overworked and disempowered: Researchers' perceptions of climate action in UK universities

Briony Latter^{1,2,3*}, Christina Demski^{4,5}, Stuart Capstick^{1,2,3}

1 Centre for Climate Change and Social Transformations, Cardiff University, Cardiff, United Kingdom, **2** Tyndall Centre for Climate Change Research, Cardiff University, Cardiff, United Kingdom, **3** School of Psychology, Cardiff University, Cardiff, United Kingdom, **4** Centre for Climate Change and Social Transformations, University of Bath, Bath, United Kingdom, **5** Department of Psychology, University of Bath, Bath, United Kingdom

* latterbi@cardiff.ac.uk



OPEN ACCESS

Citation: Latter B, Demski C, Capstick S (2024) Wanting to be part of change but feeling overworked and disempowered: Researchers' perceptions of climate action in UK universities. *PLOS Clim* 3(1): e0000322. <https://doi.org/10.1371/journal.pclm.0000322>

Editor: Md Wahid Murad, University of South Australia, AUSTRALIA

Received: July 28, 2023

Accepted: November 30, 2023

Published: January 8, 2024

Copyright: © 2024 Latter et al. This is an open access article distributed under the terms of the [Creative Commons Attribution License](https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Data Availability Statement: The anonymised data set is stored in the UK Data Service repository: <https://dx.doi.org/10.5255/UKDA-SN-856632>.

Funding: This work was supported by Cardiff University (BL) and the Economic and Social Research Council (SC, CD): grant reference ES/S012257/1. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing interests: The authors have declared that no competing interests exist.

Abstract

Interest in the relationship between the activities of universities and action on climate change is growing, but until recently there has been little focus on the critical role of researchers, particularly with regards to how research practices and culture can enable or inhibit change. This study addresses this gap, exploring researchers' perceptions of universities' measures to tackle their own emissions, their own engagement on issues surrounding the climate crisis, and challenges and opportunities for researchers to contribute to them. We present findings from a representative survey of 1,853 researchers from 127 UK universities across disciplines and career stages, including comparing responses across these professional differences, and analysis based on over 5,000 open text responses provided by the survey participants. The results show that while most have some knowledge of actions being taken by their universities and feel that universities' public declarations of a climate emergency are making a difference, almost half think not enough is being done. They feel that responsibility for university climate action sits across government, universities and research councils, but almost all researchers are also personally worried about climate change and want to do more themselves to address it. For the most part, they also strongly support climate advocacy by those engaged in research. Yet high workload, uncertainty about what actions to take, perceived lack of agency or power, inflexible university processes and pressure to travel are just some of the many barriers researchers face in taking action. The study highlights how these barriers can be overcome, and the steps universities and researchers can take to better incorporate climate action into their research culture and practices.

Introduction

The actions required to mitigate and adapt to climate change are substantial [1]: while much responsibility lies with industry and government, including for example addressing the role and activities of fossil fuel companies [2], a cross-societal response is needed that connects personal action with broader systemic change [3]. One sector that plays a unique and important role in society is Higher Education (HE), with governments across the world reliant upon and looking to expand this area [4]; in the UK alone, there are 161 HE institutions [5]. Education and research are seen as universities' central functions, but these institutions are also major contributors to the economy and society more broadly [6–8]; as such, many argue that universities can, and should, take climate action across these multiple roles, including but not limited to their own campus operations [9–11].

In the Centre for Climate Change and Social Transformations (CAST), we focus on multiple scales (see Fig 1) in exploring the “systemic and society-wide transformations” needed for climate action: individual, community, organisation, city/region and national/international [12]. These scales intersect and influence each other, with different types of action, levels of agency and rates of change occurring across all of them [12]. The present research is situated in this approach, at different points focusing on the individual, community and organisational levels. While climate action needs to be taken at an organisational level, as reflected by a number of studies addressing this topic, we focus primarily on researchers as a key group, given that little has been explored about them in this context; as part of this, we take the view that researchers together comprise a wider community, with the potential to take collective action and to contribute to larger-scale change. In the literature below, we first explore university climate action and the organisational context in which academic researchers operate, then consider researchers' own engagement with climate action,

Since the early 2000s, there has been increasing interest in sustainability and the HE sector in the UK [13], alongside university action being monitored and ranked by the People & Planet University League [14]. This interest became particularly prominent towards the end of the 2010s, with several universities declaring climate emergencies [15]. That same year also saw the creation of the Climate Commission for UK Higher and Further Education Students and Leaders [16] with the aim of generating a sector-wide response to the climate emergency. Some clear examples of progress do exist, such as divestment (or stated intentions to divest) from fossil fuels by over 100 universities [17] as well as a new college in Wales founded in response to the climate crisis which specifically focuses on sustainable futures [18]. There was a noticeable increase in 2022 in the amount of universities' net zero targets and the communication of their sustainability actions compared to the previous year [19]. However, the majority did not actually meet their sector-wide targets for 2020/2021 [14] and a survey of Higher and Further Education (FE) institutions in the UK found that almost half are not confident or are unsure about whether they will meet their next round of emissions reductions targets from the UK government [20]. Overall, there appears to be a long way to go to achieve the types of changes at a transformational level that some argue are needed for the sector [21, 22]. Despite some action and good intentions, then, it is important to understand why there may be challenges in reducing emissions in the sector. Universities and further education colleges represent approximately 2.3% of the UK's carbon emissions [23] which, alongside their important platform as thought leaders, gives them substantial potential to influence wider action.

Universities have the potential to act in a variety of ways; for example, university advocacy may lead to changes in government policy which in turn has a societal impact [11]. However, universities still have a significant carbon footprint and this and other factors may also impede change in a positive direction [21]; in particular, there is a need to understand the ways in which universities might lock in or promote high carbon culture and practices. One of the



Fig 1. CAST scales of change for climate action.

<https://doi.org/10.1371/journal.pclm.0000322.g001>

barriers to university climate action is cultural [24, 25], that is to say—“pattern[s] or system[s] of beliefs, values, and behavioral norms that come to be taken for granted as basic assumptions” [26]—and is therefore an important consideration in understanding how change can occur, or may be impeded. This cuts across universities as organisations as well as the people within them. It has been argued that culture change may emerge in different ways, arising from individuals [24] or elsewhere in the organisation, as long as there is leadership [27]. Therefore, both those within and outside of senior management and governance structures may have the power to change culture and practices, particularly in a sector where professional autonomy is often emphasised. This idea has been affirmed by Professor Carly McLachlan [28] who argued that academics should not talk about the academic system as though it is separate to them, but accept that they are part of creating the system itself—“We run our sector. [...] We create and recreate many of the structures and they’re not just something that exists separate to us that we need to wait for someone else to change”.

One challenging area that cuts across the individual, community and organisational scales is the internationalisation of universities. This provides collaboration opportunities for

research but at the same time substantially increases institutions' carbon emissions from travel [29], leading to air travel becoming "increasingly entrenched" and part of career expectations [30, 31]. With regards to sustainable conference travel, it is argued that academics to some degree "have the power and freedom to strategize, to organize effective action and to lobby" for change, without having to wait for systemic change [32]. At an institutional level, however, UK universities have become increasingly reliant for their income on international students whose emissions from travel are rising, as the value of UK student income has fallen [33, 34]. While UK universities recognise the significance of travel emissions, their plans to address this are so far minimal [35].

Where cultural change does occur, it is not always immediately or across the whole institution [36]. The ways in which power is distributed and operates is a key reason why carbon emissions, in general, have not decreased despite 30 years of research and efforts to do so [37]. Similarly, in universities, the location and operation of power is a significant factor in forming and sustaining cultures [38] and so affecting the ways in which climate action does or does not progress. There may be barriers to action not only at the different scales but also within them. For example, some individuals may have less agency than others if they occupy more junior or precarious positions.

Universities as organisations and those working within them can engage with the climate crisis and affect change in different ways. Cannon [39] offers several recommendations to universities, including "positively focus[ing] on any barriers [...] to help change cultures and systems that encourage high emissions activities". Individual and community engagement can take many forms. For example, the Climate Action Venn Diagram ("What are you good at? What is the work that needs doing? What brings you joy?") is purposefully applicable to anyone [40] and could generate myriad actions for those in different disciplines and career stages. It is also suggested that researchers have a role in sustainability action in three increasingly challenging approaches—mainstream, critical and beyond sustainability [21]. Staff, and students in particular, are positioned as advocates and collaborators for climate action in UK universities' climate emergency declarations [15]. They have the potential to effect change through advocacy and activism, defined respectively as behaviours that involve "listening, amplifying, and promoting an issue, cause or organization [that are] low-cost or low-risk" and those that are "more direct, committed, and vigorous [that are] high-cost and high-risk" [41] which also "draw public attention and concern to an issue" [42]. Both approaches have been used by academics who have publicly urged governments and universities to take action [43, 44], with some advocating for peaceful civil disobedience by scientists and acting on it [45–47]. Some argue that more academics and students need to engage in activism to create transformations in universities [22, 48], though as we explore below, some literature suggests they face barriers in engaging in environmental activity at all.

There has been relatively little focus on the role of research culture and practices in relation to climate action—or lack thereof—within universities. Knowledge of researchers' perceptions and their role within this is piecemeal, with a mix of participant types and often explored as individual university case studies or in universities' own staff surveys. Looking firstly at staff perceptions of university climate action, some internal sustainability surveys from UK universities indicate positive perceptions but also a significant amount of uncertainty [49–52]. There are also some insights at a global level. A survey of (mainly teaching and administrative) university staff in 51 countries involved with sustainability found that a majority think their university views climate change as important, yet less than a third feel the plans for tackling it are 'well developed' or well implemented in teaching and research [53].

Secondly, regarding researchers' own engagement, some staff in the UK already address sustainability in their teaching and research, feel motivated to be sustainable at work [49] and

understand how to address sustainability [54]. There is some support for climate action or greater sustainability in their job roles [52, 54] but also a lack of professional development to do so [49]. Surveys of researchers across France and academics at a Colombian university found almost universal levels of concern about the climate crisis [55, 56], yet in France this is not translating into corresponding action [54]. Barriers to conducting sustainability research include a lack of power, funding, motivation and a common goal [57–59], while lack of knowledge is a key barrier to reducing personal carbon emissions and taking climate action [49, 60]. Some of these same barriers (funding and a lack of expertise or knowledge) are seen at an organisational level, as well as resistance to change and high workload [20, 61].

Finally, there is some indication of differences between researchers. Evidence from the United States shows differences between subject areas in knowledge, concern, perceived responsibility and comfort in teaching climate change [62]. Broader research with climate change communication practitioners in Australia found mixed views with regards to being seen as advocates as well as facing barriers including funding and measuring impact [63]. However, other research in this area has tended to focus on travel; understandably, given the internationalisation of universities and that researchers may be under implicit or explicit obligations to travel and boost their profile, with calls for researchers from multiple disciplines to act on their own carbon emissions [32, 64–66]. In fact, a global survey of climate researchers found that they fly more compared to non-climate researchers, while also being more concerned about the environmental impact of travel and wanting to reduce how much they fly for work [67]. However, other research found that university staff in general were less willing to change their behaviour around flying the harder the action was (i.e., abstaining from travel was less favoured than using a different mode of transport) [68]. Given that travel is often perceived to comprise a core part of academic practice and culture, it is argued that changes need to be made at different scales, such as participatory creation of travel policies [69, 70].

Despite these various insights from prior research, a thorough understanding of researchers' perceptions of the climate crisis within the UK university sector is lacking, including in the context of how they shape and reproduce research practices and culture as well as the organisational culture in which they are situated. While there is much to be done at the organisational level, given researchers' important role in potentially transforming the sector [21, 22]—and the ways in which they collectively comprise the organisation itself—a greater understanding of their perceptions, engagement and how they relate to research and university culture and practices is needed. Therefore, the aims of the present research are to:

1. Explore researchers' perceptions of universities' measures to tackle university emissions
2. Explore how researchers engage on issues surrounding the climate crisis, including factors that encourage and restrict engagement, and how they might be overcome
3. Explore differences in researchers' perceptions of measures and engagement with regards to their professional characteristics

Given the large number of differences that could be explored for the third research aim, we have outlined a series of hypotheses and exploratory questions to test for differences in specific areas (Tables B, C in [S2 Appendix](#)). These include, for example, whether there are differences between researchers in terms of how relevant they think their subject area is for addressing climate change.

Methods

An anonymous survey of researchers ($N = 1,853$) was undertaken using the online survey platform Qualtrics. The survey was piloted in May 2022 and data was collected between 11th May

2022 and 4th August 2022. Prior to analysis, the data was quality checked to ensure responses are genuine and accurate [71]. For example, responses were removed where participants had not ticked the box to confirm they wanted to submit their answers.

Thematic analysis was used for the qualitative data [72], creating codes and broader themes for each question. Most of the coding was inductive—codes were created and adapted as analysis took place. However, a deductive approach was also used, where there were particular elements of the data that we wanted to draw out. The statistical tests used to explore the professional differences between researchers were independent samples *t*-tests, Mann-Whitney U tests, Kruskal-Wallis H tests, Chi-Square tests, z-tests, a Friedman test and Wilcoxon signed-rank tests. A 0.05 alpha (significance) level was used across these tests. However, to correct for the greater likelihood of finding a statistically significant result from conducting multiple statistical tests [73], the Holm-Bonferroni correction method was applied when testing across the hypotheses and exploratory questions.

Ethics statement

Ethical approval was received by the School of Psychology Research Ethics Committee at Cardiff University (EC.22.03.08.6544). Participants read an information sheet and provided written informed consent before starting.

Sample and distribution

The population for the survey was researchers at UK universities. The aim of this broad approach was to reach participants from across different disciplines, career and level of professional involvement with climate change. Universities UK provided the clearest list of UK universities to work from and use as the sampling frame—140 in total [74]. While participants from other UK universities were eligible to complete the survey, only universities from the Universities UK list were directly contacted. A conservative sample size of 200 respondents was aimed for, based on existing literature which showed a large variation in the number of participants from less than a hundred to over a thousand [75–77].

The process of distributing the survey involved a large amount of detailed, procedural work over several months. The sample design was a convenience stratified sample, in line with similar research with UK academics [78] who approached Heads of Departments in particular subject areas to ask for permission to share their survey directly to staff. For this research, participants were recruited through Heads of Departments (or equivalent) at all 140 UK universities on the Universities UK membership list. However, the email asked Heads of Departments to forward the survey to researchers in their department rather than asking for permission to contact the researchers directly. The aim of this approach was to ensure the survey came from an internal, senior contact who already had a close relationship to their colleagues rather than an external 'cold contact'; we adopted this approach in the expectation it was likely to be more successful for increasing uptake.

The survey was only shared via direct email. It was not shared on social media or by any other means, to ensure that the sample would not be skewed towards the lead researcher's contacts (who mainly work in climate change) or those who use social media but were not in fact employed at universities. A template was created, though each email was personalised and sent manually to encourage positive responses. Follow-up emails were sent four to six weeks after initial contact to universities where there were less than 20 responses. A total of 3,759 emails were sent to senior staff requesting they share the survey; the overall response rate from Heads of Departments or equivalent was 10.7%.

Survey development

The survey questions were developed from the results of individual interviews (not reported in this paper) which were conducted beforehand with staff at UK universities and HE focused organisations. These interviews were in-depth discussion of issues with university-based researchers and staff, which had not been covered in existing literature, in order to understand this topic area.

The survey consisted of four sections, with 25 questions in total and took participants on average 17 minutes to complete (not including the top and bottom 1% response times). It included a variety of different question types including multiple choice, Likert Scale, rank, and open text boxes. Some questions were based on existing work and others were newly created for the survey. The full survey is available in Text A in [S1 Appendix](#), along with references to where questions were adapted or used from existing literature (Table A in [S1 Appendix](#)).

Section one consisted of introductory questions to confirm that participants were eligible to complete the survey and to identify demographic information that would help to see whether there were any differences between how participants answered the other survey questions. The second section focused on climate change within universities, including first and second order beliefs, responsibility, and their knowledge and perceptions of university climate action. The third section focused on researchers' own engagement with climate change, including links to their subject area and role, extent to which they worried about climate change, and their advocacy and engagement. The final section of the survey focused on challenges and opportunities within universities, specifically looking at barriers, incentives and generating ideas.

To encourage survey responses and thank them for their time, all participants that completed the survey had the opportunity to enter a prize draw to win a £100 voucher.

Results

A total of 1,853 survey responses were received, with the open text boxes generating 5,082 comments. Additional tables and statistical test data can be found in Tables B-W, Text A-P in [S2 Appendix](#).

Demographics

Survey responses were received from 127 UK universities across England (105 universities; 1,505 responses), Northern Ireland (2 universities, 43 responses), Scotland (14 universities, 197 responses) and Wales (6 universities, 108 responses). This encompasses 90.0% of the universities contacted (140) and 79.0% of the total universities in the UK (161) [5]. The universities with the highest number of responses (the top 15) are shown in [Fig 2](#); the median number of responses per university is 10.5. See Table A in [S2 Appendix](#) for a full breakdown of responses per university.

The professional characteristics of the survey participants are shown in [Table 1](#). Participants were represented across all the disciplinary groupings used in the survey and are largely reflective of the UK HE sector [79]. Although the survey was about climate change, it was important that it was not unduly skewed towards those who work in the area. The survey was successful in this respect, as the majority of participants do not conduct research on or teach about climate change. The results also show that participants' positions at work are varied across career stages.

A sample size of at least 384 was needed to be representative of the population (254,975 total research staff and PhD researchers) [80, 81] at a confidence level of 95% and a margin of error of 5% [82]. Although demographic data (such as gender, age, ethnicity) was not collected in order to ensure anonymity, there is a broad range of responses geographically and across professional characteristics.

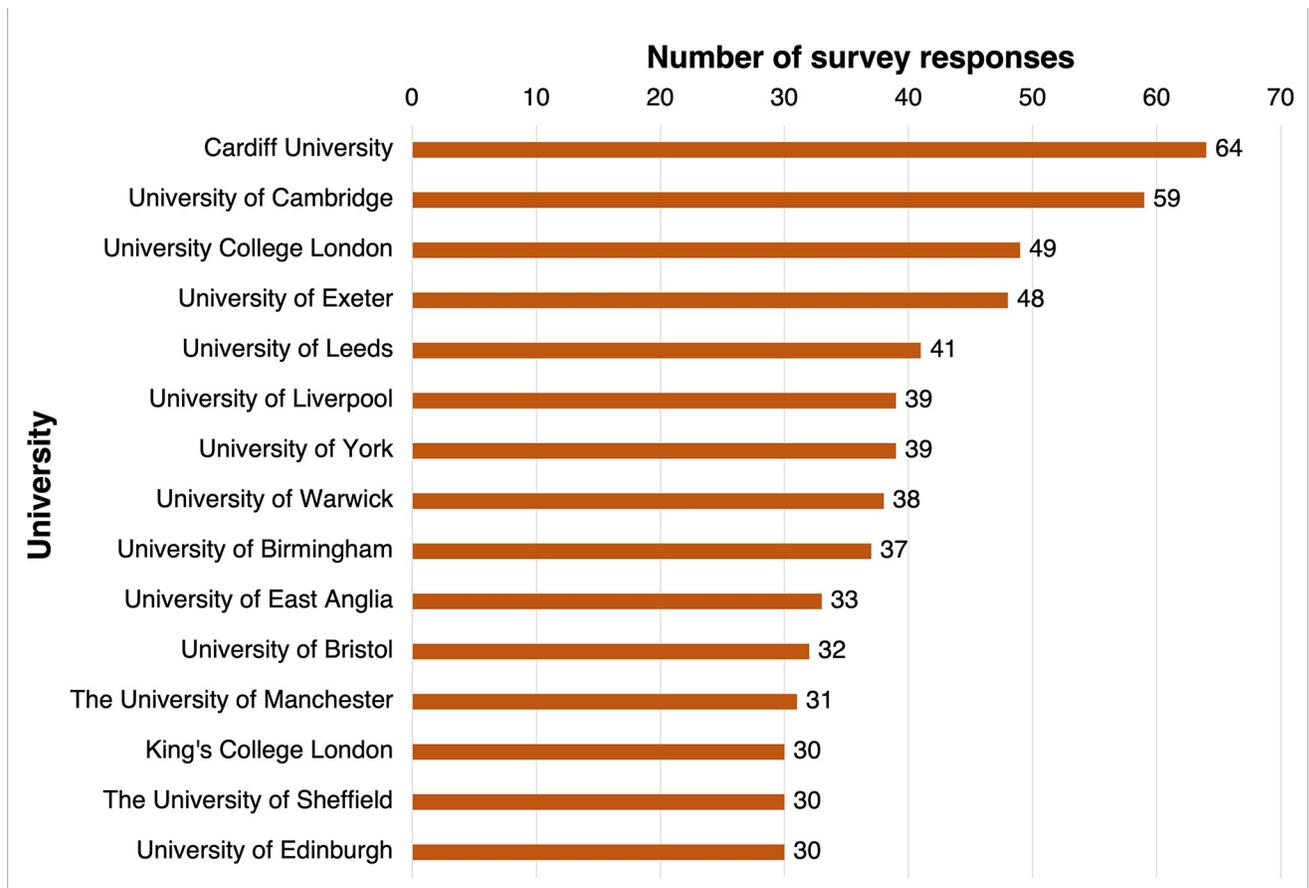


Fig 2. Top 15 universities with the highest number of responses.

<https://doi.org/10.1371/journal.pclm.0000322.g002>

The survey findings are split into three sections below: what researchers think about universities, how researchers engage with climate change, and the differences found across professional characteristics.

Table 1. Professional characteristics of the survey participants.

Characteristic		Percentage and number
Discipline	Arts and humanities	16.3% (302)
	Medicine, health and life sciences	32.3% (599)
	Physical sciences, engineering and mathematics	19.4% (360)
	Social sciences	31.9% (592)
Work involves researching or teaching on climate change	Yes (major part)	11.3% (209)
	Yes (minor part)	23.7% (439)
	No	65.0% (1,205)
Current position	Early-career	43.2% (800)
	Mid-career	28.6% (530)
	Senior/professor	26.3% (487)
	Other	1.9% (36)

<https://doi.org/10.1371/journal.pclm.0000322.t001>

Main findings

Researchers' views on universities. We explored researchers' perceptions of who holds responsibility for climate action in and by universities. We found that 90.7% think that government and policymakers have a high responsibility for addressing climate change in universities, followed by research institutions themselves e.g., universities and colleges (82.3%), and research councils (74.7%).

When asked about universities' attitudes towards climate change, over half of researchers (54.0%) feel that addressing climate change is a priority for their university with regards to its own impacts and emissions, though less so with regards to its research activities (42.9%). Despite a reasonable number of researchers feeling it is a priority for their university, almost half think their universities are not doing enough on climate change with regards to research activities (45.0% versus 28.4% who think they are) and the university's own impacts and emissions (48.4% versus 32.1% who think they are). There were also mixed responses regarding the effectiveness of climate emergency declarations, with the majority (53.3%) feeling that they are making 'only a little' bit of difference in addressing climate change at universities (Fig 3).

We also saw variation in researchers' knowledge about what their university is doing with regards to climate change. Researchers are fairly evenly split on whether they feel they receive

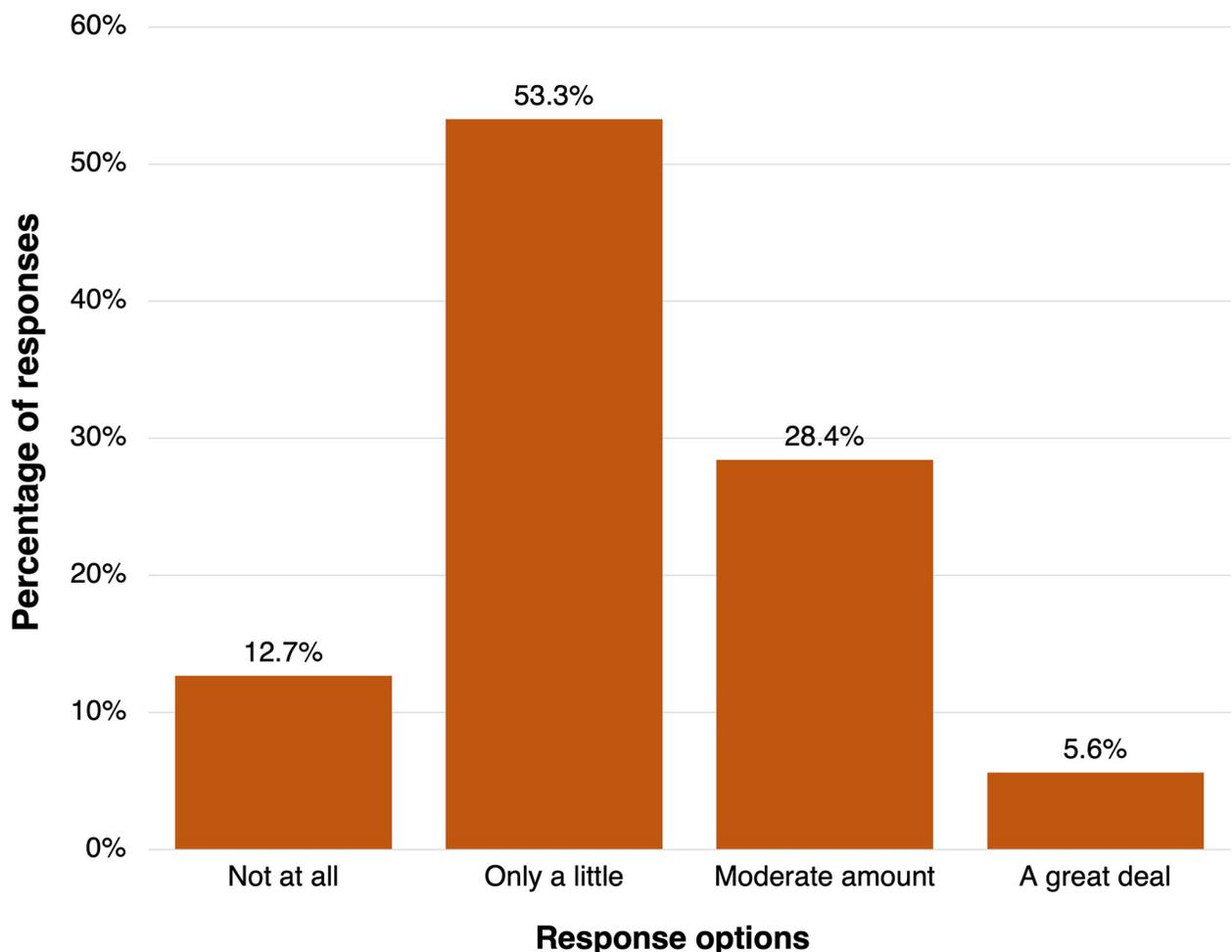


Fig 3. Some universities have declared climate emergencies, stating their commitment to reducing carbon emissions. To what extent do you think this is making a difference in addressing climate change at universities?

<https://doi.org/10.1371/journal.pclm.0000322.g003>

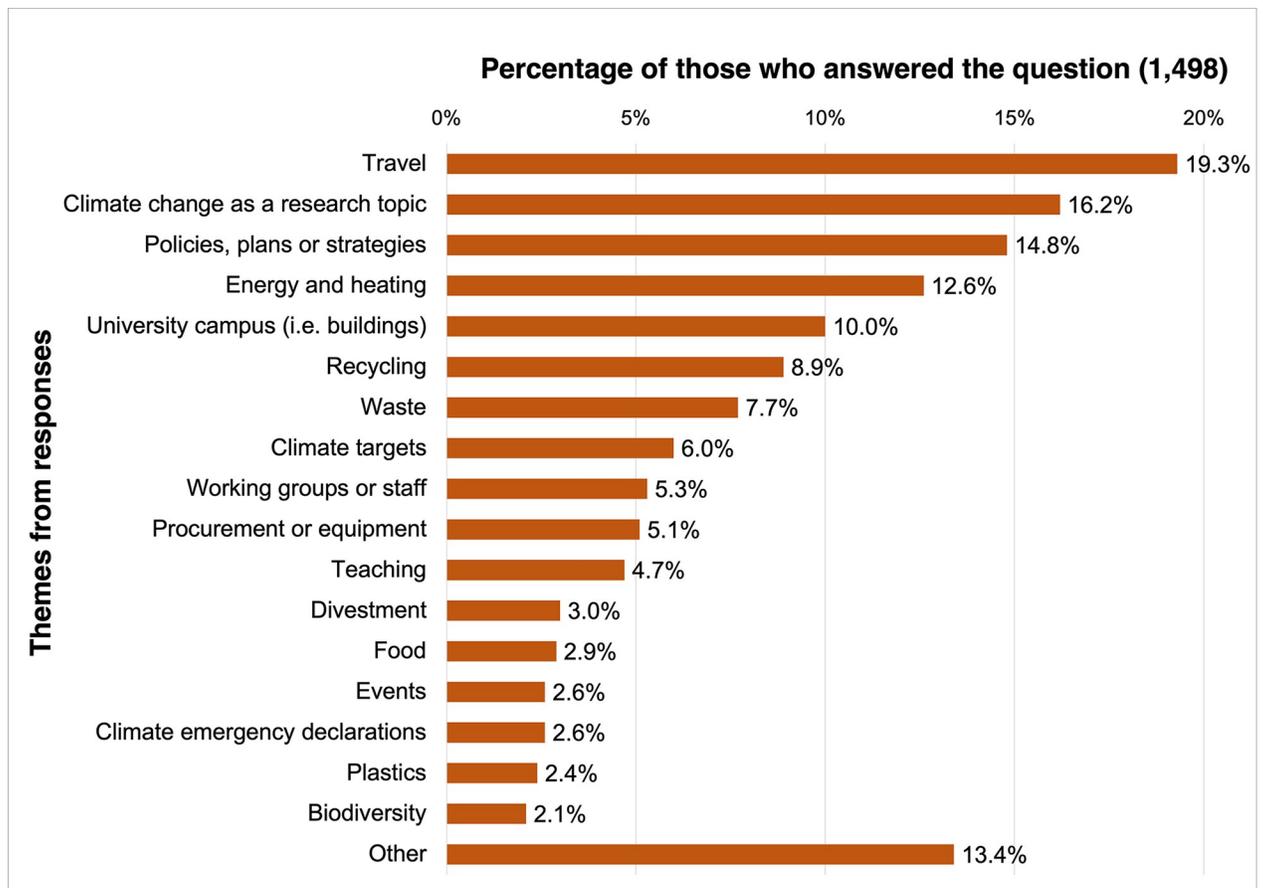


Fig 4. Thematic analysis: What do you know about what your university is doing to address climate change?

<https://doi.org/10.1371/journal.pclm.0000322.g004>

enough information from their university about what it is doing to address climate change, or do not feel this is the case (45.6% do, 40.2% do not). While a majority (69.6%) were able to describe at least one thing that their university is doing to address climate change, 14.5% of answers overall were vague and did not provide detailed information about what they knew (e.g., “there’s a whole strategy” and “various initiatives”). Based on thematic analysis from open text boxes, 18.8% overall stated that they knew nothing (unprompted, N = 1,498). Also, while 5.5% of comments started by saying they felt they did not know much, they nevertheless went on to give some insight into university action. The most common areas of action that researchers knew about can be seen in Fig 4.

More than 100 researchers (7.3%) mentioned contradictions in their university’s approach to climate action, greenwashing, lip service or token efforts, and 5.9% commented about how they felt their university was not doing enough on climate change, for example:

“Largely green washing and trying to find ‘innovations’ to solve climate issues rather than behavioural or institutional change”

- Early career (medicine, health & life sciences)

“The sense of climate emergency is lacking—despite having declared one”

- Mid career (social sciences)

As well as questions about their university generally, we explored perceptions of research culture and practices. 66.2% of researchers think their university does not provide them with information about how to conduct their research in a low-carbon way, compared to only 16.9% who feel that it does. There is a similar perception towards funding, as more than half of researchers (54.7%) think that funding processes do not incentivise low-carbon approaches to research compared to only 14.8% who think they do. The results also show that there is high support (63.8%) for changing the research culture of universities to better address climate change; only 16.2% feel it does not need to change.

Looking forward to how changes could be made, researchers highlighted ways in which their universities could better incorporate climate action into their research practices. There were a very large number of responses ($N = 1,260$) provided on this topic in open text box responses, indicating a high degree of interest and engagement from survey participants. Fig 5 shows the main thematic areas mentioned in these responses.

Using another open text box, researchers also highlighted ways in which they felt they themselves could better incorporate climate action into their research practices. Again, researchers provided a very large number of responses ($N = 1,248$), with thematic analysis showing that 13.3% state they are already doing some things, though 8.7% are unsure and 8.4% feel there is not anything they could do or that it is out of their control.

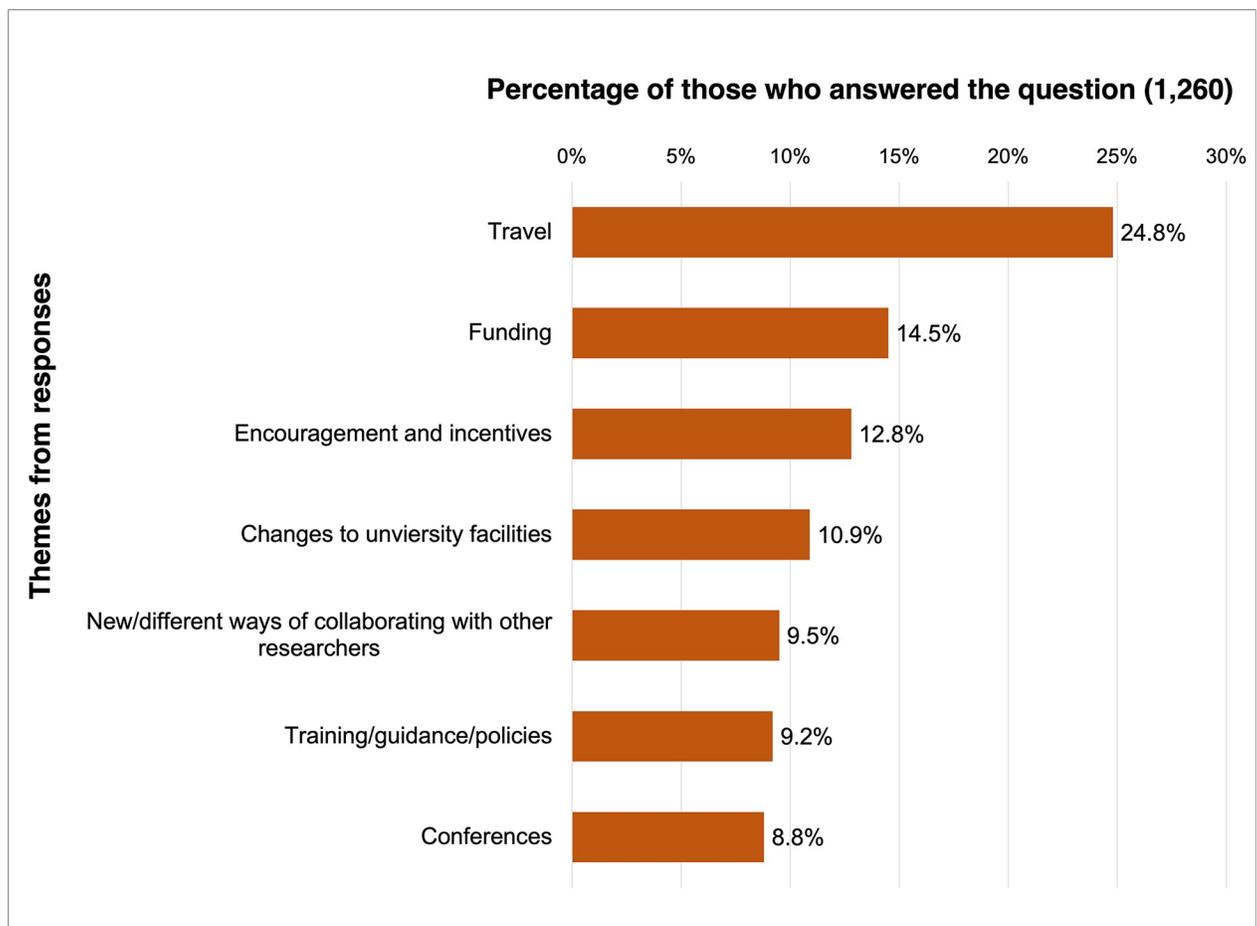


Fig 5. Thematic analysis: In your view, what opportunities are there for your university to better incorporate climate change into your research practices?

<https://doi.org/10.1371/journal.pclm.0000322.g005>

“Resisting pressure to do lots of international travel unless there is an extremely strong justification for it.”

- Early career (medicine, health & life sciences)

“Starting thinking outside the box. For example, some of my research is in nursing and mental health, and when I talked about climate change and nursing I was laughed at. But actually, [in] nursing and climate change there is a lot that we should be exploring!”

- Mid career (medicine, health & life sciences)

The most common types of suggestions from the thematic analysis can be seen in Fig 6.

Researchers' engagement with climate change. The results show that almost all (95.5%) researchers want to do more on climate change within their university, though less—but still a large majority (77.3%)—say they want to do this specifically through their role as a researcher. Most also think their subject area (70.2%) and role as a researcher (67.3%) are relevant for addressing climate change. Yet despite this willingness and perceived relevance, almost half (48.5%) do not know how to address climate change within their role (38.7% feel that they do).

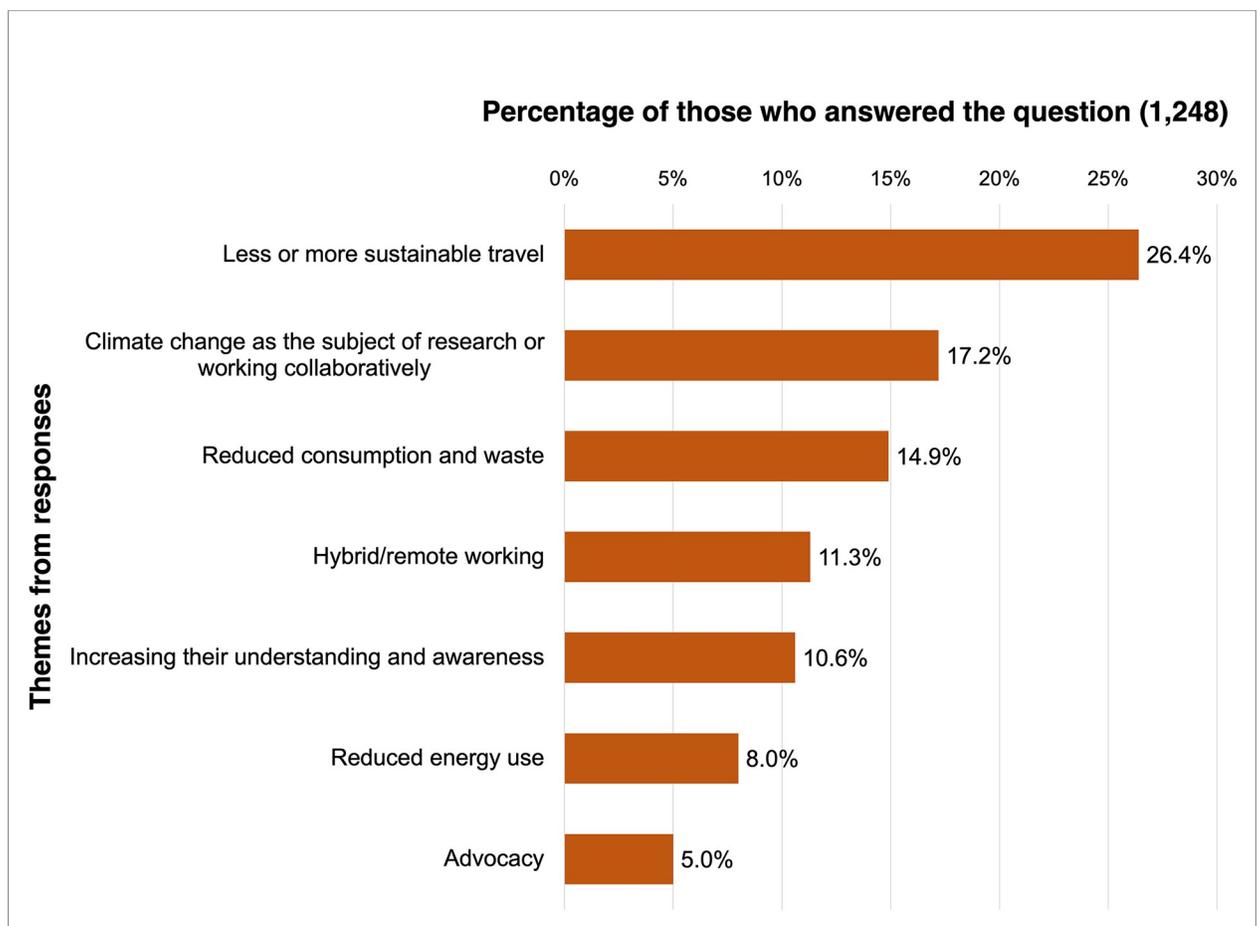


Fig 6. Thematic analysis: As an individual, what actions do you think you could take to better incorporate climate change into your research practices?

<https://doi.org/10.1371/journal.pclm.0000322.g006>

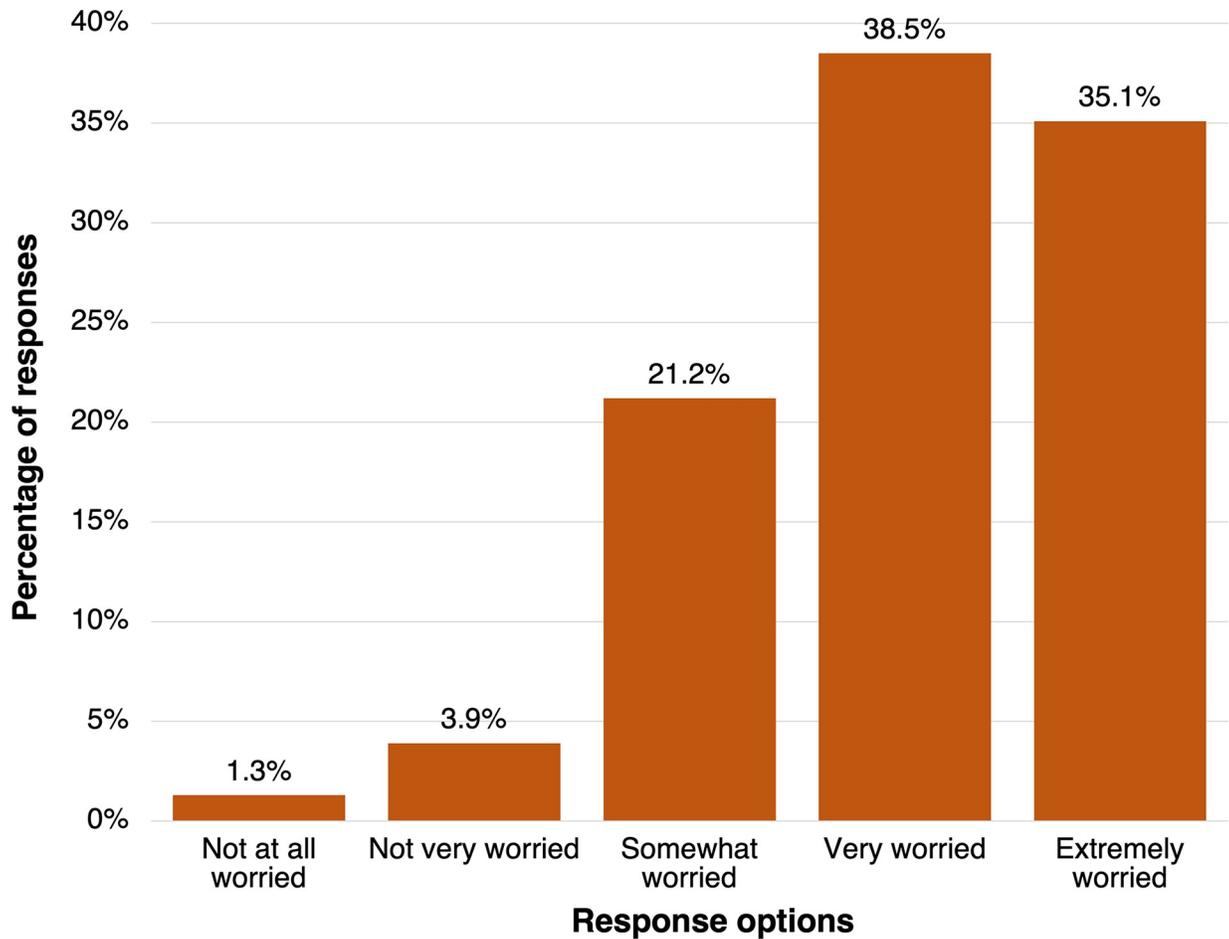


Fig 7. How worried are you about climate change?

<https://doi.org/10.1371/journal.pclm.0000322.g007>

We also found high levels of concern about climate change, with almost all (94.8%) researchers saying that they are extremely, very or somewhat worried (Fig 7).

We found that almost all (95.8%) researchers say their own views about climate change affect their practices, choices and activities at work. For 24.5% of researchers, their views affect them a great deal. Just over half the researchers (50.6%) say their views affect them a moderate amount, and 20.7% only a little. Only 4.2% of researchers say that their views about climate change do not affect them at work.

We explored how researchers think they could use their role to positively address climate change, asking them to rank a series of options in terms of impact. Teaching others, professional practice and research and scholarship were the most highly ranked and therefore perceived to be the most impactful (see Table 2; $\chi^2(9) = 2048.556, p = <.001$). Aside from campaigning and mobilisation, and secondment opportunities, the items were clustered closely together. This shows that there was quite a lot of variation regarding where researchers ranked the activities on the 1–10 scale, averaging somewhere in the middle. There are significant differences between the bottom two items (campaigning and mobilisation, secondment opportunities) and all other items, including each other, showing that these are viewed as the least impactful. There are no significant differences between the top three ranked items. See Tables B–W, Text A–P in S2 Appendix for full results. Additionally, 26.6% of researchers felt

Table 2. How do you think you could use your role to positively address climate change?

Please rank the following items, with 1 being the highest impact and 10 being the lowest impact.	Mean Rank
Teaching others (directly teaching about climate change)	4.44
Professional practice (applying sustainability principles to your work)	4.66
Research and scholarship (directly researching about climate change)	4.83
Application of knowledge/innovation (practical implications of your research beyond your institution)	4.98
Community engagement (working with people or organisations outside of the university)	5.01
Personal action (using knowledge gained in your role to inform your personal actions)	5.20
Campus sustainability (engaging in university climate change processes)	5.27
Awareness raising with the public	5.37
Campaigning and mobilisation	6.67
Secondment opportunities	8.58

<https://doi.org/10.1371/journal.pclm.0000322.t002>

that in their role, they do not or could not have a positive impact in addressing climate change at all.

We also explored researchers' perceptions of their peers, which revealed a great deal of uncertainty. Many researchers neither agreed nor disagreed on the following measures: that addressing climate change at work is a priority for other researchers (43.4%), that other researchers know how to address climate change (44.6%) or are reluctant to address it (48.4%) in their roles; this finding was affirmed by open text responses, for example:

"I [. . .] have no sense of what my colleagues in other departments are doing about climate change."

- Mid career (arts & humanities)

Nevertheless, there is a very high level of peer support for climate advocacy by other researchers. When asked to what extent they think it is appropriate for researchers to advocate for university action on climate change, the majority (54.2%) feel that it is very appropriate, 37.3% moderately appropriate, and 6.6% only a little. We also found that more researchers placed a high responsibility on senior academics and researchers (50.2%) to address climate change in universities, compared to early career researchers (26.2%).

Researchers say that they face multiple barriers to doing more on climate change within their universities (Fig 8; N = 1,443), though 16.2% say they face no barriers at all. Percentages below are of the whole sample.

High workload is the biggest barrier (57.5%), followed by uncertainty about what actions to take (45.5%), lack of agency or power (37.1%) and inflexible university processes (32.2%); for example:

"For something to be a priority something else has to be dropped out as I am only human"

-Senior/professor (arts and humanities)

However, societal issues were also highlighted as barriers such as the marketisation of universities, government policies (or lack of government action), and capitalism. Although numbers were relatively low as a proportion of responses, it is important to note that some people highlighted personal issues as barriers including caring responsibilities, disabilities and health issues.



Fig 8. In your view, what barriers do you face in doing more on climate change through your role in the university? Please select all that apply.

<https://doi.org/10.1371/journal.pclm.0000322.g008>

We also explored what would incentivise researchers to do more on climate change through their roles at work (Fig 9).

The greatest incentives for more than half of researchers to do more on climate change through their roles, are knowledge of what actions to take (51.6%), more institutional support (50.9%) and reduced workload (50.2%). A small amount (5%) of researchers provided open text box responses; there was an emphasis on having a supportive environment in a number of different ways such as better working conditions, flexibility, training, collaboration, conversations, and genuine change from the university:

“More institutional support—with a huge caveat; it would need to be genuine.”

–Senior/professor (social sciences)

“Transparent and explicit policy supporting slow travel”

–Early-career (medicine, health and life sciences)

Through open text box responses, we also found that the survey itself provided an incentive for some researchers to think about or act on the issues raised, with the realisation that they may have not engaged with this topic before (how climate change relates to research practices and culture).

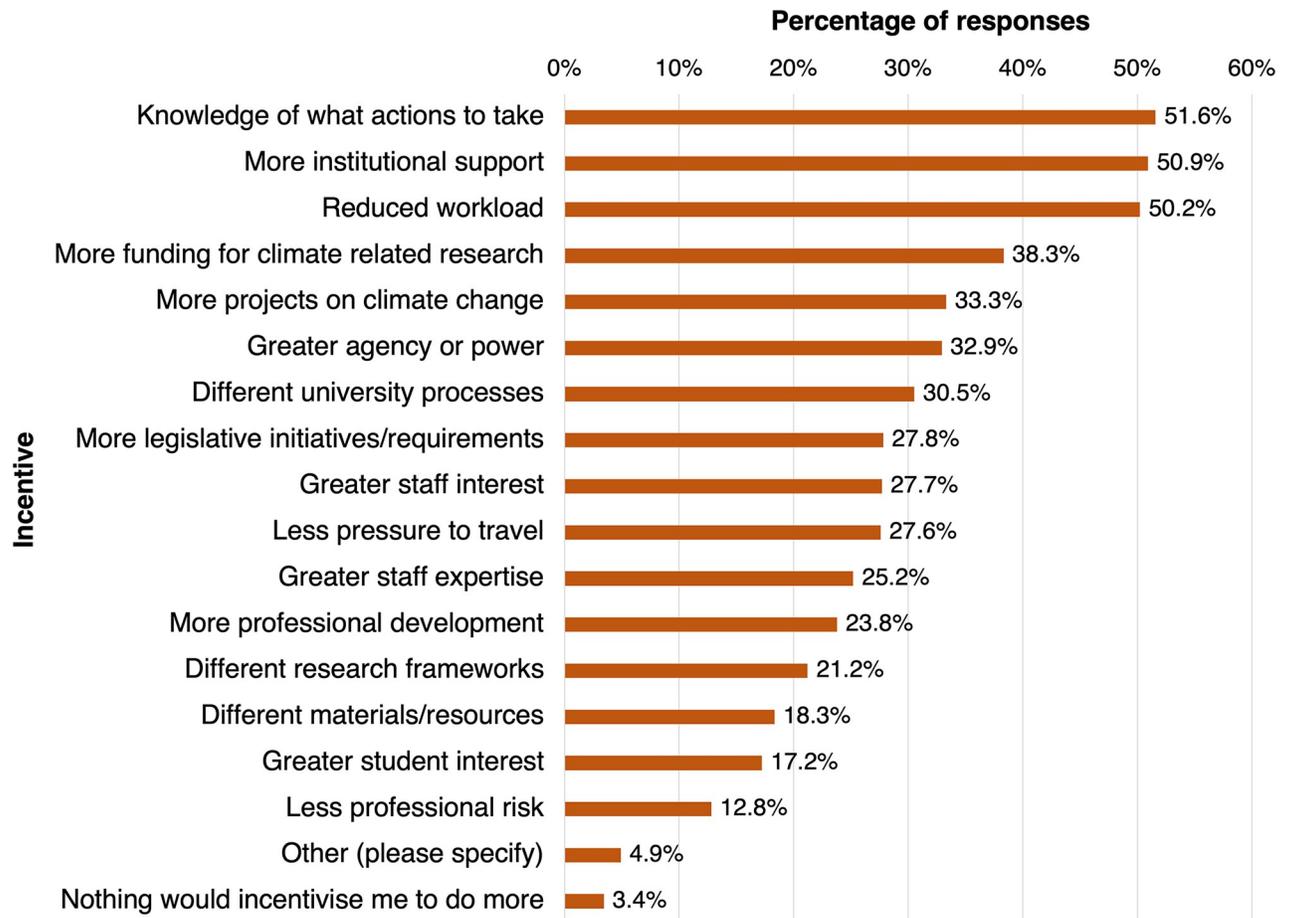


Fig 9. Percentage of researchers who say that these items would incentivise them to do more on climate change through their roles in their university.

<https://doi.org/10.1371/journal.pclm.0000322.g009>

Professional differences between researchers. There are several differences between researchers based on whether they work on climate change or not, their career stage and their subject area. See Tables B-W, Text A-P in [S2 Appendix](#) for full results.

Climate vs non-climate researchers. We compared responses from climate and non-climate change researchers across several questions. We found that compared to non-climate researchers, climate researchers are more likely to be worried about climate change, think they know how to address it at work, that their role as a researcher and their subject area are more relevant for addressing it, think their work has or could have a positive impact in addressing it, and feel it is appropriate for researchers in general to advocate for university action on climate change (see [Table 3](#)). They are also more likely to think that a lack of funding for climate related research and inflexible university processes are barriers to them taking climate action at work. These differences can clearly be seen when comparing combined percentages between climate and non-climate researchers ([Fig 10](#)), all of which are statistically significant ($p = 0.003$ for worry, $p = < .001$ for all others).

We also found that non-climate researchers are more likely than climate researchers to say that uncertainty about what actions to take and lack of staff expertise are barriers to them taking climate action at work. Again, these differences can be seen when comparing percentages between the two groups of researchers ([Fig 11](#)), both of which are statistically significant ($p =$

Table 3. Statistical test results for measures comparing climate to non-climate researchers.

Question	Mean (mean ranks for advocacy)	Degrees of freedom	Test statistic (* <i>t</i> -test, **Chi-Square, ***Mann-Whitney U)	<i>p</i> value
Worry	4.21 (climate) 3.92 (non-climate)	1851	6.538*	< .001
Know how to address climate change at work	3.29 (climate) 4.55 (non-climate)	1851	-16.508*	< .001
Relevance of role	5.48 (climate) 4.33 (non-climate)	1358.579	15.537*	< .001
Relevance of subject area	5.86 (climate) 4.54 (non-climate)	1393.641	16.202*	< .001
Positive impact of work on climate change	Not applicable	2	409.256**	< .001
Appropriateness of advocacy	1029.50 (climate) 869.43 (non-climate)	Not applicable	322054.0***	< .001
Barrier: lack of funding	Not applicable	1	23.040**	< .001
Barrier: inflexible university processes	Not applicable	1	9.283**	.002
Barrier: uncertainty about actions	Not applicable	1	71.013**	< .001
Barrier: lack of staff expertise	Not applicable	1	10.871**	< .001

Note: The mean for 'know how to address climate change at work' is lower for climate researchers because the question was framed as a negative ("I do not know how to address climate change").

<https://doi.org/10.1371/journal.pclm.0000322.t003>

< .001). There were no significant differences between climate and non-climate researchers for the remaining barriers (13 out of 17) or the number of barriers for each group.

Subject area. We explored differences in researchers' responses by subject area and found that there were some significant results regarding relevance of subject area and appropriateness of advocacy. We found that medicine, health & life sciences researchers are less likely than those from social sciences and arts & humanities to think it is appropriate for researchers in general to advocate for university action on climate change ($H(3) = 15.682, p = < .001$). Medicine, health & life sciences researchers are also less likely than researchers from all other disciplines to think that their subject area is relevant for addressing climate change ($H(3) = 128.175, p = < .001$).

Career stage. We also explored differences in researchers' responses by career stage. Senior researchers/professors are more likely than early and mid-career researchers to think they know how to address climate change at work ($H(2) = 90.176, p = < .001$). There are also differences regarding responsibility. Senior researchers/professors are more likely than early and mid-career researchers to think that senior academics and researchers have a high responsibility for addressing climate change in universities ($H(2) = 18.296, p = < .001$), i.e. they recognise their own role. Also, early career researchers are more likely than senior researchers/professors to think that research institutions themselves have a high responsibility for addressing climate change in universities.

The amount of barriers that researchers face differ across career stages. Early and mid-career researchers face a greater number of barriers in doing more on climate change through their role at work than senior researchers/professors ($H(2) = 37.253, p = < .001$)—a median of 4 compared to 3 barriers, respectively.

There are also different types of barriers between career stages. Early career researchers are more likely than senior career researchers/professors to say that a lack of institutional support is a barrier ($X^2(2, N = 1,443) = 11.556, p = .003$). They are also more likely than mid- and senior career researchers/professors to say that a lack of projects on climate change ($X^2(2, N = 1,443) = 18.262, p = < .001$) and uncertainty about what actions to take are barriers ($X^2(2,$

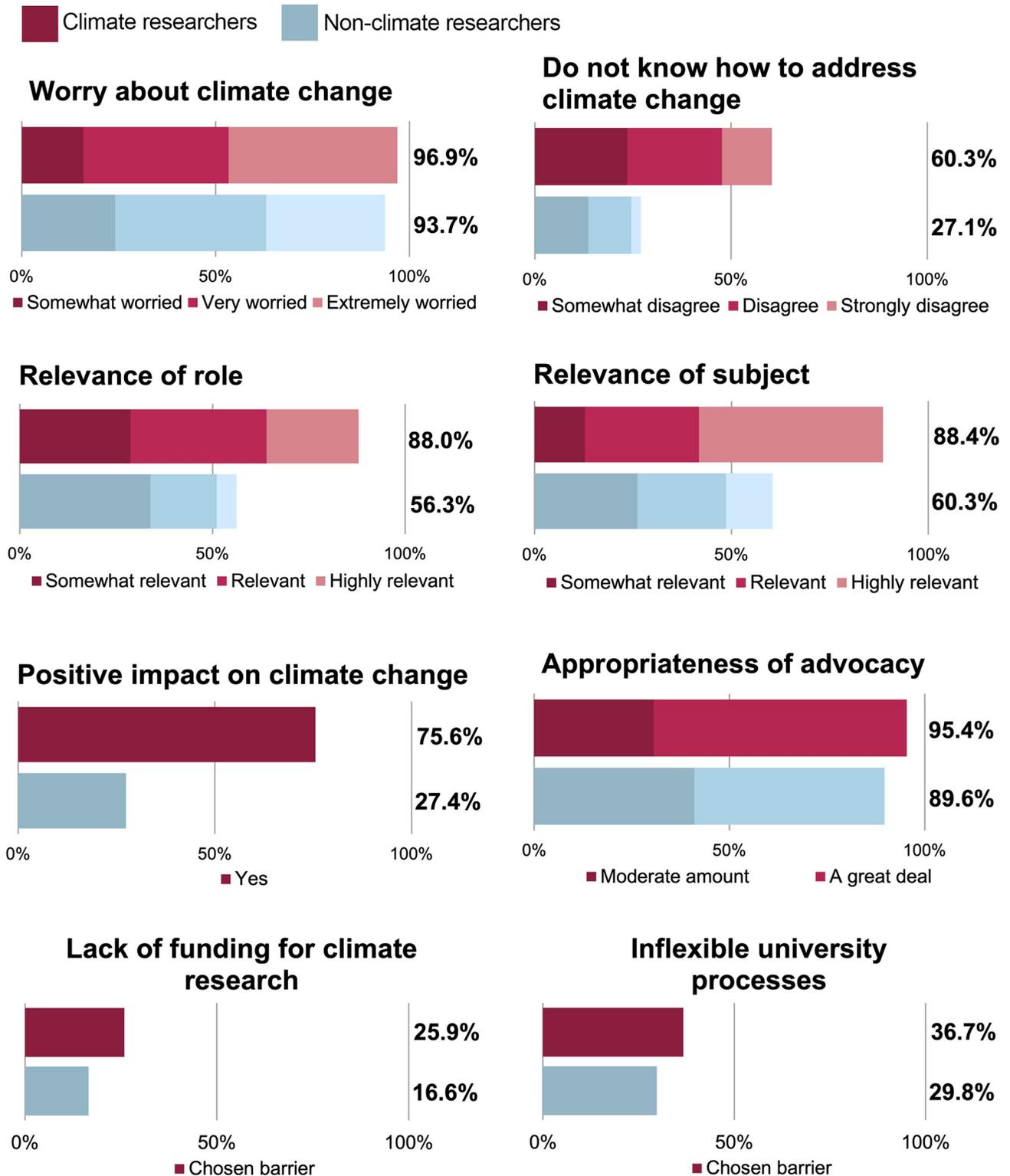


Fig 10. Comparison of climate researchers and non-climate researchers across multiple measures.

<https://doi.org/10.1371/journal.pclm.0000322.g010>

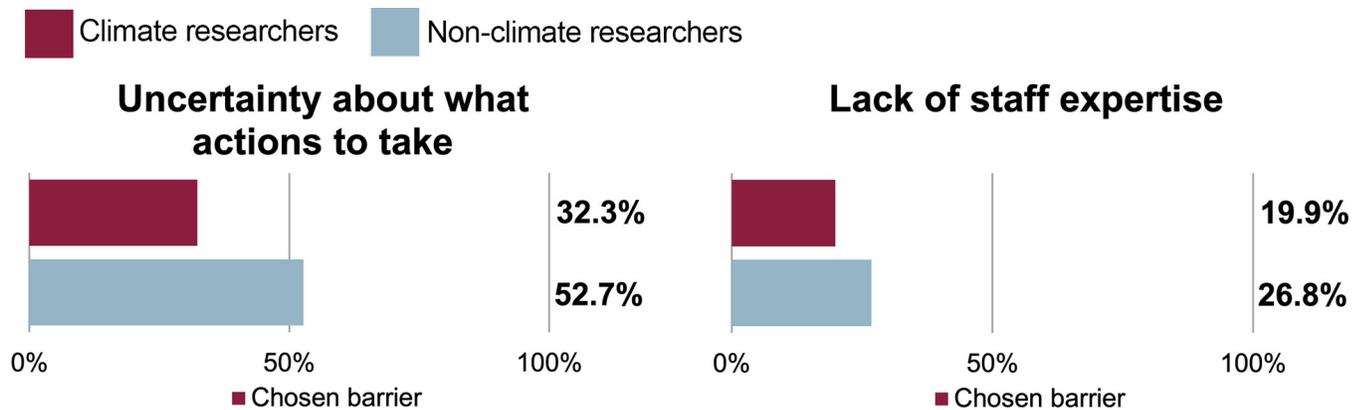


Fig 11. Comparison of climate researchers and non-climate researchers across perceived barriers.

<https://doi.org/10.1371/journal.pclm.0000322.g011>

$N = 1,443$) = 60.266, $p < .001$). Both early and mid-career researchers are more likely than senior career researchers/professors to say that a lack of agency or power ($X^2(2, N = 1,443) = 43.386, p < .001$), lack of materials/resources ($X^2(2, N = 1,443) = 26.189, p < .001$) and too much professional risk are barriers ($X^2(2, N = 1,443) = 24.804, p < .001$). Mid-career researchers are more likely than senior career researchers/professors to say that inflexible research frameworks are a barrier ($X^2(2, N = 1,443) = 11.979, p = .003$) and are more likely than both early and senior career researchers/professors to say that high workload is a barrier ($X^2(2, N = 1,443) = 11.173, p = .004$).

Discussion

This UK-wide survey aimed to explore how researchers in universities perceive and engage with climate change. We found that researchers are highly concerned about climate change and want to do more but need support in overcoming multiple barriers to doing so which cover their personal knowledge (uncertainty about what actions to take) as well as broader cultural and practical issues (high workload and lack of agency/power). Also, overall, researchers have mixed perceptions of universities' climate action, with a fairly good (albeit surface level) knowledge of actions being taken but the perception that governments, universities and research councils have considerable responsibility to act.

The results offer important new insights into researchers' perceptions of the climate crisis across numerous measures as they explore data that has not previously been collected. When compared to researchers and academics in France and Colombia [55, 56] and university students globally [50], we found that UK researchers' level of climate worry (94.8%) is similar. However, it is higher than the UK public (83%) [83] and even more so when accounting only for those who are extremely or very worried (73.6% compared to 46% general public) [84]. We did not specifically ask about climate anxiety, and while the overall level of climate anxiety for the UK public is low, it is higher for those who are more concerned and therefore may also be a more common experience for researchers [85].

A key finding, though perhaps an unsurprising one, is that the main barrier to climate action for over half of UK researchers is high workload. This is currently a critical issue in the UK—in a survey of University and College Union members, 74% of researchers said they may leave the sector by 2027, mainly due to workload as well as issues regarding pay and casualisation [86]. Other research in the UK and internationally found that a smaller, but certainly not insignificant, number of researchers were thinking of moving elsewhere in the sector or

leaving completely (37% and 36% respectively) [87]. This also supports the suggestion by Urai and Kelly [88] that the nature of modern academia means that academics have no energy to engage with climate change, with these authors also suggesting that new principles for scientific practice are needed to remove barriers to academics acting on climate change, such as changing from being part of the rat race to 'slow scholarship'. Similarly, high workload is a barrier for climate education in primary and secondary schools [89] and is one of the many barriers to universities becoming more sustainable [61].

Concerningly, almost half of researchers state that they do not know how to address climate change within their role and specifically state this as a barrier, as well as identifying knowledge about what actions to take as the most effective way that they could be incentivised to take climate action. This lack of knowledge reflects some existing research [51, 60]. When asked how they could use their role to positively address climate change, actions that related to the core functions of universities (teaching and research) were the most highly ranked, suggesting that researchers are most comfortable in these traditional university roles (i.e., what are commonly seen as universities' central functions). While applying sustainability principles to their work was also the most highly ranked, there is clearly a lack of knowledge about how to do this. There is important knowledge creation about climate change from the sector but it is argued that there is "a shortage of the skills needed to drive change from within" [70]. Given the survey results, this should also include guidance about how to practice research sustainably. It is suggested that there is a role for Government here, with The Royal Anniversary Trust [70] recommending the creation of an online hub of practical advice and information. Yet there is an existing resource—the Research for a Future toolkit—developed by academics themselves along with activists and other researchers as part of the organisation Faculty for a Future, to provide guidance for researchers around the climate crisis [90]. This toolkit was published after the survey took place and starts to fill an important gap. However, given that it is purposefully quite general (providing overall tools and advice rather than specific methodologies), there is still a need for more tailored advice for how researchers in different subject areas and at different career stages can better address the climate crisis in their research practices.

Another barrier, for just over a quarter of researchers, is pressure to travel. By acting on travel, the university sector can not only reduce its emissions and change its culture in this area—as it has been argued is needed [35, 64, 70]—but at the same time enable researchers to better address climate change in their roles by reducing this barrier for them. Travel has hitherto been a central part of research culture, and the majority of researchers feel that the research culture generally in their university needs to change in order to properly address climate change. There is a need for the sector to help researchers understand how to conduct their work in a low-carbon way but also be enabled to do so—as the majority feel that funding processes do not incentivise low-carbon approaches to research. This is an area that has recently been highlighted to Government to act upon, as "currently, no explicit consideration is required of the carbon impact of most research funding bids, including UKRI" [70].

The survey showed multiple differences between researchers who work in climate change and those who do not. Non-climate researchers feel more uncertain about what climate actions to take and that what they do is less relevant. Also, climate researchers are more than twice as likely to feel they know how to address the topic at work and almost three times more likely to think their work can positively address it compared to non-climate researchers. They also feel their subject area is much more relevant for addressing climate change, reflecting findings in the education sector where some primary and secondary school teachers in the UK struggle to see how climate change links to their disciplines [89]. While it could be argued that these differences are to be expected given what they do in their roles, efforts should be made to reduce the gap between them so that those not working in climate change feel better able to contribute

their own expertise; after all, climate change is an issue that spans all subject disciplines. For example, McCowan, Leal Filho and Brandli [91] recommend that universities incorporate climate change across subject areas in research and teaching as one way to overcome barriers to climate action in the sector. Involvement from different types of researchers will allow for different ideas and forms of engagement, both within and outside of universities.

The results also identified some differences between the positions of researchers which were not apparent in existing literature. Early and mid-career researchers perceive a greater number of barriers in doing more on climate change than senior researchers/professors. While both face slightly different barriers, there is overlap, with both more likely than those in senior positions to say that a lack of agency or power, lack of materials/resources and too much professional risk are barriers. Early career researchers in particular face a lack of institutional support and lack of projects on climate change as well as uncertainty about what actions to take, whereas the biggest barrier—high workload—is faced more by mid-career researchers. Other research has shown that early career researchers in the UK face high workload, lack of recognition for their work, and negative impacts on their personal lives, and it is suggested that more funding for this group is needed [87]. While our research did not find that high workload was a particular barrier to climate action for early career researchers, we did not list impacts on personal wellbeing as a potential barrier. Overall, this suggests that different approaches are needed to enable researchers at different career stages to engage with climate change.

Exploring differences between subject areas also highlighted an interesting finding. It is unclear why medicine, health & life sciences researchers do not think their subject area is as relevant for addressing climate change compared to those in other disciplines. There was a similar finding for some health sciences and dental teaching staff in the United States, who felt both less comfortable and less responsible for teaching climate change than those in some other subject areas (science, agriculture & natural resources, and engineering) [62], though potential reasons for this were not expanded upon. Several barriers to sustainable healthcare education have also been identified in the literature, including negative attitudes and a resistant organisational culture, with a call for future research to understand these further and how to overcome them [92]. In contrast, the Lancet Countdown [93] makes the health aspects of the climate crisis very clear. From a student perspective, one study found that only 1.8% of students at a London university felt they had been taught about sustainable healthcare, despite it now being a requirement for the curriculum [94]. The survey result is also interesting because health is commonly seen as a way to frame climate change [95] and communicating climate change as a health issue can increase public support for climate policies [96]—yet there appears to be a disconnect with medicine, health & life sciences researchers. It may be that this perceived lack of relevance will soon change, given calls for climate change to be better taught in medical schools [97, 98] and a collaboration between the World Health Organization and the NHS to decarbonise global healthcare systems [99]. The survey finding underlines the importance of these initiatives in highlighting the link between health and climate.

It is interesting that while researchers support advocacy by their peers, campaigning and mobilisation were personal actions that were seen to be one of the least impactful. It is unclear whether these are simply perceived as being less impactful without researchers having engaged in these actions or whether researchers have in fact tried to take these actions, but they have not had much impact. This could also suggest that advocacy and activism may be viewed differently by researchers. Despite the high peer support for advocacy, it is unknown to what extent there would be support if this tips into activism, particularly given its low ranking in the positive climate actions researchers could take. This split between advocacy and activism is seen in research from Germany and the USA, with most citizens supportive of climate policy

advocacy from scientists, but they felt that scientists supporting climate protests was not appropriate [100]. However, if universities heed the call to better support academic advocacy and activism [48], it may be that this would enable researchers to feel they could have a greater impact.

Additionally, if researchers are to have a wider community impact, which is one of the pathways for climate action in universities [11], then the extent to which researchers see this as being impactful needs to change given it did not rank as highly as actions that more clearly sit within their academic roles. Although almost all researchers want to do more on climate change within their university, less want to do so specifically through their role as a researcher. This could be linked to several of the barriers mentioned (for example, uncertainty about what actions to take) if they feel it is difficult or not possible to act within the confines of their role, or it could be because some feel that their subject area and role are not relevant for addressing climate change.

The high perceived responsibility for government and policymakers to address climate change in universities is similar to surveys of the UK public, who feel that government are particularly responsible for addressing climate change generally [101]. However, a large majority also think universities themselves, along with research councils, have a high responsibility, suggesting that they feel action needs to come from within the sector as well as through external measures. At the same time, the results show that many researchers think universities are not doing enough, despite climate change being seen as a priority. This may reflect what O'Neill and Sinden [102] call "a cognitive-practice gap [. . .] whereby radical research undertaken within universities is absent in the climate actions they operationalise".

Alongside identifying barriers, it is essential to understand how the university sector can overcome these. The results provided some key insights: for just over half of researchers, having knowledge of what actions to take, more institutional support and reduced workload would enable them to act. There was a very large number of comments from researchers about how they felt their universities and they themselves could better incorporate climate action into their research practices. This is encouraging as an important characteristic of the survey was to hear from researchers directly, in their own words. This shows that researchers have key insights and practical suggestions about how to move forwards that are, as of yet, untapped by universities. This builds on McCowan, Leal Filho and Brandli's [91] suggestion for universities to ensure there are ways for academics to "develop their own sustainability initiatives". Acknowledging that researchers themselves are part of the university system, whether researchers will be able to move from their role of knowledge creation and dissemination (mainstream) to addressing issues of power and inclusion (critical) and even further to being held accountable to those most impacted by climate change and having different priorities e.g., "collaboration over competition" (beyond) remains to be seen [21].

Conclusions

Despite the extensive barriers to researchers being able to engage in climate action at work, there is a way forward. The results outline actions for universities to take: mainly that researchers need more knowledge about what climate actions to take, institutional support to implement this and for the critical issue of high workload to be addressed. The extent to which these changes can be addressed without transforming universities in the way suggested by others [21, 22] is unknown. Yet that does not mean that progress cannot be made. Our findings highlight that there needs to be tailored engagement and solutions for those at different career stages and in different subject areas, including support for those who are not involved climate change research and teaching.

While this research is representative of the UK university sector, it may not generalise well to other countries, and though we have addressed a gap in the literature, we recognise that there is a disparity in climate research between the Global North and Global South [103]. Given the large amount of survey data, it was not possible to explore connections between all the questions or how the wide range of responses differed for every professional characteristic. Therefore, there are likely to be some relationships that have not been drawn out from the data—for example, potential differences in incentives for all groups, and potential differences in barriers by subject area. Also, given the large number of open text box responses, it was unfortunately not possible to do them justice in a single article alongside the quantitative data—particularly regarding how to overcome the barriers identified and future actions that universities and researchers could take to address the climate crisis.

As further action is taken within universities, future research could monitor this to understand and illuminate how change is able to happen. Research could also explore why medicine, health & life sciences researchers do not think their subject area is as relevant for addressing climate change compared to those in other disciplines and how to overcome this. This said, strong action to reduce emissions and involve researchers and universities across disciplinary areas can be taken with the existing evidence we have. This research has implications both for researchers themselves and others able to enact changes to the culture and practices within universities. We hope that the findings allow researchers to gain some understanding of what their peers think about climate change, given their uncertainty around this in the results when explored as a second-order belief. Also, where results show that certain perceptions are widespread or where there are common barriers and ways to overcome them, we hope that this empowers researchers to both initiate and push for change. For universities, we recommend that the insights regarding barriers and incentives to action are taken on board to assist researchers in addressing an area that they are clearly very concerned about and want to take action in. Overall, we hope that this research can contribute towards encouraging researchers and universities to take further action on the climate crisis.

Supporting information

S1 Appendix.

(DOCX)

S2 Appendix.

(DOCX)

Acknowledgments

A big thank you to everyone who took the time to complete the survey so thoroughly, particularly in the open text box responses. Thank you also to those who helped to distribute the survey to your colleagues. We greatly appreciate your time and effort. We would also like to thank the two reviewers whose comments helped to improve the paper and make it much clearer.

Author Contributions

Conceptualization: Briony Latter.

Data curation: Briony Latter.

Formal analysis: Briony Latter.

Investigation: Briony Latter.

Methodology: Briony Latter.

Project administration: Briony Latter.

Supervision: Christina Demski, Stuart Capstick.

Writing – original draft: Briony Latter.

Writing – review & editing: Briony Latter, Christina Demski, Stuart Capstick.

References

1. IPCC. Summary for Policymakers. In: Lee H, Romero J, editors. *Climate Change 2023: Synthesis Report Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Geneva, Switzerland: IPCC; 2023. p. 1–34. Available from: [10.59327/IPCC/AR6-9789291691647.001](https://www.ipcc.org/report/ar6-synergy-report/)
2. Grasso M, Heede R. Time to pay the piper: Fossil fuel companies' reparations for climate damages. *One Earth*. 2023; 6(5):459–63. <https://doi.org/10.1016/j.oneear.2023.04.012>
3. Capstick S, Khosla R, Wang S, van den Berg N, Ivanova D, Otto IM, et al. Chapter 6. Bridging the gap—the role of equitable low-carbon lifestyles. United Nations Environment Programme. 2021. (The Emissions Gap Report). [accessed 21 Aug 2021] Available from: <https://www.un-ilibrary.org/content/books/9789280738124c010>
4. Wotherspoon T. Triple helix or trible jeopardy? Universities and the social relations of knowledge. In: Dzisah J, Etzkowitz H, editors. *The age of knowledge the dynamics of universities, knowledge & society*. Leiden: Brill; 2012. p. 51–71. (Studies in critical social sciences).
5. Amber KP, Ahmad R, Chaudhery GQ, Khan MS, Akbar B, Bashir MA. Energy and environmental performance of a higher education sector—a case study in the United Kingdom. *International Journal of Sustainable Energy*. 2020; 39(5):497–514. <https://doi.org/10.1080/14786451.2020.1720681>
6. Atherton G, Lewis J, Bolton P. Higher education in the UK: Systems, policy approaches, and challenges. House of Commons Library; 2023 Apr. (Research Briefing). [accessed 18 May 2023] Available from: <https://commonslibrary.parliament.uk/research-briefings/cbp-9640/>
7. Boulton G, Lucas C. What are universities for? Belgium: LERU; 2008. [accessed 26 Jul 2023] Available from: <https://www.leru.org/files/What-are-Universities-for-Full-paper.pdf>
8. Harayama Y, Carraz R. Addressing global and social Challenges and the Role of University. In: Weber LE, Duderstadt JJ, editors. *Global Sustainability and the Responsibilities of Universities*. France: Economica Ltd.; 2012. p. 85–96.
9. Adefila A, Chen YF, Dang Q, Dewinter A, Antonelli M, Massari S, et al. Integrating Sustainability-Oriented Ecologies of Practice Across the Learning Cycle: Supporting Transformative Behaviours in Transgenerational, Transnational and Transdisciplinary Spaces. *Discourse and Communication for Sustainable Education*. 2021; 12(2):142–54. <https://doi.org/10.2478/dcse-2021-0022>
10. Facer K. Beyond business as usual: Higher education in the era of climate change. Oxford: Higher Education Policy Institute; 2020. (Debate Paper 24). [accessed 10 Jun 2023] Available from: <https://www.hepi.ac.uk/2020/12/10/beyond-business-as-usual-higher-education-in-the-era-of-climate-change/>
11. McCowan T. The impact of universities on climate change: a theoretical framework. Centre for Global Higher Education; 2020. (Centre for Global Higher Education working paper series). [accessed 30 Sep 2022] Available from: <https://www.researchcghe.org/perch/resources/publications/final-working-paper-55.pdf>
12. Centre for Climate Change and Social Transformations (CAST). Our research programme. n.d. [accessed 29 Oct 2023] Available from: <https://cast.ac.uk/vision-and-core-principles/>
13. Sterling S, Maxey L, Luna H. *The Sustainable University: Progress and prospects*. London: Routledge; 2013.
14. People & Planet. Cardiff Metropolitan University Tops Ranking of 153 UK Universities by Sustainability and Ethics Criteria. People & Planet. 2022. [accessed 18 May 2023] Available from: <https://peopleandplanet.org/university-league/2021-press-release>
15. Latter B, Capstick S. Climate Emergency: UK Universities' Declarations and Their Role in Responding to Climate Change. *Front Sustain*. 2021; 2:660596. <https://doi.org/10.3389/frsus.2021.660596>
16. EAUC. Climate Commission for UK Higher and Further Education. EAUC The Alliance for Sustainability Leadership in Education. n.d. [accessed 28 May 2023] Available from: https://www.eauc.org.uk/climate_commission

17. People & Planet. Universities committed to pursuing fossil fuel divestment. 2023. [accessed 7 Jun 2023] Available from: <https://peopleandplanet.org/fossil-free-victories>
18. Black Mountains College. Black Mountains College. n.d. [accessed 9 Jun 2023] Available from: <https://blackmountainscollege.uk>
19. Whiteley A. Climate crisis: what progress have universities made? Universities UK. 2022 Dec 20; [accessed 18 May 2023] Available from: <https://www.universitiesuk.ac.uk/latest/insights-and-analysis/climate-crisis-what-progress-have>
20. Jamdar S, Phillips R, Read C, Gayle C, Rice J, Maharaj S, et al. Building a green campus: What's stopping institutions? Shakespeare Martineau; n.d. [accessed 1 Jul 2023] Available from: <https://www.shma.co.uk/market-expertise/education/green-campus/>
21. Stein S. Universities confronting climate change: beyond sustainable development and solutionism. *High Educ.* 2023; [accessed 18 Jul 2023] <https://doi.org/10.1007/s10734-023-00999-w>
22. McGeown C, Barry J. Agents of (un)sustainability: democratising universities for the planetary crisis. *Front Sustain.* 2023; 4:1166642. <https://doi.org/10.3389/frsus.2023.1166642>
23. Priestley Centre for Climate Futures. Analysis reveals scale of tertiary education's carbon emissions. University of Leeds. 2023. [accessed 26 Oct 2023] Available from: <https://climate.leeds.ac.uk/news/analysis-reveals-scale-of-tertiary-educations-carbon-emissions/>
24. Adams R, Martin S, Boom K. University culture and sustainability: Designing and implementing an enabling framework. *Journal of Cleaner Production.* 2018; 171:434–45. <https://doi.org/10.1016/j.jclepro.2017.10.032>
25. Sterling S. The sustainable university: challenge and response. In: Sterling S, Maxey L, Luna H, editors. *The Sustainable University: Progress and prospects.* London: Routledge; 2013. p. 17–50.
26. Schein ED, Schein P. *Organizational Culture and Leadership.* 5th ed. New York: Wiley; 2016.
27. Kotter JP, Heskett JL. *Corporate Culture and Performance.* 1st ed. New York: The Free Press; 1992.
28. ALLEA. Online Panel: Climate Sustainability in the Academic System. 2022. [accessed 9 Feb 2022] Available from: <https://allea.org/panel-climate-sustainability-in-the-academic-system>
29. Internationalisation McCowan T. and Climate Impacts of Higher Education: Towards an Analytical Framework. *Journal of Studies in International Education.* 2023;102831532311648. <https://doi.org/10.1177/10283153231164843>
30. Higham J, Font X. Decarbonising academia: confronting our climate hypocrisy. *Journal of Sustainable Tourism.* 2020; 28(1):1–9. <https://doi.org/10.1080/09669582.2019.1695132>
31. Tseng SHY, Lee C, Higham J. The impact of COVID-19 on academic aeromobility practices: Hypocrisy or moral quandary? *Mobilities.* 2023; 18(3):445–67. <https://doi.org/10.1080/17450101.2022.2121658>
32. Caset F, Boussauw K, Storme T. Meet & fly: Sustainable transport academics and the elephant in the room. *Journal of Transport Geography.* 2018; 70:64–7. <https://doi.org/10.1016/j.jtrangeo.2018.05.020>
33. Shields R. The sustainability of international higher education: Student mobility and global climate change. *Journal of Cleaner Production.* 2019;(217):594–602. <https://doi.org/10.1016/j.jclepro.2019.01.291>
34. Aguilar García C, Weale S, Swan L, Symons H. Fifth of UK universities' income comes from overseas students, figures show. *The Guardian.* 2023. [accessed 26 Oct 2023] Available from: <https://www.theguardian.com/education/2023/jul/14/overseas-students-uk-universities-income>
35. Hoolohan C, McLachlan C, Jones C, Larkin A, Birch C, Mander S, et al. Responding to the climate emergency: how are UK universities establishing sustainable workplace routines for flying and food? *Climate Policy.* 2021; 21(7):853–67. <https://doi.org/10.1080/14693062.2021.1881426>
36. Bauer M, Niedlich S, Rieckmann M, Bormann I, Jaeger L. Interdependencies of Culture and Functions of Sustainability Governance at Higher Education Institutions. *Sustainability.* 2020; 12(7):2780. <https://doi.org/10.3390/su12072780>
37. Stoddard I, Anderson K, Capstick S, Carton W, Depledge J, Facer K, et al. Three Decades of Climate Mitigation: Why Haven't We Bent the Global Emissions Curve? *Annu Rev Environ Resour.* 2021; 46(1):653–89. <https://doi.org/10.1146/annurev-environ-012220-011104>
38. Hoover E, Harder MK. What lies beneath the surface? The hidden complexities of organizational change for sustainability in higher education. *Journal of Cleaner Production.* 2015; 106:175–88. <https://doi.org/10.1016/j.jclepro.2014.01.081>
39. Cannon S. From commitment to reality: Delivering ambitious decarbonisation targets in the higher education sector. ARUP; 2023. [accessed 9 Jun 2023] Available from: <https://www.arup.com/perspectives/publications/research/section/delivering-ambitious-decarbonisation-targets-in-the-higher-education-sector>

40. Johnson AE. Climate Action Venn Diagrams. n.d. [accessed 29 Oct 2023] Available from: <https://www.ayanaelizabeth.com/climatevenn>
41. McKeever BW, McKeever R, Choi M, Huang S. From Advocacy to Activism: A Multi-Dimensional Scale of Communicative, Collective, and Combative Behaviors. *Journalism & Mass Communication Quarterly*. 2023;107769902311610. <https://doi.org/10.1177/10776990231161035>
42. Parsons ECM. “Advocacy” and “Activism” Are Not Dirty Words—How Activists Can Better Help Conservation Scientists. *Front Mar Sci*. 2016;3. [accessed 11 Jun 2023] <https://doi.org/10.3389/fmars.2016.00229>
43. Ripple WJ, Wolf C, Newsome TM, Barnard P, Moomaw WR. World Scientists' Warning of a Climate Emergency. *Bioscience*. 2019;(biz088):1–5. <https://doi.org/10.1093/biosci/biz088>
44. Times Higher Education. Universities must act swiftly and independently on climate change. *Times Higher Education*. 2019. [accessed 26 Jul 2023] Available from: <https://www.timeshighereducation.com/opinion/universities-must-act-swiftly-and-independently-climate-change>
45. Capstick S, Thierry A, Cox E, Berglund O, Westlake S, Steinberger JK. Civil disobedience by scientists helps press for urgent climate action. *Nat Clim Chang*. 2022; 12(9):773–4. <https://doi.org/10.1038/s41558-022-01461-y>
46. Gardner C, Cox E, Capstick S. Extinction Rebellion scientists: why we glued ourselves to a government department. *The Conversation*. 2022; [accessed 28 May 2023] Available from: <https://theconversation.com/extinction-rebellion-scientists-why-we-glued-ourselves-to-a-government-department-181799>
47. Artico D, Durham S, Horn L, Mezzenzana F, Morrison M, Norberg A. “Beyond being analysts of doom”: scientists on the frontlines of climate action. *Front Sustain*. 2023; 4:1155897. <https://doi.org/10.3389/frsus.2023.1155897>
48. Gardner CJ, Thierry A, Rowlandson W, Steinberger JK. From Publications to Public Actions: The Role of Universities in Facilitating Academic Advocacy and Activism in the Climate and Ecological Emergency. *Front Sustain*. 2021; 2:679019. <https://doi.org/10.3389/frsus.2021.679019>
49. Manchester Metropolitan University. Students, Staff and Sustainability. *Manchester Metropolitan University*; 2020 Jun 29. [accessed 10 Jun 2023] Available from: <https://www.mmu.ac.uk/sustainability/news-and-events/news/story/?id=12543>
50. Leal Filho W, Yayeh Ayal D, Wall T, Shiel C, Paco A, Pace P, et al. An assessment of attitudes and perceptions of international university students on climate change. *Climate Risk Management*. 2023; 39:100486. <https://doi.org/10.1016/j.crm.2023.100486>
51. University of Bath. Systemic transformation and individual action: Keys to addressing the climate crisis. 2023 May 11. [accessed 10 Jun 2023] Available from: <https://blogs.bath.ac.uk/climate-action/2023/05/11/systemic-transformation-and-individual-action-keys-to-addressing-the-climate-crisis/>
52. University of Bath. Climate Action Survey results 2023: Students and staff united to drive strong action. 2023 May 15. [accessed 10 Jun 2023] Available from: <https://blogs.bath.ac.uk/climate-action/2023/03/15/climate-action-survey-results-2023-students-and-staff-united-to-drive-strong-action/>
53. Leal Filho W, Mifsud M, Molthan-Hill P, J. Nagy G, Veiga Ávila L, Salvia AL. Climate Change Scepticism at Universities: A Global Study. *Sustainability*. 2019; 11(10):2981. <https://doi.org/10.3390/su11102981>
54. Allen J, Rapkins C. Bangor university staff survey: overall report. *DJS Research, Bangor University*; 2022 Apr. [accessed 11 Jun 2023] Available from: <https://www.bangor.ac.uk/humanresources/staffsurvey2022/staff-survey.php.en>
55. Blanchard M, Bouchet-Valat M, Cartron D, Greffion J, Gros J. Concerned yet polluting: A survey on French research personnel and climate change. *PLOS Clim*. 2022; 1(9):e0000070. <https://doi.org/10.1371/journal.pclm.0000070>
56. Espinosa M, Larrahondo JS, Mendez-Espinosa JF, Cortés DV, Forero VF, Franco JF. Perception of climate change in an academic community in Colombia—a pilot study in a developing country. *Discov Sustain*. 2023; 4(1):14. <https://doi.org/10.1007/s43621-023-00129-7>
57. Alam M, Lin F-R. Internalizing Sustainability into Research Practices of Higher Education Institutions: Case of a Research University in Taiwan. *Sustainability*. 2022; 14(15):9793. <https://doi.org/10.3390/su14159793>
58. Overland I, Fossum Sagbakken H, Isataeva A, Kolodzinskaia G, Simpson NP, Trisos C, et al. Funding flows for climate change research on Africa: where do they come from and where do they go? *Climate and Development*. 2022; 14(8):705–24. <https://doi.org/10.1080/17565529.2021.1976609>
59. Leal Filho W, Morgan EA, Godoy ES, Azeiteiro UM, Bacelar-Nicolau P, Veiga Ávila L, et al. Implementing climate change research at universities: Barriers, potential and actions. *Journal of Cleaner Production*. 2018; 170:269–77. <https://doi.org/10.1016/j.jclepro.2017.09.105>

60. Bekaroo G, Bokhoree C, Ramsamy P, Moedeem W. Investigating personal carbon emissions of employees of higher education institutions: Insights from Mauritius. *Journal of Cleaner Production*. 2019; 209:581–94. <https://doi.org/10.1016/j.jclepro.2018.10.238>
61. Blanco-Portela N, Benayas J, Pertierra LR, Lozano R. Towards the integration of sustainability in Higher Education Institutions: A review of drivers of and barriers to organisational change and their comparison against those found of companies. *Journal of Cleaner Production*. 2017; 166:563–78. <https://doi.org/10.1016/j.jclepro.2017.07.252>
62. Beck A, Sinatra GM, Lombardi D. Leveraging Higher-Education Instructors in the Climate Literacy Effort: Factors Related to University Faculty's Propensity to Teach Climate Change. *The International Journal of Climate Change: Impacts and Responses*. 2013; 4(4):1–17. <https://doi.org/10.18848/1835-7156/CGP/v04i04/37181>
63. Badullovich N. 'It is a bloody big and responsible job': perspectives on climate change communication from Australia-focused practitioners. *Clim Action*. 2022; 1(1):20. <https://doi.org/10.1007/s44168-022-00021-6>
64. Le Quéré C, Capstick S, Corner A, Cutting D, Johnson M, Minns A, et al. Towards a culture of low-carbon research for the 21st Century. Tyndall Centre for Climate Change Research; 2015. (Working Paper 161). [accessed 26 Jul 2023] Available from: <https://tyndall.ac.uk/working-papers/towards-a-culture-of-low-carbon-research-for-the-21st-century/>
65. Desiere S. The Carbon Footprint of Academic Conferences: Evidence from the 14th EAAE Congress in Slovenia. *EuroChoices*. 2016; 15(2):56–61. <https://doi.org/10.1111/1746-692X.12106>
66. Grant C. Academic flying, climate change, and ethnomusicology: personal reflections on a professional problem. *Ethnomusicology Forum*. 2018; 27(2):123–35. <https://doi.org/10.1080/17411912.2018.1503063>
67. Whitmarsh L, Capstick S, Moore I, Köhler J, Le Quéré C. Use of aviation by climate change researchers: Structural influences, personal attitudes, and information provision. *Global Environmental Change*. 2020; 65:102184. <https://doi.org/10.1016/j.gloenvcha.2020.102184>
68. Thaller A, Schreuer A, Posch A. Flying High in Academia—Willingness of University Staff to Perform Low-Carbon Behavior Change in Business Travel. *Front Sustain*. 2021; 2:790807. <https://doi.org/10.3389/frsus.2021.790807>
69. Hamant O, Saunders T, Viasnoff V. Celebrate sustainable travel at conferences. *Nature*. 2019; 573(7774):451–2. <https://doi.org/10.1038/d41586-019-02747-6>
70. The Royal Anniversary Trust. Accelerating the UK Tertiary Education Sector towards Net Zero: A sector-led proposal for action and connected thinking. The Royal Anniversary Trust; 2023. [accessed 18 May 2023] Available from: <https://www.universitiesuk.ac.uk/topics/climate-and-sustainability/accelerating-uk-tertiary-education>
71. Huxley K. Data Cleaning. In: SAGE Research Methods Foundations. 1 Oliver's Yard, London: SAGE Publications Ltd; 2020. [accessed 1 Oct 2022] <https://doi.org/10.4135/9781526421036842861>
72. Fugard A, Potts H W. Thematic Analysis. In: Atkinson P, Delamont S, Cernat A, Sakshaug JW, Williams RA, editors. SAGE Research Methods Foundations. London: SAGE Publications Ltd; 2019. [accessed 25 Apr 2023] <https://doi.org/10.4135/9781526421036858333>
73. Abdi H. Holm's Sequential Bonferroni Procedure. In: Salkind N, editor. SAGE Research Methods: Encyclopedia of Research Design. SAGE Publications, Inc.; 2012. [accessed 5 Jan 2023] <https://doi.org/10.4135/9781412961288>
74. Universities UK Our members. Universities UK. n.d. [accessed 30 Sep 2022] Available from: <https://www.universitiesuk.ac.uk/about-us/our-members>
75. Guthrie S, Lichten C, Harte E, Parks S, Wooding S. International mobility of researchers: A survey of researchers in the UK. RAND Europe and the Royal Society; 2017 p. 80. [accessed 30 Sep 2022] Available from: https://www.rand.org/pubs/research_reports/RR1991.html
76. Leal Filho W, Sima M, Sharifi A, Luetz JM, Salvia AL, Mifsud M, et al. Handling climate change education at universities: an overview. *Environ Sci Eur*. 2021; 33(1):109. <https://doi.org/10.1186/s12302-021-00552-5> PMID: 34603904
77. Lozano R, Ceulemans K, Alonso-Almeida M, Huisingh D, Lozano FJ, Waas T, et al. A review of commitment and implementation of sustainable development in higher education: results from a worldwide survey. *Journal of Cleaner Production*. 2015; 108:1–18. <https://doi.org/10.1016/j.jclepro.2014.09.048>
78. Fullwood R, Rowley J, Delbridge R. Knowledge sharing amongst academics in UK universities. *Journal of Knowledge Management*. 2013; 17(1):123–36. <https://doi.org/10.1108/13673271311300831>
79. HESA. What areas do they work in? HESA. 2021. [accessed 30 Sep 2022] Available from: <https://www.hesa.ac.uk/data-and-analysis/staff/areas>

80. HESA. Who's studying in HE? HESA. 2022. [accessed 30 Sep 2022] Available from: <https://www.hesa.ac.uk/data-and-analysis/students/whos-in-he>
81. HESA. Who's working in HE? HESA. 2022. [accessed 30 Sep 2022] Available from: <https://www.hesa.ac.uk/data-and-analysis/staff/working-in-he>
82. Qualtrics. Sample size calculator & complete guide. Qualtrics. 2022. [accessed 5 Feb 2023] Available from: <https://www.qualtrics.com/blog/calculating-sample-size/>
83. Climate Engagement Partnership. Public support majority of net zero policies. . . unless there is a personal cost. Ipsos. 2021 Oct 18; [accessed 21 Feb 2023] Available from: <https://www.ipsos.com/en-uk/public-support-majority-net-zero-policies-unless-there-is-a-personal-cost>
84. Demski C, Steentjes K, Poortinga W. Public worry about climate change and energy security in the cost-of-living crisis. Centre for Climate Change and Social Transformations; 2022. (CAST Briefing Paper). Report No.: 17. [accessed 21 Feb 2023] Available from: <https://cast.ac.uk/publications/briefings/>
85. Whitmarsh L, Player L, Jiongco A, James M, Williams M, Marks E, et al. Climate anxiety: What predicts it and how is it related to climate action? *Journal of Environmental Psychology*. 2022; 83:101866. <https://doi.org/10.1016/j.jenvp.2022.101866>
86. University and College Union. UK higher education: A workforce in crisis. London: University and College Union; 2022 Mar. [accessed 18 May 2023] Available from: <https://www.ucu.org.uk/article/12212/Two-thirds-of-university-staff-considering-leaving-sector-new-report-reveals>
87. Wellcome, Shift Learning. What Researchers Think About the Culture They Work In. wellcome; 2020. [accessed 30 Sep 2022] Available from: <https://wellcome.org/reports/what-researchers-think-about-research-culture>
88. Urai AE, Kelly C. Rethinking academia in a time of climate crisis. *eLife*. 2023; 12:e84991. <https://doi.org/10.7554/eLife.84991> PMID: 36748915
89. Walshe N. Class action. *Portico Magazine*. 2023. [accessed 29 May 2023] Available from: <https://magazine.ucl.ac.uk/insider-nicola-walshe/>
90. Lumina I, Raine J, Dyke J, Knorr W, Rowe A, Saglietti C. Research for a Future. Faculty for a Future; n.d. [accessed 25 Jun 2023] Available from: <https://facultyforafuture.org/research>
91. McCowan T, Leal Filho W, Brandli L, editors. Universities facing Climate Change and Sustainability. Hamburg: Körber-Stiftung; 2021. [accessed 10 Jun 2023] Available from: https://discovery.ucl.ac.uk/id/eprint/10142640/1/GUC%20Study_Universities%20facing%20Climate%20Change%20and%20Sustainability.pdf
92. Bray L, Meznikova K, Crampton P, Johnson T. Sustainable healthcare education: A systematic review of the evidence and barriers to inclusion. *Medical Teacher*. 2023; 45(2):157–66. <https://doi.org/10.1080/0142159X.2022.2110052> PMID: 35981688
93. Countdown Lancet. Lancet Countdown: Tacking Progress on Health and Climate Change. Lancet Countdown. 2019. [accessed 26 Jul 2023] Available from: <https://www.lancetcountdown.org>
94. Gupta D, Shantharam L, MacDonald BK. Sustainable healthcare in medical education: survey of the student perspectives at a UK medical school. *BMC Med Educ*. 2022; 22(1):689. <https://doi.org/10.1186/s12909-022-03737-5> PMID: 36151552
95. Badullovich N, Grant WJ, Colvin RM. Framing climate change for effective communication: a systematic map. *Environ Res Lett*. 2020; 15(12):123002. <https://doi.org/10.1088/1748-9326/aba4c7>
96. Dasandi N, Graham H, Hudson D, Jankin S, vanHeerde-Hudson J, Watts N. Positive, global, and health or environment framing bolsters public support for climate policies. *Commun Earth Environ*. 2022; 3(1):239. <https://doi.org/10.1038/s43247-022-00571-x>
97. Bevan J, Blyth R, Russell B, Holtgrewe L, Cheung AHC, Austin I, et al. Planetary health and sustainability teaching in UK medical education: A review of medical school curricula. *Medical Teacher*. 2023; 45(6):623–32. <https://doi.org/10.1080/0142159X.2022.2152190> PMID: 36503358
98. Grover N. UK medical schools must teach about climate crisis, say students. *The Guardian*. 2021 Aug 17; [accessed 29 May 2023] Available from: <https://www.theguardian.com/environment/2021/aug/17/uk-medical-schools-must-teach-about-climate-change-say-students>
99. World Health Organization. WHO and NHS to work together on decarbonization of health care systems across the world. World Health Organization. 2022 Apr 7. [accessed 29 May 2023] Available from: <https://www.who.int/news-room/feature-stories/detail/who-and-nhs-to-work-together-on-decarbonization-of-health-care-systems-across-the-world>
100. Cologna V, Knutti R, Oreskes N, Siegrist M. Majority of German citizens, US citizens and climate scientists support policy advocacy by climate researchers and expect greater political engagement. *Environ Res Lett*. 2021; 16(2):024011. <https://doi.org/10.1088/1748-9326/abd4ac>

101. Department for Business, Energy & Industrial Strategy. DESNZ Public Attitudes Tracker (March 2021, Wave 37, UK). gov.uk. 2021. [accessed 14 Jul 2021] Available from: <https://www.gov.uk/government/collections/public-attitudes-tracking-survey>
102. O'Neill K, Sinden C. Universities, Sustainability, and Neoliberalism: Contradictions of the Climate Emergency Declarations. *PaG*. 2021; 9(2):29–40. <https://doi.org/10.17645/pag.v9i2.3872>
103. Tandon A. Analysis: The lack of diversity in climate-science research. *Carbon Brief*. 2021 Oct 6; [accessed 26 Jul 2023] Available from: <https://www.carbonbrief.org/analysis-the-lack-of-diversity-in-climate-science-research/>