Educational policies can strengthen climate coalitions

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Building public support for ambitious climate policies is a central challenge for governments seeking to decarbonize their economies. Many climate change mitigation policies pose visible material costs on citizens, while fiscal constraints limit governments' abilities to use compensatory incentives. Education is used as a tool to build public awareness about climate change and support for mitigation policies, but the political effects of climate education policies are not well understood. We evaluate the effects of a real-world climate education policy through the study of a large-scale educational intervention: a three-hour interactive workshop which has so far been implemented in over 500 French universities. We employ a randomized control trial reaching 1,845 students across 167 workshops. Students who took the workshop expressed 7 percentage points higher support for costly climate policies, including a beef tax, short-haul flight ban, and meat-free university canteen, compared with the control group. The workshop increased beliefs in the effectiveness of these policies and elicited more positive emotions about climate action. Evidence from a sub-sample of follow-up survey respondents suggests these effects may persist for at least six weeks. We find no evidence that the workshop increased willingness to donate to a climate NGO. Overall, the results suggest that well-designed climate education can play a role in broadening public coalitions for ambitious climate policies by strengthening perceived policy efficacy and support for costly policies.

Education | Climate Policy | Political Preferences | Field Experiment

Significance Statement

Governments increasingly use education to build public support for ambitious climate policies, yet evidence of its effectiveness remains limited. This large-scale field experiment shows that a short, interactive climate workshop can increase support for costly climate policies, such as meat taxes and flight restrictions. The effects are driven by stronger beliefs in the effectiveness of climate policies and more positive emotions toward climate action. These findings suggest that well-designed educational programs have a role to play in broadening coalitions for climate policies.

Governments worldwide face the challenge of building public support for climate policies that require significant personal sacrifice. These *"costly climate policies"*—such as meat taxes or flight restrictions—require large-scale behavioral change and impose visible, concentrated costs on individuals while providing diffuse social benefits (1). So far, the literature has concentrated on compensation as a means to garner public support and build a broader coalition of support (2–4). However, given lackluster economic growth and worsening budgetary pressures (5), many governments are constrained in their use of fiscal incentives and thus leverage an additional coalition-building strategy: climate education.

This emphasis on climate education is reflected in Article 12 of the Paris Agreement, which calls for enhanced climate change education, training, and public awareness (6). Many governments have heeded this call and adopted climate education programs. For instance, the Italian government passed legislation in 2019 to make climate change study mandatory in schools (7), Argentina requires that all public employees receive environmental training (8), and several U.S. states have recently passed laws to incorporate climate change education into school curricula (9).

Despite growing political enthusiasm for climate education, the evidence on its effectiveness is mixed. Meta-analyses of field interventions find education to be one of the least effective strategies for promoting pro-environmental behaviors (10, 11). A global mega-study conducted in 63 countries found similarly muted effects on climate policy support across eleven different informational interventions (12). A review of school-based programs finds large gains in knowledge, but only small and inconsistent shifts in climate attitudes (13). So, is climate education an effective tool for building political coalitions in favor of addressing climate change?

We suggest that the mixed findings in prior research reflect the conditions under which most climate educational interventions have been designed and tested, rather than the inherent effectiveness of education itself. Researchers have primarily studied climate education in isolated laboratory or survey experimental settings (12) with interventions that provide abstract rather than personally relevant information (14). In education research, active learning has been shown to be an effective technique for achieving improved student performance (15) and narrower

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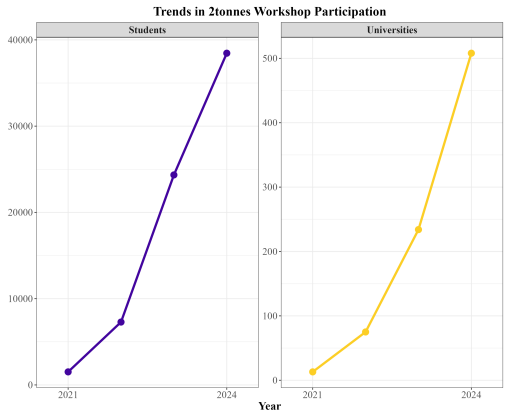
achievement gaps for underrepresented students (16). We contend that educational interventions will be more effective when they meet three conditions: (i) they take place in real-world settings that foster peer discussion (17, 18), (ii) the content combines factual and personally relevant information in an interactive environment (19–21), and (iii) they reach audiences which remain 'impressionable' and thus more open to shifting attitudes (22–24).

Our study evaluates an educational intervention that satisfies these three criteria. The "2tonnes" workshop is a standardized three-hour interactive educational program. Delivered in a real-world classroom setting by trained facilitators, the workshop blends factual learning with a serious-game simulation in which students use their own carbon footprint data to explore pathways to a net-zero future. As Figure 1a, shows there has been a rapid increase in the deployment of the 2tonnes workshop across French universities, with over 38,000 students across 500 universities participating in 2024. Many universities have begun voluntarily implementing the workshop in response to policy directives from the French government which require universities and higher education institutions to incorporate ecological and environmental education into their curricula since 2020 (25). In 2023, a new directive from the Ministry of Higher Education mandated that all undergraduate programs include climate change and planetary boundaries training by 2025 (26).

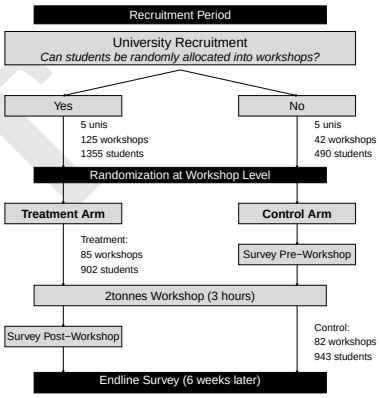
This rapid expansion provides an opportunity to evaluate whether climate education can build support for costly climate policies. To do so, we partnered with ten French universities that integrated the 2tonnes workshop into their curricula during the 2024-25 academic year. Our study includes 1,845 respondents across 167 workshops, an average of 11 participants per workshop. The universities span a wide range of programs and are located across France. Because the workshops were mandatory parts of the curriculum, participation was high and self-selection bias limited (see SI Section A for more).

Figure 1b outlines our research design. We conducted a block randomized control trial. Recruitment occurred along two tracks. At five universities, students could be randomly allocated into workshops (125 workshops; 1,355 students). In the other five universities, students could not be randomly allocated to workshops (42 workshops; 490 students). We randomly assigned workshops to one of two timing conditions: treatment workshops completed the survey after the three-hour 2tonnes session (85 workshops; 902 students), while control workshops completed the survey before the session (82 workshops; 943 students). Randomization achieved balance across pre-treatment covariates (see SI Section B for more). This timing randomization preserves the collective nature of the intervention while identifying the causal impact of participation.

Our primary outcome measures are support for *costly climate policies*. They are: (i) a tax doubling the price of beef, (ii) a ban on flights for destinations accessible by train or bus within six hours, and (iii) a university-level ban on serving meat in the canteen. All outcomes are informed by previous academic studies (27) and contemporary policy debates in France. Participants rated each policy on a five-point Likert scale, which we dichotomize as 1 for those who



(a) Growth of 2tonnes workshop participation among students and universities, 2021–2024



(b) Research design

Fig. 1. (a) Growth of 2tonnes participation and (b) research design.

"support" or "strongly support" the policy, and 0 otherwise (see SI Section C for more detail).

To assess longer-term effects, we re-contacted participants six weeks after the conclusion of the workshop with an invitation to complete an endline survey. Participation was voluntary, yielding a final endline sample of 331 respondents (18%). Endline respondents differed somewhat in attitudes and behavior from non-respondents, but importantly not by treatment status (see Appendix B).

As a secondary outcome, we measure willingness to donate to a climate NGO. Participants who opted in to a €100 lottery could donate a share of their potential winnings to *Réseau Action Climat*, a well-known French climate NGO.

Our pre-registered hypotheses test whether participation in the 2tonnes workshop **(H1)** increases support for costly climate policies, and **(H2)** increases willingness to donate to a climate NGO. We conceptualize **H2** as a behavioral extension of **H1**. We also pre-registered a set of mediating, moderating, and exploratory hypotheses which we report in Table 1 (see SI Section D for more detail).

Table 1. Pre-registered hypotheses

ID	Statement
H1	The workshop increases participants' support for high-cost climate policies.
H1a	Driven by a decrease in psychological distance to the climate crisis.
H1b	Driven by an increase in belief in policy effectiveness.
H1c	Stronger for participants with lower personal costs.
H1d	Smaller for participants with low trust in government.
H2	The workshop increases willingness to donate to a climate NGO that supports the proposed policy goals.
H2a	Stronger when the NGO is framed as advocating on the supported issue.

Results

We test our primary, secondary, and exploratory hypotheses using ordinary least squares regression with standard errors clustered at the workshop level to estimate the Intent-to-Treat (ITT) effect of participating in the workshop, in line with our pre-analysis plan. All regressions include university and experimental block fixed effects. For robustness, we also estimate the local average treatment effect and find results consistent with the main analysis (see SI Section G.1).

Main Effect: Support for Costly Climate Policies. We first consider the effect of participating in the 2tonnes workshop on support for costly climate policies **(H1)**. The results, presented in Figure 2, show that across each of the three policy outcomes, support was 7 percentage points higher among students surveyed after the workshop compared to those surveyed before.

Breaking the results down by policy, we observe that support for a tax doubling the price of beef increased by 7.5 percentage points from a baseline of 34% ($p = 0.003$). Support for a ban on short-haul flights rose by 6.7 percentage points from a baseline of 55% ($p = 0.004$). Likewise, support for a university-level ban on serving meat in canteens increased by 6.8 percentage points from a baseline of 36% ($p = 0.003$). These results provide robust evidence that participating in the 2tonnes workshop positively shifts attitudes towards costly climate policies.

Mechanisms Underlying the Main Effect. We pre-registered two main mediators – that increased policy support is driven by (i) a decrease in the psychological distance between a participant and the climate **(H1a)** and (ii) an increase in participants' belief in the effectiveness of the policy **(H1b)**. As mediation analyses are susceptible to omitted variable bias, we evaluate each mediation pathway as an intermediate outcome using the same regression framework as we do for our main outcomes.

First, as shown in Figure 2, we find no evidence that the workshop reduced participants' psychological distance ($\beta = 0.04$; $p = 0.32$). By contrast, we do find evidence that the workshop increased effectiveness beliefs. On workshop day, the treatment group reported significantly stronger beliefs in the effectiveness of both a beef tax ($\beta = 0.10$; $p < 0.001$) and a flight ban ($\beta = 0.18$; $p < 0.001$).

We also pre-registered two manipulation checks that can be understood as mechanisms (results presented in Appendix X). The first dimension is information uptake, as measured

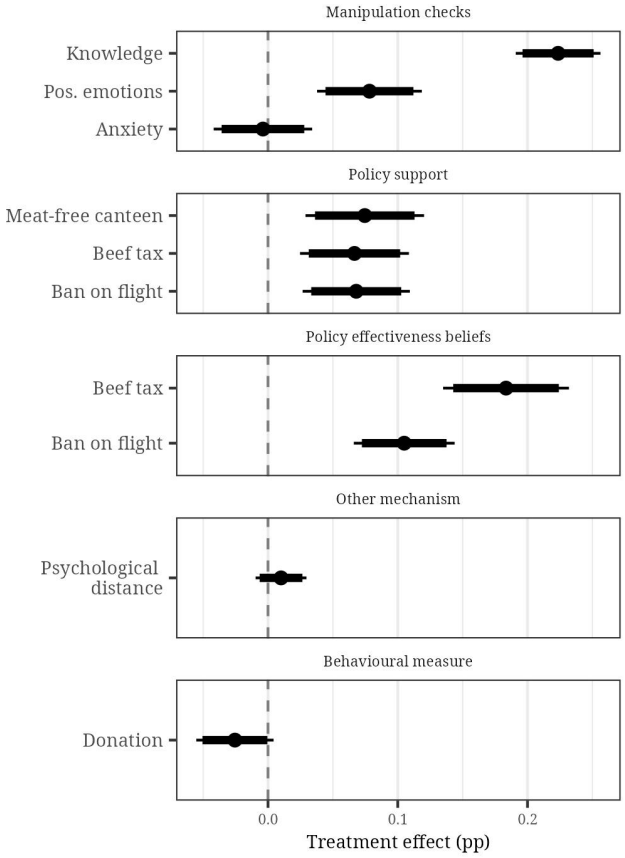


Fig. 2. Results for models testing H1, H1a, H1b, and H2. All models use an Intent-to-Treat (ITT) estimator with experimental block fixed effects and cluster robust standard errors at the workshop level. Thick (thin) bars represent 95% (90%) confidence intervals.

by two knowledge questions, each of which elicits a correct response to a multiple-choice question about the components of the average French carbon footprint. Taking the average of these two variables as our outcome variable, we find that the workshop significantly increases respondents' knowledge about the sources of greenhouse gas emissions ($\beta = 0.22$; $p < 0.001$).

The second dimension is participants' emotions when thinking about climate change. We presented respondents with a choice list of different emotions they could feel in reaction to climate change, from which we created a binary variable indicating whether they picked at least one positive emotion from the list. The results indicate that taking the 2tonnes workshop increases positive emotions among participants, i.e. hope, calm, optimism and motivation ($\beta = 0.07$; $p < 0.001$). The results for these two dimensions are clear – taking the 2tonnes workshop increases participants' knowledge about what causes climate change and as well as their positivity towards the issue.

Heterogeneous Treatment Effects. We pre-registered two main and three exploratory moderators. All results are presented in Figure 3. Each moderator is tested using the same regression framework as the main effects but including an interaction term for the relevant variable.

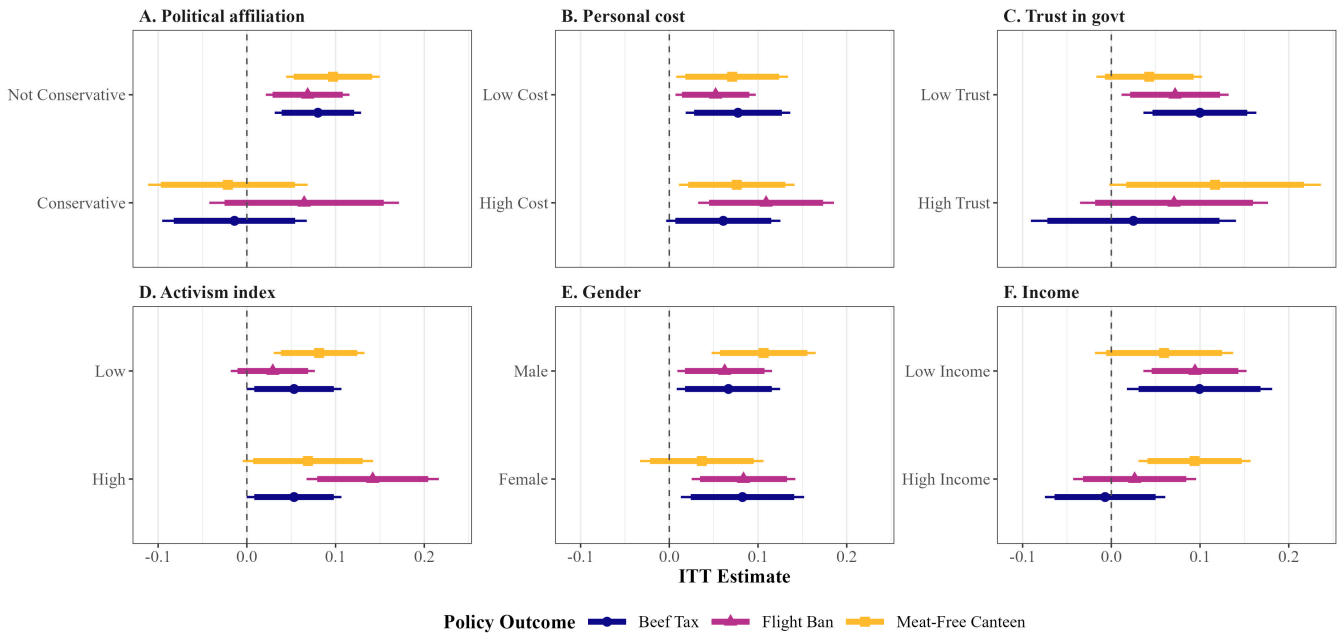


Fig. 3. All models use an Intent-to-Treat (ITT) estimator with experimental block fixed effects and cluster robust standard errors at the workshop level. Thick (thin) bars represent 95% (90%) confidence intervals.

Turning first to the pre-registered hypotheses, we expected weaker effects among participants who face a higher level of personal cost from the proposed policies (**H1c**). Personal cost is measured in terms of both meat and flight consumption, depending on the outcome. Contrary to our expectations, we observe no difference in treatment effects across participants facing higher and lower personal costs. All effects are positive and significant across all policy outcomes regardless of the cost faced (Panel B, Fig 3). The fact that the workshop was as effective among individuals bearing high personal costs challenges a common assumption in the climate policy literature.

For our second pre-registered hypothesis, we expected effects to be weaker among participants with low trust in government, measured by the degree to which respondents perceived French institutions as corrupt. Again, our expectations were not borne out (Panel C, Fig 3). If anything, effects were larger among low trust respondents for both the beef tax ($\beta = 0.10$; $p = 0.003$) and the flight ban ($\beta = 0.07$; $p = 0.025$). These results indicate that the effectiveness of the workshop is not undermined by low levels of institutional trust.

The lack of heterogeneity across genders is noteworthy (Panel E), especially given recent research emphasizing a gender gap in climate attitudes (28, 29). If anything, men seem to be more supportive of a meat-free canteen compared with women. Additionally, we observe that respondents from low income families are more supportive of both a ban on beef ($\beta = 0.10$; $p = 0.025$) and flight restrictions ($\beta = 0.09$; $p = 0.003$), with null effects for high income participants (Panel G).

Persistence of Effects. For the subsample of respondents who answered our endline survey, we test whether the observed effects persist six weeks after the 2tonnes workshop date. These respondents are on average, slightly older and come from less wealthy families. They are more left-wing, fly less often, and eat less red meat. In line with this demographic profile, these respondents are also more likely to show greater support for our three main climate policy outcome variables (see Appendix X). We therefore interpret these results as suggestive evidence of the persistence of workshop effects.

We employ two complementary estimation strategies. First, a within-individual estimator compares students who were initially in the control group at baselines but later

completed the endline survey after completing the workshop. These results, again presented in Figure 4, show a sustained 22 percentage point increase in support for a beef tax ($p < 0.001$) and a 13 percentage point increase in support for a meat-free university canteen policy ($p = 0.002$). The effect on support for a flight ban was smaller (+4pp) and not statistically significant ($p = 0.26$). This likely reflects ceiling effects given this outcome had the highest baseline level of support among the control group.

Second, a between-individual estimator – a difference-in-differences specification which interacts treatment status and survey wave – yields a similar pattern. Support for a beef tax increased by 21 percentage points ($p < 0.001$), and support for a meat-free canteen policy increased by 19 percentage points ($p = 0.003$), while the flight ban again showed no detectable effect ($p = 0.65$). The treatment effects identified in these analyses are large, but with relatively large standard confidence intervals due to the small and skewed sample. However, taken together, these results provide suggestive evidence that the workshop's effect persisted over time (6-weeks post-treatment) for two of the three costly climate policies, buttressing support for **H1**.

In line with these results, we also find that several attitudinal mechanisms show persistence six weeks after treatment. Specifically, beliefs in the effectiveness of the beef tax remain significantly higher (within $\beta = 0.22$; between $\beta = 0.21$; both $p < 0.001$), whereas beliefs in the effectiveness of the flight ban do not (within $\beta = 0.04$; between $\beta = 0.03$; within $p = 0.26$; between $p = 0.65$). Likewise, the workshop's positive effects on climate knowledge (between $\beta = 0.39$; $p < 0.001$) and on positive emotions towards climate change (between $\beta = 0.15$; $p = 0.01$) both persist over the six-week period.

Other Results and Robustness. We pre-registered two additional exploratory outcomes. We expected that taking the workshop would increase the salience of the climate crisis to participants. However, we find no meaningful effect of taking the workshop on salience ($\beta = 0.02$; $p = 0.35$; see Table X in App.).

We also investigated whether participation in the workshop altered respondents' perceptions of which actors – individuals, firms, or government – are currently doing enough to address climate change. The results, presented in Table X in App, suggest that taking the workshop worsened participants' perceptions that individuals are doing enough ($\beta = -0.35$; $p < 0.001$), while improving their perceptions of government efforts ($\beta = 0.22$; $p = 0.04$). We find null effects for firms. That said, the control means were 4.82 for citizens (on an 11 point scale) and 3.64 for government. This implies that, even after taking the workshop, respondents still felt the government should be doing more relative to individuals.

In the Supporting Information we also present results for heterogeneity by university (Table X) and by academic disciple (Table X).

We also conducted three main robustness checks. First, we re-estimated the main workshop day effects using a LATE estimator which re-confirms our findings (Table X). Next we examine whether treatment effects are confounded by the time of day (morning or evening) the workshops are conducted. Results from models that subset on time of day indicate no confounding influence of time (see Table X). Third, we

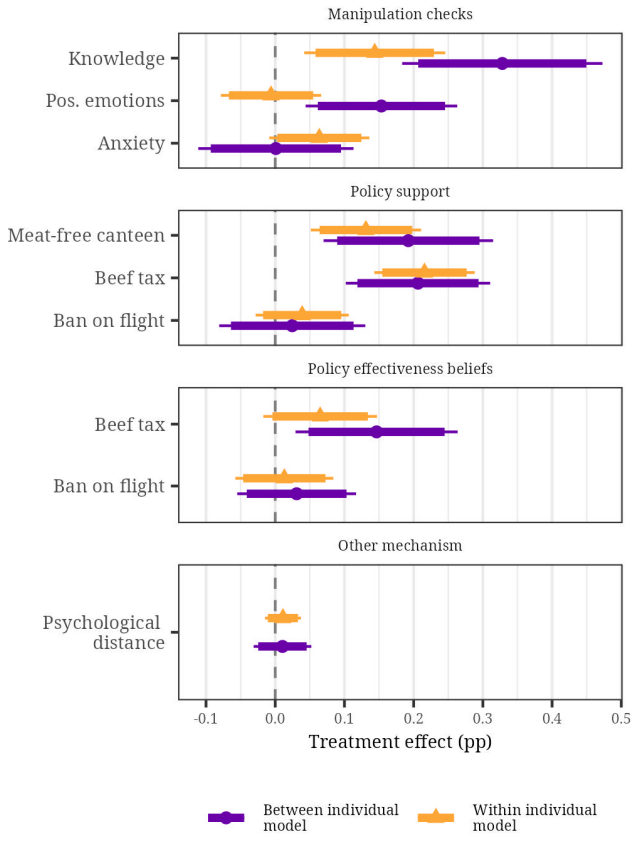


Fig. 4. Estimated treatment effects six weeks after the workshop using within-group (left) and between-group (right) designs. All models use an Intent-to-Treat (ITT) estimator with experimental block fixed effects and cluster robust standard errors at the workshop level. Thick (thin) bars represent 95% (90%) confidence intervals.

conduct a leave-one-out sensitivity analysis by re-estimating our main specification iteratively, each time excluding one university from the sample. This analysis indicates that our results are not driven by any single university (Table X).

Behavioral Effect. Finally, we turn to our behavioral outcome – willingness to donate to the climate NGO, Réseau Action Climat (**H2**). First, participants had to opt in to a lottery to win €100, which 83% did. They were then asked to donate a portion of the potential winnings to the NGO. Panel C of Fig. 2 shows that students in the treatment group donated, on average, €2.55 less than those in the control group, a difference that was not statistically significant ($p = 0.10$). The average donation in the control group was €32. This evidence indicates that, while the workshop did increase support for costly climate policies, it did not translate into greater willingness to donate to climate advocacy groups.

Additionally, we embedded a vignette experiment in the donation task. Respondents were randomly assigned one of three descriptions of the NGO, (i) a general description, (ii) a description emphasizing the NGO's focus on reducing beef consumption, and (iii) a description emphasizing the NGO's focus on reducing air travel. Compared to the general description, donations were €3.20 lower when the NGO was framed around beef consumption ($p = 0.08$) and €1.37 lower

when framed around air travel ($p = 0.50$). In sum, these results do not offer support for **H2**.

Discussion

Governments around the world are turning to climate education as a low-cost tool to build political support in favor of climate action. However, evidence of its effectiveness remains rather weak. We suggest that such weakness reflects the limitations of previous research designs, rather than the actual efficacy of climate education. By conducting a randomized control trial of a climate education program that takes place in a real-world classroom setting, blends factual with personally relevant information, and targets an impressionable student audience, we provide causal evidence that climate education can increase support for costly climate policies.

Our results show that participation in the 2tonnes workshop increases support for each of the three costly climate policies we examined, with an average increase of 7 percentage points. In the endline survey, completed six weeks later by a smaller subsample, these effects persisted for both a beef tax and a meat-free canteen, though not for a short-haul flight ban, where baseline support was already high. By contrast, we find no evidence that the workshop increased participants' willingness to donate to a climate NGO, suggesting that its impact is stronger on policy attitudes than on private behavior. However, this lack of effect might be related to participants estimating their chances of winning to be low in our lottery-based design. We therefore treat this outcome as a secondary measure and focus primarily on attitudinal results.

Analyses of mechanisms indicate that the workshop's impact operated primarily by strengthening beliefs in the effectiveness of climate policies. This echoes findings from previous studies over the role of effectiveness beliefs in building up support for policies (30–32). The workshop also increased knowledge about the sources of greenhouse gas emissions and elicited positive emotions from participants. Subgroup analyses show little variation in effects, including for participants who would bear higher personal costs, though we do find null effects among conservative students.

Our findings have direct implications for policymakers. They show that education can complement fiscal and regulatory instruments by creating political space for ambitious policy action. By increasing support even among participants who personally face higher costs or express low trust in institutions, education can help expand coalitions that might otherwise resist climate action. At the same time, the absence of detectable effects among conservatives highlights a political boundary that education alone cannot overcome, underscoring the need to pair educational interventions with broader strategies to address ideological divides.

Our study has limitations. First, while the university context accurately captures the group targeted by this education policy in the French context, we take caution in assuming generalizability to broader populations. Our study population is more supportive of climate policies than the general French population: baseline support for a beef tax is 34% in our control group compared with a national average of 29% (27). Our estimates may thus represent an upper bound for what might be observed in other contexts. Second, we acknowledge that although participants were aware of the confidentiality of their responses, greater social desirability bias in survey responses among the treatment group could potentially inflate the observed treatment effects. Third, attrition at the endline reduces our ability to draw strong conclusions about persistence of the observed effects. Future work should test similar interventions over longer periods in different institutional contexts (e.g., workplaces) where participants are older or more politically diverse.

Overall, our findings show that climate education, when carefully designed and rolled out on a large scale, can increase support for ambitious climate policy. Education is not a substitute for compensatory or regulatory approaches, nor is it sufficient to bridge deep ideological divides. However, it can complement such approaches by strengthening beliefs in the effectiveness of climate policies, creating more constructive engagement with the climate crisis, and, ultimately, increasing the public acceptability of costlier climate policies to mitigate the risks of public backlash. This may lead to a larger coalition in favour of climate mitigation (2). At a time when costly climate policies are increasingly necessary to attain climate targets, and when opposition against climate policy is mounting (33–35), climate education is an important policy tool for governments in their pursuit of decarbonization.

Materials and Methods

Institutional Review Board Approval and Pre-Registration. This study was approved by the Ethics Committee at European University Institute on 28 June 2024. All participants provided informed consent prior to participating in each survey. The study was pre-registered on OSF on 31 August 2024: https://osf.io/d4vwm

Treatment: The 2tonnes Workshop. The 2tonnes workshop is a three-hour climate education program that teaches participants about climate change and the impacts of individual and collective actions to reduce greenhouse gas emissions. Its name reflects the benchmark set by climate models that average annual emissions must fall to 2 tonnes of CO2eq per person to meet the goals agreed under the Paris Agreement.

In the week prior to the workshop, participants are invited to calculate their personal carbon footprint – covering transport, housing, diet, and consumption of goods and services – using an online tool. Participants receive immediate feedback comparing their footprint to the average French citizen. Those who do not complete this step are assigned a randomly generated footprint for use in the gamified element of the workshop.

The workshop itself is a three-hour session consisting of an introduction, a simulation game, and a debrief. The introduction takes around 30-40 minutes. The facilitator educates participants on topics related to greenhouse gas emissions and carbon footprints, and participants answer quiz-style questions. Participants learn which activities are the most polluting and how their carbon footprint compares to national and workshop averages.

Next, participants take part in the main simulation, which alternates between eight individual and collective decision-making rounds. The shared objective is reducing both their individual and the collective carbon footprints to below 2tonnes of CO2eq by 2050. Each round iteratively simulates a future point in time where climate conditions continually worsen. Participants must choose from a set of actions across domains such as energy, food, housing, transport, industry, and international cooperation. They face a cost constraint in choosing actions. Individual rounds involve private choices about lifestyle, efforts to influence their private network, and political action. Collective rounds require group deliberation to choose various policy actions, simulating the role of government.

Finally, there is a concluding debrief where participants are asked to reflect on their experience, key takeaways, and one action

they will implement in their lives going forward. Additional details on the workshop and its content can be found in the SI Section X.

Recruitment, Sample Composition, Attrition and Compliance. We used a snowball sampling procedure to recruit participant universities which already integrate the 2tonnes workshop into their curricula. Ultimately, we recruited 10 universities which are located across France, in Paris, Toulouse, Lyon, Nancy, and Clermont-Ferrand. They cover a range of study programs: social sciences and public administration, aerospace engineering, civil aviation, civil engineering and urban planning, chemical and industrial engineering, agronomy and food sciences, veterinary sciences and business studies.

Across our 10 universities there were 167 workshops and 1,845 participants. Students in our final sample had an average age of 20, 45% were female, and a majority had at least one parent earning above the national average income. Full summary statistics are reported in Table X in the SI Section X. Full details of the recruitment strategy, randomization procedures, and distribution of workshop / students into treatment and control groups can be found in 1b and in the SI Section X.

We collaborated with administrative staff at each university to coordinate randomization procedures and distribution of online surveys. The mandatory nature of the workshop helped to mitigate against self-selection bias. The overall workshop-day attrition rate – which includes both absences and participation without a completed survey – was 19%. This rate differed between treatment (22%) and control (16%) groups. The higher rate for the treatment group likely reflects the lengthy nature of the workshop. Participation without completion of the survey was 13%, though this was lower for more experienced workshop facilitators. Table X in the SI shows that there was no significant imbalance between control and treatment arms across 15 variables plausibly unaffected by treatment (F-test = 1.05), indicating that attrition rates did not differ substantially between groups. Empirically, we also implement bounding analyses following (36), which confirm that our main conclusions are robust to attrition. Further details on workshop attrition can be found in the SI Section X.

Of the 1,845 workshop participants we surveyed, 331 opted in to complete an endline survey six-weeks later. As a result, our persistence effects must be interpreted with caution. Table X in the SI Section X presents balance tests which show that participants who took the endline survey were more supportive of costly climate policies at baseline, identified as more left-wing, and exhibited lower carbon-intensive lifestyles (less flying, less meat). Importantly, however, treatment status was balanced. This means that the endline sample is not representative of the baseline sample and thus limits the generalizability of the persistence effects. Further details on endline attrition can be found in the SI Section X.

Measurement of Outcome Variables. We collected data on support for three costly climate policies. Each respondent was asked to indicate their support on a 5-point Likert scale. We then created a binary indicator for policy support, coded as 1 if the respondents selected 'support' or 'strongly support' on the scale, and 0 if the show indifference or opposition to the policy. For our first two policy outcomes – a tax on beef products and a ban on flights – we provided respondents with the following descriptions and then asked their support:

- *"Imagine that, to fight climate change, the government decides to limit the consumption of beef. A high tax on beef is put in place, doubling its price."*
- *"Imagine that, to fight climate change, the government decides to limit the use of aeroplanes. A ban on national and international flights for destinations accessible by train or bus within 6 hours is put in place."*

Then for our third policy outcome – a ban on meat in the school canteen – we asked respondents the following question:

- *"Would you be in favor of introducing exclusively vegetarian menus in the university canteen?"*

For our behavioral outcome, we first offered participants an option to enter a lottery with a €100 prize (conditional on also completing a follow-up survey six weeks later). If they opted in, they are then given the opportunity to donate a portion of their potential winnings to Réseau Action Climat, an environmental NGO which does advocacy work on the topics of the policies we ask about earlier in the survey. Donation allocations were elicited using a sliding scale, with €1 increments ranging from €0 to €100.

Additional information on the measurement of other variables used in our analysis is provided in the SI Section X.

Estimation Strategy. The randomization strategy allows us to identify the immediate effect of the workshop on climate policy preferences. Our main estimand of interest is a finite population estimand at the student level. More specifically, we are interested in the average treatment effect of the workshop on our target population of students. We use the following estimation strategy:

$$Y_{ijsu} = \beta_0 + \beta_1 Z_j + \delta_s + \theta_u + \epsilon_{ijsu} \quad [1]$$

where i is the individual in the workshop j in experimental block s at university u, Z is a binary treatment indicator, and Y is the outcome of interest. The specification includes university fixed effects (θ_u) and experimental block fixed effects (δ_s) and uses CR2 cluster-robust standard errors at the workshop to account for the collective nature of the treatment. The coefficient β_1 captures the average treatment effect.

To test the persistence effects six weeks after the workshop we use two empirical strategies. First, using a within-group design, we estimate the following:

$$Y_{it} = \beta_0 + \beta_1 T + \theta_i + \delta_w + \epsilon_{it} \quad [2]$$

where i is the respondent, T is a dummy indicating whether an individual's response was recorded at time of the workshop or 6 weeks later, and Y is the outcome of interest. We use an individual fixed effect (θ), a workshop fixed effect (α_w) and cluster-robust standard errors CR2 at the individual level. β_1 is the average treatment effect we are interested in.

Next, using a between-group design, we estimate a difference-in-differences specification that interacts treatment status and survey wave (workshop day vs. endline). This approach compares changes in support for costly climate policies between treated and control respondents over time. The specification is:

$$Y_{it} = \beta_0 + \beta_1 Z_i + \beta_2 Post_t + \beta_3 (Z_i \times Post_t) + \theta_u + \epsilon_{it} \quad [3]$$

where Z_i is a treatment indicator, $Post_t$ is a post-treatment dummy (equal to 1 for endline responses), and θ_u are university fixed effects. The coefficient of interest is β_3, which captures the persistence of treatment effects relative to the control group. Standard errors are clustered at the workshop level.

Across all specifications, our primary estimand is the Intent-to-Treat (ITT) effect, in line with our pre-analysis plan. For robustness, we also estimate Local Average Treatment Effects (LATE), conduct leave-one-university-out sensitivity checks, and examine potential confounding by time-of-day of the workshop. Further implementation details, as well as additional robustness analyses, are reported in the SI Section X.

ACKNOWLEDGMENTS.

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Supporting Information for "Educational policies can strengthen climate coalitions"

November 12, 2025

A The 2tonnes Workshop

A.1 The invention of the 2tonnes workshop

The French Ministry for Higher Education set as objective that by 2025, all students in their bachelors should have followed a training on climate change, biodiversity and the ecological transition (Ministère de l'Enseignement Supérieur et de la Recherche 2022). Alongside these targets, entrepreneurial NGOs designed standardised climate change workshops which educate participants about the science of climate change and the types of changes needed to reduce greenhouse gas emissions to levels required by targets set by the Paris Agremeent, within or outside formal education institutions. Since their beginning in 2018, more than a million people have participated in the "Climate Fresk", which aims to educate participants about the fundamental science of climate change. Since their launch in 2020, over 260,000 people have taken the "2tonnes" workshop, which take a more policy-oriented approach to the climate crisis, focusing on individual- and societal-level changes needed to transition to a low-carbon society where individual carbon footprints are reduced to 2tonnes of CO2 equivalent per year by 2050. The 2tonnes workshops are deployed jointly by two organisations, headed by the same founders and CEOs. One organisation is a non-profit association responsible for running free workshops for a large and not predefined audience ("the general public"). The other is a social economy start-up (i.e. simplified joint stock company) which organises workshops in professional settings, i.e. for companies and public authorities.[1]. The theory of change behind the 2tonnes workshops centres on the idea that learning about the problem and its solutions can encourage people to change both the way they think about the climate crisis, and how they act to address it.

A.2 Workshop content

This section gives details of the main questions and points covered during the three-hour 2tonnes workshop.

Part 1: Introduction

1. How have poverty rates changed over time?
2. What is the average life expectancy?
3. How much have global temperatures risen since the last glacial period?
4. Are humans responsible for this?
5. What is the Paris Agreement goal? And how does this relate to the concept of "2tonnes"?

[1] See: https://www.2tonnes.org/a-propos

6. What are greenhouse gases?
7. What is a carbon footprint?
8. Which are the greatest sources of emissions amongst French citizens?
9. How do carbon footprints vary across countries?
10. How does your footprint compare to the average French citizen? And to others in the workshop group?

Part 2: Simulation Game

Below we summarise the main learning points from each of the rounds of the game. The discussion points can vary according to the group composition and topics of discussion of each workshop group. The points summarised here are those given most prominence on the slide deck, thus representing the most likely learning points.

- Round 1: Reduction in red meat consumption has by far the largest impact of any action that can be taken regarding individual food consumption habits.
- Round 2: changing agricultural practices (for example, using less fertiliser) and switches to biogas instead of "natural" gas are impactful policies.
- Round 3: Travelling alone in a combustion engine car is highly emitting, and can reach levels comparable with flying. Car-sharing reduces this. Reducing or stopping flying, investing in an electric vehicle, using public transport and travelling less are effective ways to reduce your carbon footprint.
- Round 4: Investment in vehicle technologies and public transport are effective ways to reduce emissions.
- Round 5: Investing in a heat pump or insulation in your home are effective ways to reduce your carbon footprint. Changing to a green electricity supplied can also be beneficial, although in countries such as France, the energy mix is already low-carbon meaning there are fewer gains to be made here.
- Round 6: Optimising energy in the tertiary sector, investing in the circular economy (using fewer raw materials) and supporting other countries in their energy transitions are beneficial ways to reduce carbon emissions.
- Round 7: If you have not yet become vegan and stopped flying, these are by far the most impactful actions you can take.

- Round 8: The group must choose between developing renewable energies and renewing investment in nuclear power (or opt for both). Radical policies such as import bans on products from high-emitting countries or carbon quotas on individuals are discussed. Participants learn that radical measures can be very effective, but will debate how desirable or feasible such policies are.

Part 3: Debrief

Below are the key points covered during the workshop debrief:

1. Whether the goal of an average of 2tonnes per person is reached depends on decisions made by the participants during the game.
2. Reaching the goal of 2tonnes is an ambitious target. The model used in the game is a simplification of reality, but it shows that significant reductions in greenhouse gas emissions are possible.
3. Action should be taken in all sectors, both at the individual and collective levels.
4. Citizens, governments and firms must all act to create change.
5. The facilitator presents a recap of actions that can be taken to reduce greenhouse gas emissions in the topics covered in the workshop.
6. The group are invited to share reflections on how they feel after taking the workshop, one key thing they have learnt and one action they want to commit to moving forward.
7. The workshop concludes with the message that reaching the goal of 2tonnes is ambitious, but necessary. It is reaffirmed that there are many ways to reach this goal, and the energy transition also presents opportunities.
8. The workshop ends with information about how participants can themselves become a volunteer facilitator.

A.3 Cost-effectiveness of the 2tonnes workshop

Summary of the results

This section examines the cost-effectiveness of the 2tonnes climate education workshop in comparison with other educational interventions designed to increase support for climate policies. While most educational programs focus on individual behavioral change or attitudinal shifts (such as beliefs about policy effectiveness), few explicitly measure impacts on policy support. Consequently, we conduct a cost-effectiveness analysis on two distinct outcomes: (a) beliefs in policy effectiveness

and (b) policy support. The former is derived from empirical effect sizes in the literature, while the latter is estimated using a bounding exercise based on comparable interventions.

Table 1 summarizes the results. We found that overall the 2tonnes workshop is less cost-effective that light greening curriculum or free simulation on updated policy effectiveness beliefs of students. However, on increasing policy support, we see a stark difference. The 2tonnes workshop is almost twice as cost-effective as other interventions.

Table 1. Cost-effectiveness of climate education and engagement interventions

Intervention	Outcome	Effect size (pp)	Cost/participant (€)	Cost-effectiveness (€/pp)
2tonnes workshop	Policy support	7	30	4.3
2tonnes workshop	Policy effectiveness belief	15	30	2.0
Light curriculum greening	Policy support	12	100	8.3
Light curriculum greening	Policy effectiveness belief	29	100	3.5
Ambitious curriculum greening	(average across outcomes)	–	–	–
Online simulation (En-ROADS, World Climate)	Policy support	2	12	6.0
Online simulation (En-ROADS, World Climate)	Policy effectiveness belief	27	12	0.4
Citizen deliberation assemblies	(not estimated)	–	–	–

Notes: Cost-effectiveness is calculated as the cost per percentage point change in the relevant outcome variable. Effect sizes for the *2tonnes* workshop are derived from the impact evaluation described in Section **??**, while other estimates are based on literature benchmarks (Aeschbach, 2025; Rooney-Varga et al., 2025; Landmann et al., 2024). All costs are expressed in euros (excl. tax) per participant.

Cost-effectiveness of the 2tonnes Workshop

In university settings, the 2tonnes workshop can be implemented in a modular format at a cost ranging from €15 to €30 per student, depending on whether facilitation is provided internally by faculty or externally by trained facilitators. In the lower-cost scenario, the university provides its own facilitator. Given a three-hour session, a facilitator rate of €60 per hour, and a group size of 15 participants, the facilitation cost is approximately:

$$\frac{60 \times 3}{15} = 12 \text{ £ per person.}$$

Including all materials and logistics, we assume an overall cost of €30 per participant.

Cost-effectiveness is computed as:

$$\text{Cost per pp change} = \frac{\text{Cost per participant}}{\text{Effect size (in pp)}}.$$

- **Policy support:** with an effect size of 7 percentage points and a cost of €30 per participant, the cost-effectiveness ratio is €4.3 per percentage point.
- **Policy effectiveness belief:** with an effect size of 15 percentage points and a cost of €30 per participant, the cost-effectiveness ratio is €2.0 per percentage point.

Greening university curricula

We compare this intervention with broader efforts to integrate climate change into university curricula. Such initiatives range from the addition of standalone courses on climate change ("light greening") to comprehensive curriculum reforms ("ambitious greening") that embed climate policy and sustainability issues across the program.

A meta-analysis of climate education interventions reports medium-to-large effects on knowledge and small-to-medium effects on attitudes (Aeschbach, 2025). Workshop- and simulation-based programs, such as 2tonnes, are considered distinct from these curricular reforms and are therefore discussed separately below.

As conducting a comprehensive cost-effectiveness assessment across all educational formats is beyond the scope of this paper, we adopt a conservative approach, biasing against the hypothesis that the 2tonnes workshop is more cost-effective than alternative interventions.

- **Light curriculum greening:** refers to short, standalone climate-related courses or certificate programs, typically offered through continuing education or executive training. Such programs entail instructor fees, coordination, digital platform access, and materials. For instance, the *Carbon Literacy Training – Carbon Charter* program consists of three 2-hour sessions and costs approximately €100 per participant (`https://carboncharter.org/events/carbon-literacy-training-3/`).

  Using Hedges' g values from Aeschbach et al. (2025) of 0.72 for policy effectiveness beliefs and 0.29 for policy support, and assuming a baseline support level of 50%, we approximate the effect in percentage points as:

  $$\Delta p \approx g \times \phi(\Phi^{-1}(0.5)) \approx g \times 0.3989.$$

  This yields effects of approximately 29 pp (for $g = 0.72$) and 12 pp (for $g = 0.29$). Corresponding cost-effectiveness ratios are therefore:

  $$100/29 \approx 3.5 \text{ £/pp}, \quad 100/12 \approx 8.3 \text{ £/pp}.$$

- **Ambitious curriculum greening:** NEED TO BE WRITTEN? Cordero et al. (2020)

Online simulation tools on climate change

Simulation-based educational tools, such as the *World Climate* and *En-ROADS Climate Action Simulation*, are freely available and primarily incur facilitation costs. These workshops have reached over 468,000 participants in 181 countries, notably within universities (Rooney-Varga et al., 2025).

Evaluations report substantial gains in knowledge and significant improvements in perceived policy effectiveness (Landmann et al., 2024).

Using an observed 27 pp increase in policy effectiveness belief (Rooney-Varga et al., 2025) and a facilitation cost of €12 per participant, we obtain:

$$12/27 \approx 0.4 \text{ £/pp.}$$

For political support, Landmann et al. (2024) report negligible effects (Hedges' $g = 0.05$), corresponding to a 2 pp change, yielding:

$$12/2 = 6 \text{ £/pp.}$$

Citizen deliberation assemblies

Finally, we consider citizen deliberation assemblies as a benchmark intervention for shaping informed public preferences on climate policy. While these processes can produce substantial attitude shifts, they involve considerably higher per-participant costs due to extended facilitation, recruitment, and deliberation logistics.

B Descriptive Statistics, Compliance and Attrition

Table 2 presents descriptive statistics on the number of workshops evaluated in each participating university, as well as the number of students in each university who participated in our study. The initial number of students refers to the number of students administrative staff expected to participate in the workshops. This data was provided to us in advance of the workshops during the randomisation phase. The number of students reached is the number of students who completed the survey (either before the workshop for workshops assigned to the control condition, or after the workshop for workshops assigned to the treatment condition). We surveyed 1,845 of the 2,274 students we expected to be included in the workshops, implying an overall attrition rate of 19%. Within this overall attrition rate, two types of attrition can be observed. Pre-attendance attrition refers to cases where students did not attend the workshop, whereas post-attendance attrition refers to students who did participate in the workshop, but didn't fill out our survey.

We achieved a compliance rate of of 93%, meaning that 93% of study participants were in the treatment condition to which we assigned them. A large part of the non-compliance we observe comes from two universities where, due to last-minute administrative changes or confusion, entire workshops switched treatment assignment. We report the Intent-to-Treat (ITT) effect in the main results and report the Local Average Treatment Effect (LATE) in the Appendix G.1 as a robustness check.

Table 2. Descriptive statistics of number of workshops, compliance and attrition for the full sample and by university

	Workshops	**Students**		**Compliance (%)**	**Overall attrition (%)**		
		Initial	Reached		All	Control	Treated
Full sample	167	2274	1845	93	19	16	22
UNI1	12	153	130	100	15	20	10
UNI2	19	213	197	100	8	1	13
UNI3	16	277	168	100	39	32	47
UNI4	17	190	154	95	19	17	21
UNI5	14	221	192	96	13	12	14
UNI6	21	277	189	68	32	29	34
UNI7	10	121	94	85	22	20	25
UNI8	2	20	17	100	15	0	30
UNI9	4	50	35	100	30	33	27
UNI10	41	581	508	94	13	9	16
UNI11	11	171	161	100	6	3	9

Note: Compliance refers to the proportion of participants in the treatment condition to which they were assigned. Overall attrition is composed of both pre-attendance attrition (i.e. absence) and post-attendance attrition (i.e. non-completion of the survey). We conduct our study in ten universities, but report eleven in this table, since UNI11 is the same institution as UNI5, but a different student cohort.

To assess pre-attendance attrition, we rely on facilitator reports, which were collected from 111 of the 167 workshops. On average, pre-attendance attrition was approximately 8.5%, with similar rates for treated (8.21%) and control workshops (8.7%). Since workshop attendance was mandatory across all participating universities, pre-attendance attrition remained relatively low. However, it was not zero, as students may have been unable (e.g., due to illness) or unmotivated to attend. Because students were unaware of their treatment status until they arrived at the workshop, pre-attendance attrition is unlikely to differ systematically between treatment and control groups. As a result, this type of attrition does not compromise our ability to identify the Average Treatment Effect (Lo, Renshon and Bassan-Nygate 2024) .

The more concerning issue is post-attendance attrition, as this may violate the core assumption required to identify the causal effect of treatment: specifically, that treatment assignment is independent of potential outcomes. We estimate that post-treatment attrition accounts for 10.5 percentage points of the overall 19% attrition rate.

In the absence of complete data for pre-attendance and post-attendance attrition, we employ strategies to further assess overall attrition which help to evaluate any potential threat to the validity of our inferences. First, we assess reasons for non-attendance. In four universities where students were assigned to workshops (covering 600 students), we examine whether non-attendees differ from attendees. Table 3 presents the results of this analysis. Gender was the only covariate consistently recorded across all four universities, and we find no systematic differences between attendees and non-attendees. For one university (approximately 250 students), we have further background in-

formation on non-participants. Notably, students of an environment-related topic (biology) were significantly less likely to be absent. They constituted 26% of survey respondents but only 6% of non-participants, a difference statistically significant at the 0.1% level. This suggests that students less interested in environmental topics were more likely to disengage from the workshop and survey, despite the mandatory nature of the workshop.

Table 3. Pre-treatment covariates balance between workshop attendees and non-attendees

	Average		**diff**	**p-value**
	Absent	Attended		
Female	0.345	0.375	0.0295	0.45
Biology bachelor	0.0625	0.259	0.197	0.001
Maths bachelor	0.312	0.187	-0.126	0.16
Physics bachelor	0.0938	0.119	0.0254	0.66
Computer science bachelor	0.0938	0.171	0.0772	0.196
Civil servant students	0.531	0.565	0.0335	0.73
Prep school students	0.574	0.626	0.0523	0.539

Note: The table represents the average of pre-treatment covariates for students who did and did not attend the workshop across four universities. The third column shows the difference between the two groups and the p-value from a t-test is shown in the fourth column. The female variable is present in all four universities. The curricula variables are from one university only.

Second, we examine whether facilitator demographics predict overall attrition rates. We calculate the number of missing responses per workshop (as self-reported by facilitators) and regress it on key facilitator characteristics. Facilitators without prior workshop experience exhibit significantly higher attrition—an increase of 19 percentage points—compared to experienced facilitators. This suggests that first-time facilitators may have struggled to balance the demands of leading a workshop while adhering to the evaluation protocol, likely contributing to the observed attrition.

Third, we assess whether attrition rates differ between the treatment and control groups. Descriptively, the combined pre- and post-attendance attrition rate is 22% in the treatment group and 16% in the control group. We use Welch's two-sample t-test to evaluate whether this difference is statistically significant. As reported in Column 2 of Table 4, the 6-percentage-point difference—equivalent to approximately one student in a workshop of 15—is significant at the 5% level. The slightly higher attrition among treated units may reflect challenges in sustaining student engagement throughout the session. In anticipation for such unbalances, we instructed facilitators to administer the post-survey before the final segment of the workshop. The covariate balance table in the main text shows no significant differences between groups, suggesting that attrition does not systematically bias the comparison between treatment and control units.

Table 4. Statistical association between facilitator demographic characteristics and attrition rates

	Attrition rates				
	(1)	(2)	(3)	(4)	(5)
Constant	15.52***		2.15		
	(1.94)		(8.33)		
Treatment	6.03·	5.91*	3.38	4.10	4.59
	(3.14)	(2.82)	(3.62)	(3.25)	(3.43)
Treatment × No experience					−3.25
					(11.98)
Female			3.43	5.86	5.82
			(3.53)	(3.73)	(3.80)
Age			0.23	0.19	0.19
			(0.17)	(0.16)	(0.16)
No experience			19.03**	8.96	10.55
			(6.66)	(6.34)	(7.38)
Experience			−0.01	−0.09	−0.09
			(0.08)	(0.08)	(0.08)
University FE	No	Yes	No	Yes	Yes
Adj. R^2	0.02	0.21	0.07	0.27	0.27
Num. obs.	167	167	112	112	112

Note: The table represents the result of the OLS regression between facilitator key demographic characteristics and attrition rates. Variables included are the treatment status of the workshop, gender, and age of the facilitator, a dummy for whether the facilitator have at least one experience in facilitating the workshop, and a variable for the number of workshop facilitating. In parenthesis robust standard errors. $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\cdot}p < 0.1$

The gold standard for addressing attrition, as discussed by Coppock et al. (2017), is the double-sampling strategy. However, in the absence of baseline data, we are unable to follow up with non-respondents. Instead, we implement the bounding approach proposed by Lo, Renshon and Bassan-Nygate (2024). Figure 1 presents the results. Under sharp bounds, we assign the highest possible outcome to control units with missing data and the lowest possible outcome to treated units with missing data. This reflects an extreme scenario in which only the most pro-climate policy students in the control group and the least pro-climate policy students in the treatment group fail to respond. Under this assumption, the Average Treatment Effect (ATE) for the university student population is undefined. However, this scenario is unlikely to be realistic. Under milder bounds—where the probability of receiving the highest score is set at 0.67 for missing control observations and 0.33 for missing treated observations—we find that the ATE is likely to be positive.

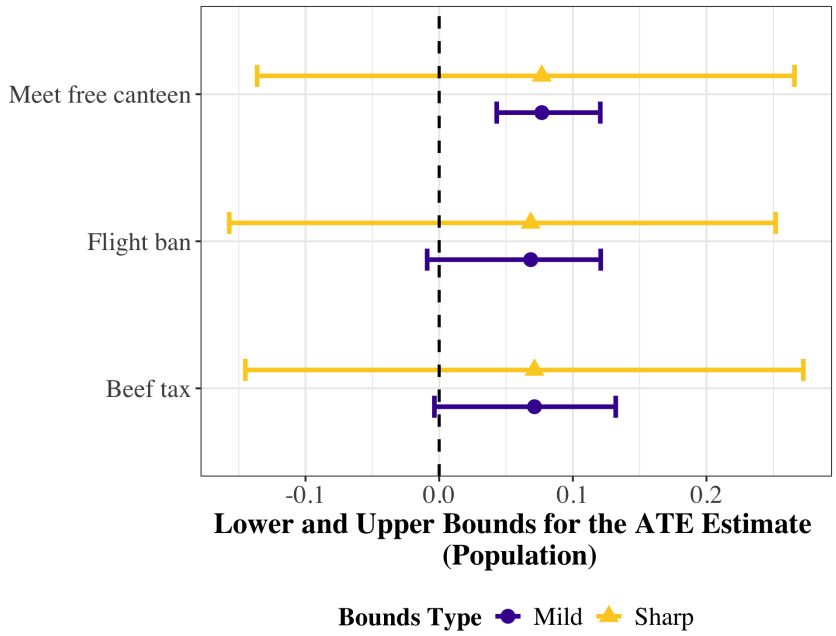

Figure 1. Sharp and mild bounds estimation of the Average Treatment Effect of participation into the 2tonnes workshop for the population of college students

C Randomization and Covariate Balance

Table 5. Covariate balances for covariates expected to not be impacted by the workshop

	Control (C)	Treatment (T)	(C) - (T)
Progress	99.74	99.77	0.03
Survey finished	0.99	0.99	0.00
Length	1387.38	578.97	-808.42
Age	19.88	19.84	-0.03
Female	0.45	0.45	0.00
Income	4334.90	4333.97	-0.92
Childhood in rural area	0.39	0.41	0.02
Participation in Climate Fresque	0.42	0.42	-0.00
Carbon footprint measured	0.80	0.77	-0.03
Demonstrated for non-environmental cause	0.07	0.05	-0.01
Demonstrated for environmental cause	0.02	0.01	-0.01
Donation to a climate NGO	0.06	0.07	0.00
Shared information on climate change	0.18	0.20	0.02
Flight consumption (log)	0.20	0.21	0.01
Meat consumption	2.48	2.53	0.05
F-test: 1.05			

Note: Income = income of the highest-earning parent (multiple choice within income brackets). Childhood in a rural area = whether respondent spent majority of years 10–18 in a rural area, where 1 = rural, 0.5 = peri-urban, 0 = urban. Participation in Climate Fresque = binary variable, prior participation in a similar climate workshop. Carbon footprint = whether participant calculated carbon footprint before the workshop. Flight consumption (log) = logarithmic transformation of number of flights taken in Europe within past year. Meat consumption = times per week eating red meat. $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{+}p < 0.1$.

Table 6. Covariate balance between participants who took only the midline survey and those who completed both midline and endline

	Midline Only	**Midline & Endline**	**Difference**
Workshop treatment status	0.50	0.52	0.02
Age	19.83	20.23	0.40***
Female	0.45	0.49	0.04
Income	4492.91	3855.30	-637.61***
Participation in Climate Fresque	0.42	0.48	0.06^{+}
Carbon footprint	0.77	0.85	0.08**
Political activism index	0.32	0.35	0.03
Donation to climate NGO	0.07	0.05	-0.02
Sharing climate info	0.18	0.21	0.03
Environmental strike participation	0.01	0.02	0.01
Any strike participation	0.06	0.07	0.01
Flight consumption (log)	0.22	0.16	-0.06***
Meat consumption	2.52	2.38	-0.14*
Support for beef tax	2.79	3.04	0.25**
Support for flight ban	3.36	3.81	0.45***
Support for meat-free canteen	2.79	3.15	0.36***
Perceived effectiveness - beef	3.24	3.43	0.19**
Perceived effectiveness - flight	3.76	4.04	0.28***
Party ID: left	0.12	0.16	0.04
Party ID: centre-left	0.15	0.28	0.13***
Party ID: centre	0.08	0.07	-0.01
Party ID: centre-right	0.10	0.08	-0.02
Party ID: (far-)right	0.05	0.05	0.00
Conservatism index	0.15	0.13	-0.02
N	1516	331	

Note: The table displays mean values for a series of variables. These variables are all measured at the initial survey. The aim here is to compare differences between those who opted-in to take the endline survey and those who did not. The difference column represents the results of a series of t-tests. Income = income of the highest-earning parent (multiple choice within income brackets). Participation in Climate Fresque = binary variable, prior participation in a similar climate workshop. Carbon footprint = whether participant calculated carbon footprint before the workshop. Flight consumption (log) = logarithmic transformation of number of flights taken in Europe within past year. Meat consumption = times per week eating red meat. Party ID refers to the political party to which the respondent feels closest, using Piketty and Cagé's (2023) classification. Conservatism index = centre-right or right. $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{+}p < 0.1$.

D Measurement and Survey Instrument

D.1 Measurement

D.2 Survey Instrument

We are a team of researchers from the European University Institute in Florence. We would like to know your views on certain environmental issues in France.

Your personal information will be stored separately from your responses to this questionnaire and will not be shared with anyone outside our team. The questionnaire takes approximately 5 to 10 minutes to complete. By answering it, as well as a follow-up questionnaire in a few weeks, you will have the opportunity to enter a lottery to win 100 euros.

The next page contains more details on data confidentiality and protection in the context of this survey and requests your consent.

Privacy Statement and Consent Form

[Omitted.]

Section 1: Demographics

d_age How old are you? [Terminate if under 17]

d_email Please enter your university email address.

d_treatment Is it the beginning or end of your workshop?

d_facilitator What is the name of your facilitator? (Please provide first and last names.)

d_female What is your gender?

d_rural Where did you grow up: in a rural or urban area? (If both, choose where you spent the majority of your time from age 10-18.)

d_income What is the total monthly income of the parent with the highest income after taxes? [Choice from list.]

d_party To which political party do you feel closest? [Choice from list.]

d_salience What do you think are the two most important issues facing France at the moment? [Crime, economic situation, rising prices/ inflation/ cost of living, taxation, unemployment, terrorism, housing, government debt, immigration, health, education system, pensions, environment and climate change, energy supply, other, none, I don't know]

d_corrupt Please tell whether you agree or disagree with the following? There is corruption in the national public institutions in France.[1-5 Likert scale]

d_meat In the past week, how many times have you eaten red meat?

d_fly In the past year, how many flights have you taken within Europe? (A return flight indicates two separate flights.)

d_psy To what extent do you feel that climate change will affect your life personally in the next 10 years? [1-5 Likert scale]

d_participate Have you taken any of the following workshops before today? [2tonnes, Fresque du Climat, neither]

d_emotion When you think about climate change, what is your reaction? Please choose up to 2 options [Motivated, anxious, optimistic, concerned, indifferent, calm, hopeful, guilty, sad, angry, none of these emotions, I don't know]

d_cf Have you already calculated your carbon footprint using 2tonnes?

activism Have you ever? [Protested, protested for the environment or climate, donated money to an environmental association or organisation, shared content around you to raise awareness about climate and the environment, none of the above]

Section 2: Climate Policies

p_beef A high tax on beef

Imagine that, to combat climate change, the government decides to limit the consumption of beef and dairy products. For this purpose, a high tax on beef products is implemented, doubling the price of beef. Do you agree or disagree with the following statements? (1-5 Likert scale)

- I am in favour of a high tax on beef products.
- A high tax on beef products would be an effective means to combat climate change.

p_flying Ban on flights to destinations accessible by train or bus within 5 hours

In 2023 the French government introduced a ban on any flight between two locations which could be reached by up to 2.5 hours via train. Now imagine this ban was increased to cover all locations, both domestic and international, which are up to 6 hours away via bus or train.

Do you agree or disagree with the following statements ? (1-5 Likert scale)

- I am in favour of implementing a ban on all flights between locations which are 6 hours apart via bus or train.
- Such a ban on flights would be an effective means to combat climate change.

p_canteen Would you support a ban on meat being served in the canteen of your university?

Section 3: Knowledge

k_car Which of the following contributes the most to the carbon footprint of the average French citizen? [Car usage, meat consumption, aeroplane travel, heating, use of digital and online services, I don't know]

k_beef What is the estimated contribution of beef consumption to the carbon footprint of the average French person? [3%, 15%, 30%, I don't know]

Section 4: Behavioural Change

b_enough On a scale of 0 (not nearly enough) - 10 (more than enough), are the following actors currently doing enough to address climate change: Individuals, Government, Firms/Private Business?

p_lottery By completing this questionnaire and a follow-up questionnaire, you can enter a lottery to win 100 euros. Would you like to participate? (Results by March 1, 2025)

p_donation If you win the lottery, would you be willing to donate part or all of your 100 euros to the climate NGO Réseau Action Climat **[(Randomise between three options): committed to fighting climate change/ committed to reducing beef consumption/ committed to reducing air travel]**? Indicate the amount of your donation on a slider from 0 (nothing) to 100 (all).

Section 6: Workshop Feedback

w_enjoyed On a scale of 0 (did not enjoy) - 10 (enjoyed a lot), did you enjoy the workshop? [Treatment only]

w_interview Would you be willing to be contacted to participate in a short interview about your experience taking the 2tonnes workshop? [Treatment only]

w_footprint_consent Do you consent to our team receiving your carbon footprint data from 2tonnes?

E Pre-Registered Hypotheses

E.1 Deviations from the Pre-Analysis Plan

In the pre-analysis plan (PAP), we included a hypothesis which stipulated that the workshop would reduce participants' psychological distance to climate change. The variable we used in our survey to capture psychological distance was a question asking "To what extent do you feel that climate change will affect your life personally in the next 10 years?". Considering that this single variable does not adequately capture the multi-faceted nature of the concept of psychological distance, we have chosen to report this as the perceived personal impact of climate change. Results are shown in Table **??** and Appendix F.3.

The PAP specifies an expectation that the workshop will have a weaker effect on participants who have previously engaged in environmental activism. We will include results which speak to this in the next version of the paper. Results for the framing experiment for the lottery donation outcome will also be reported in the next version of the paper.

F Further Results

F.1 Knowledge

Table 7. Effects of workshop participation on climate knowledge

	Immediate Effect	**6-Week Effect**
	Knowledge	Knowledge
Treatment	0.22***	0.48***
	(0.02)	(0.05)
Post-Survey (6 wks)	–	0.20**
		(0.06)
Treatment × Post	–	0.39***
		(0.08)
Control mean	0.49	–
DV range	[0, 1]	
Block FE	Yes	Yes
Individual FE	No	Yes
Estimator	ITT	DiD
Adj. R^2	0.11	0.14
Num. obs.	1832	549
Clusters	167	101
RMSE	0.34	0.43

Note: Immediate effect results are estimated using an Intent-to-Treat (ITT) model with experimental block fixed effects and cluster-robust standard errors. The 6-week effect column reports estimates from a difference-in-differences (DiD) model with time and workshop fixed effects. Knowledge = the average of two binary variables, each coded 1 if the respondent correctly identified components of the average French carbon footprint. The long term effect model reports the interaction of the treatment dummy with a time dummy indicating whether the survey was answered 6 weeks later. We use experimental block fixed effects, and cluster-robust standard errors at the workshop level.$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\dagger}p < 0.1$.

F.2 Policy effectiveness beliefs

Table 8. Effects of workshop participation on beliefs about policy effectiveness

	Immediate Effect		**6-Week Effect**	
	Beef Tax	Flight Ban	Beef Tax	Flight Ban
Treatment	0.18***	0.10***	0.24***	0.09
	(0.02)	(0.02)	(0.06)	(0.06)
Post-Survey (6 wks)	–	–	0.05	0.01
			(0.05)	(0.03)
Treatment × Post	–	–	0.13†	0.02
			(0.07)	(0.04)
Control mean	0.49	0.66	–	–
DV range		$[0, 1]$		
Block FE	Yes	Yes	Yes	Yes
Individual FE	No	No	Yes	Yes
Estimator	ITT	ITT	DiD	DiD
Adj. R^2	0.05	0.09	0.09	0.05
Num. obs.	1804	1809	549	547
Clusters	167	167	101	101
RMSE	0.49	0.43	0.47	0.39

Note: Immediate effects are estimated using Intent-to-Treat (ITT) models with experimental block fixed effects and cluster-robust standard errors. 6-week effects are estimated using difference-in-differences (DiD) models with time and workshop fixed effects. Outcome variables are binary: 1 if respondent rated policy as effective (Likert 4–5), 0 otherwise. The long term effect model reports the interaction of the treatment dummy with a time dummy indicating whether the survey was answered 6 weeks later. We use experimental block fixed effects, and cluster-robust standard errors at the workshop level.$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\dagger}p < 0.1$.

F.3 Perceived personal impact of climate change

Table 9. Effects of workshop participation on perceived personal impact of climate change

	Immediate Effect	**6-Week Effect**
	Perceived Impact	Perceived Impact
Treatment	0.01	0.03
	(0.01)	(0.02)
Post-Survey (6 wks)	–	0.01
		(0.01)
Treatment × Post	–	0.02
		(0.02)
Control mean	0.70	–
DV range	$[0, 1]$	
Block FE	Yes	Yes
Individual FE	No	Yes
Estimator	ITT	DiD
Adj. R^2	0.04	0.15
Num. obs.	1835	552
Clusters	167	101
RMSE	0.22	0.19

Note: Midline results are reported using an intent-to-treat (ITT) estimator, experimental block fixed effects, and cluster-robust standard errors at the workshop level. Endline results use a difference-in-differences estimator (ATT) with individual and workshop fixed effects. Perceived impact = perceived personal impact of climate change over the next ten years, originally on a 1–5 scale (1 = not at all, 5 = a lot), rescaled to range from 0 to 1. The long term effect model reports the interaction of the treatment dummy with a time dummy indicating whether the survey was answered 6 weeks later. We use experimental block fixed effects, and cluster-robust standard errors at the workshop level. $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$.

F.4 Issue salience of climate change

Table 10. Effects of workshop participation on climate salience

	Immediate Effect	**6-Week Effect**
	Salience	Salience
Treatment	0.02	0.07
	(0.02)	(0.07)
Post-Survey (6 wks)	–	0.03
		(0.04)
Treatment × Post	–	0.02
		(0.07)
Control mean	0.44	–
DV range	$[0, 1]$	
Block FE	Yes	Yes
Individual FE	No	Yes
Estimator	ITT	DiD
Adj. R^2	0.11	0.08
Num. obs.	1845	558
Clusters	167	101
RMSE	0.47	0.47

Note: The immediate effect results are reported using an Intent-to-Treat (ITT) estimator, experimental block fixed effects, and cluster-robust standard errors at the workshop level. The 6-week effect column reports estimates from a difference-in-differences model with time and workshop fixed effects. Salience = binary variable indicating whether participant listed "environment and climate change" as one of the two most important problems France is facing. The long term effect model reports the interaction of the treatment dummy with a time dummy indicating whether the survey was answered 6 weeks later. We use experimental block fixed effects, and cluster-robust standard errors at the workshop level. $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\dagger}p < 0.1$.

F.5 Positive emotions

Table 11. Effects of workshop participation on climate-related positive emotions

	Immediate Effect	**6-Week Effect**
	Positive Emotions	Positive Emotions
Treatment	0.08***	0.06
	(0.02)	(0.06)
Post-Survey (6 wks)	–	0.00
		(0.04)
Treatment × Post	–	0.13*
		(0.06)
Control mean	0.37	–
DV range	[0, 1]	
Block FE	Yes	Yes
Individual FE	No	Yes
Estimator	ITT	DiD
Adj. R^2	0.03	0.10
Num. obs.	1845	566
Clusters	167	101
RMSE	0.48	0.47

Note: The immediate effect results are reported using an Intent-to-Treat (ITT) estimator, experimental block fixed effects, and cluster-robust standard errors at the workshop level. The 6-week effect column reports estimates from a difference-in-differences model with time and workshop fixed effects. Positive emotions = binary variable indicating whether respondents pick at least one positive emotion from a choice list when asked about their reaction to climate change. The long term effect model reports the interaction of the treatment dummy with a time dummy indicating whether the survey was answered 6 weeks later. We use experimental block fixed effects, and cluster-robust standard errors at the workshop level. $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\dagger}p < 0.1$.

F.6 Responsibility

Table 12. Causal effects of workshop participation on assessment of perceptions of whether different actors are doing enough to address climate change

	Citizens	Firms	Government
Treatment	-0.35^{***}	0.04	0.22^{*}
	(0.09)	(0.12)	(0.11)
Control mean	4.82	3.12	3.64
DV range		$[0, 10]$	
Block FE	Yes	Yes	Yes
Covariates	Yes	Yes	Yes
Estimator	ITT	ITT	ITT
Adj. R^2	0.02	0.10	0.09
Num. obs.	1830	1830	1830
Clusters	167	167	167
RMSE	1.90	2.33	2.24

Note: This table only reports immediate effects. Results are reported using an intent-to-treat (ITT) estimator, experimental block fixed effects, and cluster-robust standard errors at the workshop level. Outcome variables are measured on a scale from 0 to 10, which captures whether workshop participants think each actor is not doing enough (0) or doing enough (10) to address climate change. $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$.

F.7 Lottery donations

Table 13. Causal effects of participation in the 2tonnes workshop on participation in the lottery and donation for an NGO advocating for the implementation of costly climate policy

	Lottery Participation	Donation (in €)
Treatment	0.02	−2.55
	(0.02)	(1.52)
Control mean	0.83	32
DV range	$\{0, 1\}$	$[0, 100]$
Covariates	No	No
Block FE	Yes	Yes
Estimator	ITT	ITT
Adj. R^2	0.03	0.04
Num. obs.	1845	1545
Clusters	167	167
RMSE	0.36	30.92

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\dagger}p < 0.1$

Note: Results reported using an Intent-to-Treat (ITT) estimator, experimental block fixed effects, and cluster-robust standard errors at the workshop level. Lottery participation is measured as a binary variable. Donation is measured in euros, ranging from 0 to 100. $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\dagger}p < 0.1$.

F.8 Results by university

The universities specialise in the following subjects:

- U1: social sciences, political science, public administration, and international relations
- U2: civil engineering, urban planning, environmental engineering, and transport infrastructure
- U3: social sciences, political science, public administration, and international relations
- U4: applied sciences, technology, and professional training in engineering and industry-related fields
- U5: civil aviation, air transport management, and aeronautical engineering
- U6: aerospace engineering, aeronautics, and space technology
- U7: agronomy, food science, biotechnology
- U8: veterinary sciences, agriculture, and food safety
- U9: technology, engineering, business, communication, applied sciences
- U10: business, management, finance, and marketing
- U11: civil aviation, air transport management, and aeronautical engineering

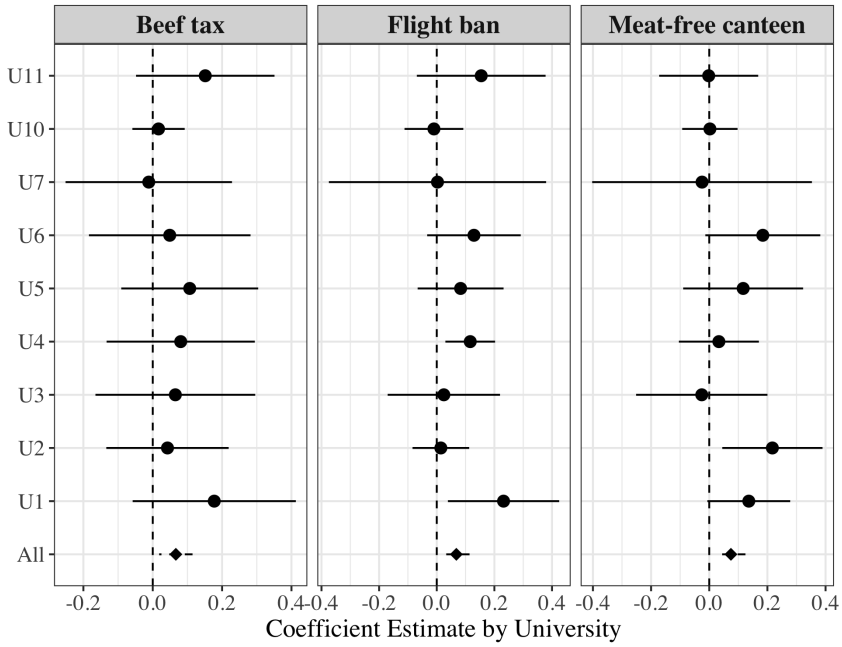

Figure 2. Estimates use a dummy measure of policy support, where responses are coded 1 if respondents show support for the policy, 0 otherwise. Dots represents the ITT estimate using block randomisation fixed effects and cluster standard errors at the workshop level. Bars represent 95% confidence interval. Two universities are excluded because of the small number of students. The final row labelled "All" shows the combined results.

F.9 Heterogeneity by discipline

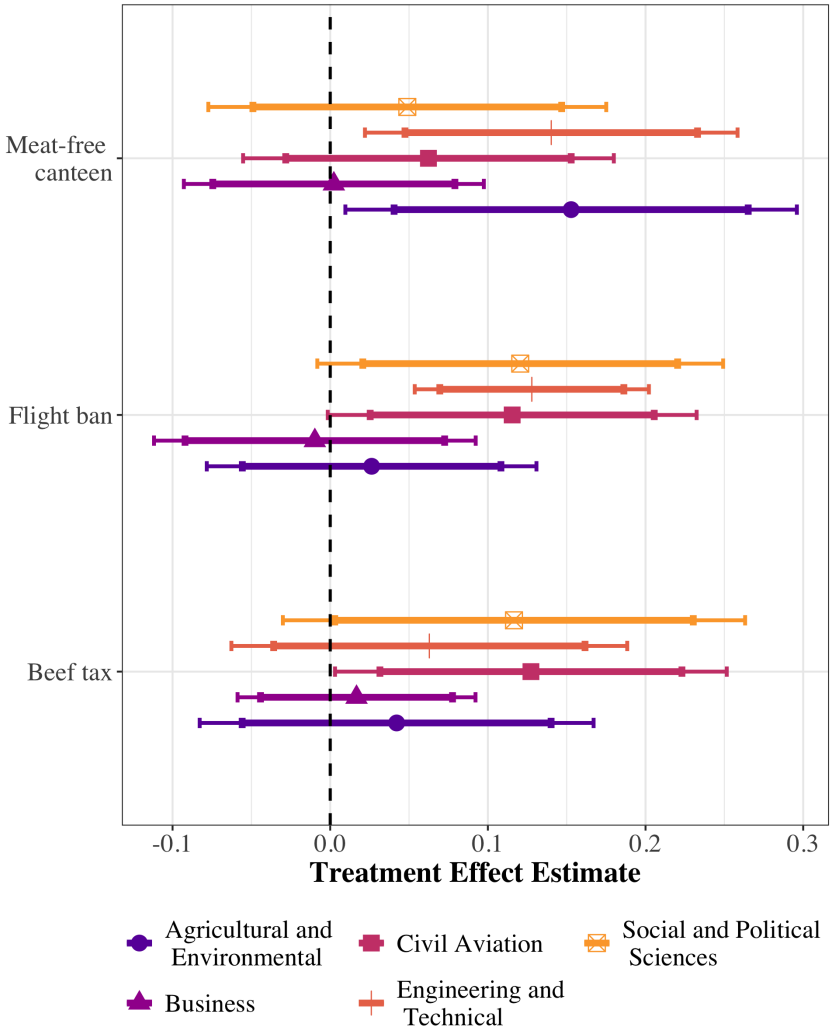

Figure 3. Estimates use a dummy measure of policy support, where responses are coded 1 if respondents show support for the policy, 0 otherwise. Dots represents the ITT estimate using block randomisation fixed effects and cluster standard errors at the workshop level. Thick bars represent 90% confidence interval and thin bars the 95% confidence interval.

G Robustness Checks

G.1 Immediate effect with LATE estimator

Table 14. Causal effects of workshop participation on support for costly climate policies with a LATE estimator

	Immediate effect		
	Fly ban	Beef tax	Meat-free canteen
Treatment	0.08***	0.08**	0.08***
	(0.02)	(0.02)	(0.02)
Num. obs.	1810	1800	1818
Adj. R^2	0.14	0.06	0.05
Block FE	Yes	Yes	Yes
Covariates	No	No	No
Estimator	LATE	LATE	LATE

Note: The immediate effect results are reported using an instrumental variable strategy where the instrument is the treatment allocation and the independent variable is the actual treatment status. It allows us to determine the LATE estimator. We use experimental block fixed effects, and cluster-robust standard errors at the workshop level. Our outcome variables are transformed from a 5-point Likert scale into a dummy variable where 1 indicates support for the policy (i.e., 4 or 5 on the Likert scale) and 0 indicates opposition or ambivalence towards the policy (i.e., 1 to 3 on the scale). $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$.

G.2 Timing of day

We examine whether treatment effects could be confounded by the time of day workshops are taken. In our design, this would pose an issue if there were an imbalance between the proportions of treated and control groups in the morning and afternoon sessions. As demonstrated in Table 15, most of the workshops were held in the afternoon (more than 80%). However, there is relative balance between the numbers of treated and control groups.

Table 15. Number of workshop by treatment condition and time of the day.

Afternoon	Control	Treatment
Morning	16	17
Afternoon	66	68

We examine whether the estimated treatment effects vary according to the time of day the workshops were conducted — specifically comparing morning and afternoon sessions. If workshop timing meaningfully influences participant responses or engagement, we would expect to observe systematic differences in treatment effects between these two groups.

We estimate our primary specification using the intent-to-treat (ITT) estimator with binary outcome variables to assess whether the workshop's impact varies by time of day. Results are presented in Table 16. The effects of treatment are consistent in direction and of comparable magnitudes, regardless of whether the workshops took place in the morning or afternoon. Lacking statistical significance for two policy outcomes in the morning sessions likely reflects limited statistical power due to a smaller sample size in that subgroup, constraining our ability to detect effects.

Table 16. Causal effects of workshop participation on support for costly climate policies by timing of the day

	Immediate effect		
	Flight ban	Beef tax	Meat-free canteen
Panel A: Morning workshops			
Treatment	0.03	0.13*	0.15·
	(0.07)	(0.05)	(0.07)
Num. obs.	290	291	293
N Clusters	33	33	33
Adj. R^2	−0.02	0.05	0.05
Block FE	Yes	Yes	Yes
Covariates	No	No	No
Estimator	ITT	ITT	ITT
Panel B: Afternoon workshops			
Treatment	0.07**	0.06*	0.06*
	(0.02)	(0.02)	(0.02)
Num. obs.	1510	1519	1525
N Clusters	134	134	134
Adj. R^2	0.07	0.13	0.05
Block FE	Yes	Yes	Yes
Covariates	No	No	No
Estimator	ITT	ITT	ITT

Note: Panel A displays the results only for workshops implemented in the morning. Panel B displays the results only for workshops implemented in the afternoon. We use an Intent-to-Treat estimator, experimental block fixed effects, and cluster-robust standard errors at the workshop level. Our outcomes are dummy measures of policy support, where responses are coded 1 if respondents show support for the policy, 0 otherwise. $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\cdot}p < 0.1$.

G.3 Leave-one-out sensitivity analysis

To assess the robustness of our findings and verify that they are not driven by any single university, we conduct a leave-one-out sensitivity analysis. Specifically, we re-estimate our main specification iteratively, each time excluding one university from the sample. This procedure is implemented for each of the three policy support outcomes: the beef tax, flying restrictions, and meat-free canteen. We use an intent-to-treat estimator with university- and experimental block-fixed effects, with clustered standard errors at the workshop level.

The results of this analysis confirm the overall stability of the estimated treatment effects. Across the various specifications, the magnitude and direction of the effects remain consistent, and the exclusion of any individual university does not substantially alter the substantive interpretation of the findings. In particular, we find that the exclusion of a single university does not result in a reversal of the direction of the treatment effect or a loss of statistical significance across all outcomes. These results increase our confidence in the internal validity of our findings and suggest that they are not idiosyncratically driven by localised implementation features or sample peculiarities at specific universities.

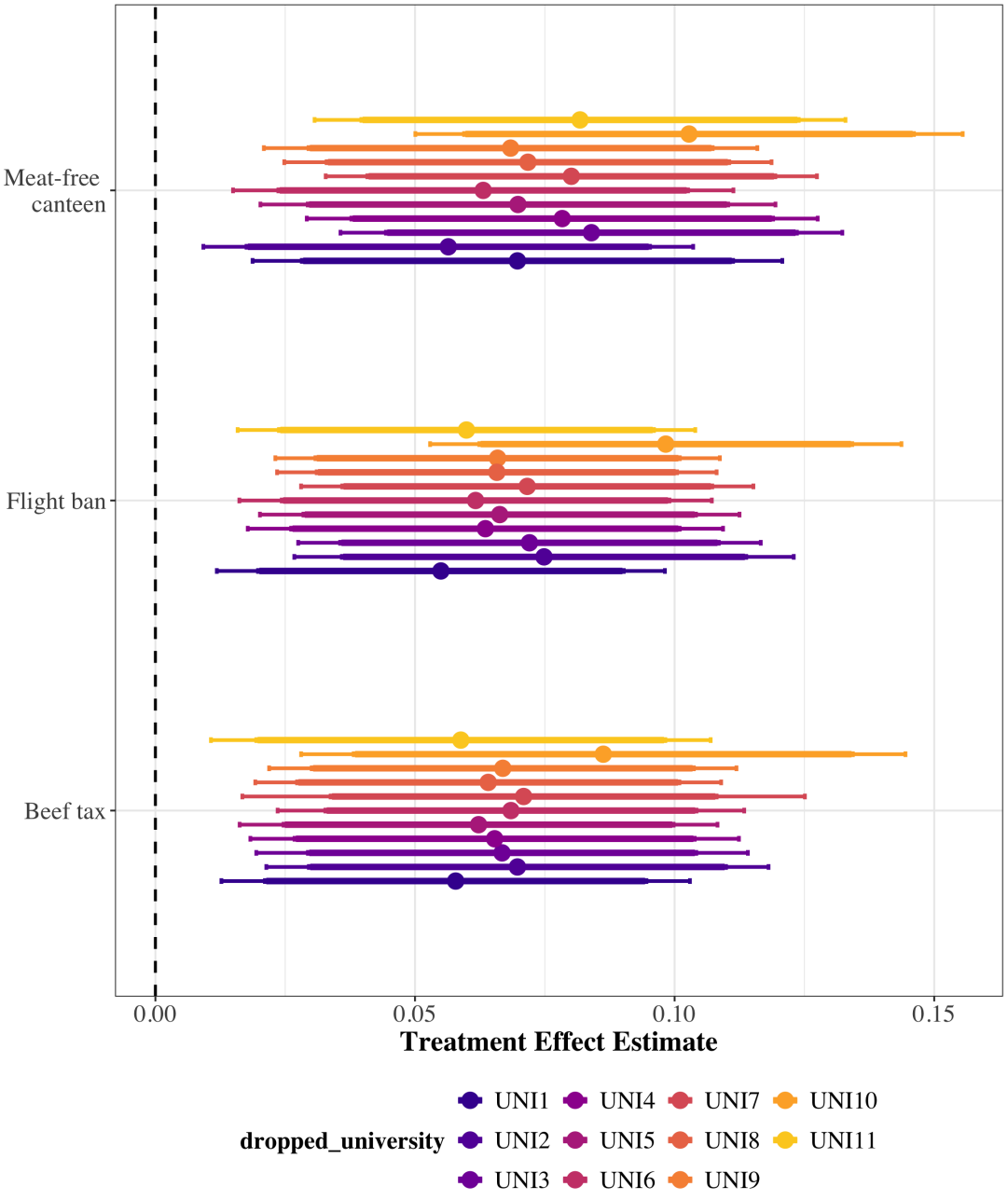

Figure 4. Leave-one-out sensitivity analysis. Estimates use a binary measure of policy support, where responses are coded 1 if respondents show support for the policy, 0 otherwise. Dots represents the ITT estimate using block randomisation fixed effects and cluster standard errors at the workshop level. Thick bars represent 90% confidence interval and thin bars the 95% confidence interval.

G.4 Long term effect

Table 17 shows the results of a difference-in-differences analysis examining the long-term effect of workshop participation on our three policy support outcomes. The models include an interaction between a treatment indicator (treatment or control during the workshop) and a time indicator (referring to the initial survey or the endline survey). The coefficient on the treatment variable reflects the difference in support in the initial survey between the treatment and control groups. The post-survey coefficient captures the change in support over time within the control group. The interaction term shows how the change in support over time in the treatment group differs from the change in the control group, i.e. the difference-in-differences estimate.

Table 17. Interaction effects models of the long term effect of workshop participation on support for costly climate policies

	Policy support (in %)		
	Beef tax	Flight ban	Meat-free canteen
Treatment	0.26^{***}	0.08	$0.13^{\dagger}$
	(0.06)	(0.06)	(0.07)
Post-Survey (6 weeks)	0.20^{***}	$0.07^{\dagger}$	0.16^{**}
	(0.04)	(0.04)	(0.05)
Treatment × Post-Survey	0.21^{***}	0.04	0.21^{**}
	(0.06)	(0.06)	(0.07)
Adj. R^2	0.12	0.06	0.10
Num. obs.	547	550	533
N Clusters	101	101	101
RMSE	0.47	0.43	0.48

Note: The long-term effects are estimated by interacting a treatment dummy with a time dummy indicating whether the survey was answered 6 weeks later. Models include experimental block fixed effects and cluster-robust standard errors at the workshop level. Outcome variables are binary indicators coded 1 if respondents rated support as 4 or 5 on a 5-point Likert scale, and 0 otherwise. $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\dagger}p < 0.1$.

The positive interaction coefficients for the beef tax and meat-free canteen policies suggest that the increase in support among control participants was larger compared with treatment participants. This pattern is driven primarily by an increase in support for costly climate policies in the control group rather than a decline in the treatment group. This in turn indicates that the treatment

persists over the medium-term, as, due to the nature of our design, the control group have been treated by the time we administered the endline survey six weeks later. The estimated treatment effects are large, but should be interpreted with caution given the small sample size and relatively large standard errors, which introduce uncertainty.

H Comparison of Effect Sizes

Reference	**Type of intervention**	**Policy outcome (support) studied**	**Hedges' g [95% CI]**	**N**
Diamond et al. (2020)	Scientific information provision	Whether mitigating climate change should be a priority	0.19 [0.11, 0.26]	3000
Our study	**2tonnes workshop (3 h climate education)**	**Support for ban on flight, meat-free canteen, and beef tax**	**0.16 [0.09, 0.23]**	**1845**
Rode et al. (2022)	Consensus-message experiment	Support for action	0.11 [0.06, 0.28]	524
Sajjadi et al. (2022)	Digital serious game vs. static website (MTurk)	Policy support regulating human impacts on FEW nexus	0.11 [0.30, 0.56]	152
Vlasceanu et al. (2024)	Letter to future generation	Agreement on 10 climate policies	0.07 [0.05, 0.09]	59,443
Vlasceanu et al. (2024)	Future self continuity	Agreement on 10 climate policies	0.05 [0.00, 0.10]	59,442
Vlasceanu et al. (2024)	Dynamic social norms	Agreement on 10 climate policies	0.04 [0.01, 0.09]	59,440
Vlasceanu et al. (2024)	Psychological distance	Agreement on 10 climate policies	0.04 [0.01, 0.09]	59,441
Linden et al. (2016)	Consensus-message experiment	Support for action	0.04 [0.03, 0.06]	1104
Vlasceanu et al. (2024)	Scientific consensus	Agreement on 10 climate policies	0.02 [0.02, 0.06]	59,444
Broockman and Kalla (2016)	Perspective-taking canvassing (10 min)	Support for nondiscrimination law	0.00 [0.09, 0.09]	1825
Kalla and Broockman (2022)	Televised issue ads	Support for LGBTQ and immigration policies	0.04 [0.01, 0.06]	31,304

Table 18. Summary of interventions and their effects on policy support (Hedges' g).

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