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# Yes we can? Effects of a participatory visioning process on perceived climate efficacy

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Lack of perceived efficacy can be an important barrier to climate mitigation action at various scales. Here, we study how a participatory visioning process, the Climate Modernity workshop in Styria, Austria, affected participants' efficacy outcomes. To this end, we conducted two survey waves eliciting self- and response efficacy regarding possible mitigation measures. We estimate difference-in-differences models and corroborate the findings using qualitative participant feedback. The results indicate that the intervention tended to decrease personal self-efficacy, in particular with regard to controversial topics like the transformation of the transport system. This suggests that participatory stakeholder processes can draw attention to the conflict potential and complexity of specific mitigation policies, decreasing the perceived feasibility of implementing them. The workshop, however, tended to increase participants' personal response efficacy, particularly regarding voting for pro-environmental candidates. Accordingly, participatory processes could raise trust in the democratic process and in the effectiveness of making a green voting decision.

## KEYWORDS

public participation, visioning process, self-efficacy, response efficacy, mode of agency

## 1. Introduction

While many are alarmed by the climate crisis, few are willing to act proportionately. A major reason for the attitude-behavior gap is the lack of a clear vision of a socio-ecological transformation and of possible steps to achieve it, resulting in low perceived self-efficacy (Gifford, 2011). Without ambitious visions of low-carbon and climate resilient futures that generate broad societal buy-in, individuals and collectives will not be able to identify and implement transformative climate actions that minimize the already unavoidable effects of climate change while supporting social cohesion. Accordingly, these visions need to be co-created with all relevant societal stakeholders that have a legitimate claim in the low-carbon transformation of our societies.

We provide a case study of a participatory process that was conducted in Austria in March 2022 with the goal to envision a socially and environmentally sustainable future and possible pathways to achieve it until 2050. In Austria, as in many other countries, national and sub-national governments are announcing net-zero targets and need to develop credible strategies and measures to achieve them. As part of such a strategy, a transdisciplinary group of researchers, practitioners, and policy-makers conducted a participatory process for Styria, one of Austria's nine states. The central building block of this process was a co-creation workshop called Climate Modernity (Klimaneuzeit) which took up less than 24 hours of participants' time over one weekend. Since registry data could not be used to invite a random sample of the population to the workshop, a call for applications was circulated via newspapers, mailing lists, and social media. 50 of the applicants were selected using stratified quota sampling (see Section 3).

The workshop consisted of four, facilitated steps. First, the 50 participants got to know each other in order to develop a sense of the diversity in the group. Second, they developed a common vision of an environmentally and socially sustainable future without any constraints regarding feasibility. Third, the participants were tasked to specify which mission Styria and its citizens have in order to realize the previously developed vision. Finally, the task was to “backcast” possible pathways for implementation, that is, to specify which steps will have to be taken by 2040, 2030, and 2025 to reach the targets. The co-generated results of the workshop will feed into the implementation of the Styrian climate and energy strategy for 2030. On the ladder of citizen participation of Arnstein (1969), the Climate Modernity accordingly represents a consultation, going beyond information but falling short of delegating power.

We study participants’ perceived efficacy as a key outcome of stakeholder processes. Efficacy is the belief in the ability to shape our individual and collective futures, enabling action in changing environments and effective responses to arising challenges (Bandura, 1997). In the context of climate change, efficacy beliefs play an important role in the efforts to curb emissions and adapt to the already irreversible changes (Lorenzoni et al., 2007). For instance, perceived efficacy has been shown to promote pro-environmental behavioral change (Kaiser and Gutscher, 2003; Bamberg and Möser, 2007; Ortega-Egea et al., 2014; Choi and Hart, 2021), influence climate change risk perception (Hornsey et al., 2015, 2021; Bostrom et al., 2018; Crosman et al., 2019), and increase environmental concern (Kellstedt et al., 2008) as well as political participation (Feldman and Hart, 2015). Among other functions, participative processes are an opportunity for all involved stakeholders to learn about each others positions and values. We highlight enhanced learning as one possible channel for the effects on efficacy.

The paper is structured as follows. Section 2 discusses definitions and conceptual linkages of public participation and efficacy measures. Section 3 describes the sampling procedure, implementation of the survey, and the specification of the regression model for the quantitative part of the study as well as the qualitative approach. Section 4 summarizes the results, highlighting the heterogeneity of treatment effects. Section 5 discusses the findings and their possible limitations. Finally, Section 6 concludes.

## 2. Public participation and efficacy

Public participation, defined by Schroeter et al. (2016) as “all activities that are voluntarily taken by citizens to influence political decisions at any stage of the political process”, can make an important contribution to the procedural justice of a socio-ecological transformation of society (Richardson and Razzaque, 2007; Cattino and Reckien, 2021). There are both intrinsic and instrumental reasons to allow the public to participate in making and implementing climate policy (Richardson, 1979; Few et al., 2007). The intrinsic values closely relate to democratic ideals and are independent of the outcome of the decision-making process (Tomlinson, 2015). All parties affected by a decision should autonomously be able to participate in the deliberation. Each actor should have equal opportunity to influence the outcome and be able to freely exchange and justify arguments in a reasonable way.

Inclusivity along these lines of autonomy, equality, and justification can facilitate the engagement of citizens in the democratic process and promote bottom-up legitimacy of environmental policy (Chess et al., 1998; Geiger et al., 2017; Cattino and Reckien, 2021). From the instrumental point of view, hypothetical benefits of participation include both political legitimacy and managerial efficiency of the resulting policy due to the greater variety of interests that are considered in the process (Richardson and Razzaque, 2007; Burton and Mustelin, 2013).

An important element of participating in a decision-making process is learning about other participants’ positions, arguments, and values (Schroeter et al., 2016). This includes factual knowledge but also deliberation of normative aspects against the background of personal experience. While exposure to different subjectivities can promote a sense of community and sociability, it can also highlight divisions and trade-offs that were previously not salient (Burton and Mustelin, 2013). At the core of climate policy are complex collective action problems. Different positions and target conflicts between stakeholders are often not so much the result of information deficit but rather of different world views and normative judgments which do not necessarily resolve themselves through continued deliberation (Tomlinson, 2015). Indeed, participatory processes that start with such reasonable disagreement could lead to the entrenchment and polarization of positions (Burton and Mustelin, 2013). Accordingly, there is a need for systematic empirical evaluation to better understand the experiences of participants and avoid potentially adverse effects.

We hypothesize that one important outcome of citizen participation as a learning process is a changed sense of efficacy. Based on Bandura (1995, 1997, 2006), we distinguish between self- and response efficacy. Self-efficacy is defined as the perceived ease of taking action while response efficacy is defined as the perceived effectiveness of the action. Disentangling these two efficacy measures is crucial in better understanding barriers to climate action since a lack of either measure is sufficient to prohibit action. Both self- and response efficacy can relate to different modes of agency on personal, collective, and proxy efficacy level (Table 1). We evaluate respondents’ efficacy with regard to possible mitigation measures in terms of personal action, collective action on the municipal level, and the Styrian government as a proxy agent.

## 3. Data and methods

The analytic sample of this study is the self-selected group of Styrian citizens who applied to participate in the Klimaneuzeit. In order to evaluate applicants’ changes in perceived efficacy, we followed a mixed methods approach. For the quantitative part of the strategy, we implemented online surveys before and after the workshop. Based on quota sampling stratified by age, gender, education, and settlement type, 50 applicants were randomly selected to participate in the two-day, in-person workshop of which 22 responded to the survey. Of the applicants who were not invited to the workshop, 40 completed both waves and serve as the control group. As a qualitative perspective, respondents were asked to provide feedback after the workshop which we assess regarding statements relevant to efficacy. We regard any statements as relevant for this study that relate to the perception of the

TABLE 1 Efficacy measures by type of efficacy and mode of agency.

|                   | Mode of agency                   |  |                                    |
|-------------------|----------------------------------|--|------------------------------------|
|                   | Personal                         | Collective                                 | Proxy                              |
| Self-efficacy     | Ease of personal action          | Ease of action on municipal level          | Ease of government action          |
| Response efficacy | Effectiveness of personal action | Effectiveness of action on municipal level | Effectiveness of government action |

Supplementary Table 1 reports the operationalization of each of the six measures with regard to mitigation action.

interaction with other participants, following the hypothesis that learning about other perspectives is central for efficacy outcomes.

### 3.1. Survey data

The questionnaire follows the operationalization of [Bostrom et al. \(2018\)](#) and [Crosman et al. \(2019\)](#) in asking the study participants to rate the feasibility and effectiveness of possible mitigation measures. On individual level, the questions concern air travel, energy consumption, meat consumption, car use, discussion of climate change, developing a vision for a sustainable future, and voting for candidates who prioritize environmental policy. On municipal and state level, the questions concern improving the modal split of transport, energy consumption, generating electricity from renewable sources, reducing plastic waste, developing a vision for a sustainable future, and generally reducing greenhouse gas emissions. A list of questions with descriptive statistics are provided in [Supplementary Table 1](#). To determine the settlement type of residences, we follow the Degree of Urbanization typology by assigning the postcodes to the respective NUTS3 regions ([Eurostat, 2018](#)).

Since the applicants to the workshop selected themselves into the sample, they are not representative of the Styrian population. The demographic characteristics that were collected with the application indicate that the sample is highly environmentally concerned. Applicants were invited to the workshop based on quota sampling, however, implying that other characteristics, namely age, gender, education, and settlement type, were represented proportional to the population at the workshop. [Table 2](#) shows that among those respondents who completed both surveys, there were too many aged above 45, too many men, too many with tertiary education, and too many living in intermediate or urban settings, compared to the distribution of the Styrian population. There was considerable attrition with 188 respondents in the first wave and 62 respondents in the second one, suggesting that self-selection also affected data collection. Since selection likely biases the estimates, they are not representative of the whole population and are intended only as preliminary, exploratory findings.

### 3.2. Model specification

The workshop as a policy intervention is used to construct a quasi-experimental setting. We estimate a difference-in-differences

TABLE 2 Composition of the Styrian population, of the first survey wave, and of the second survey wave by age, gender, education, and community.

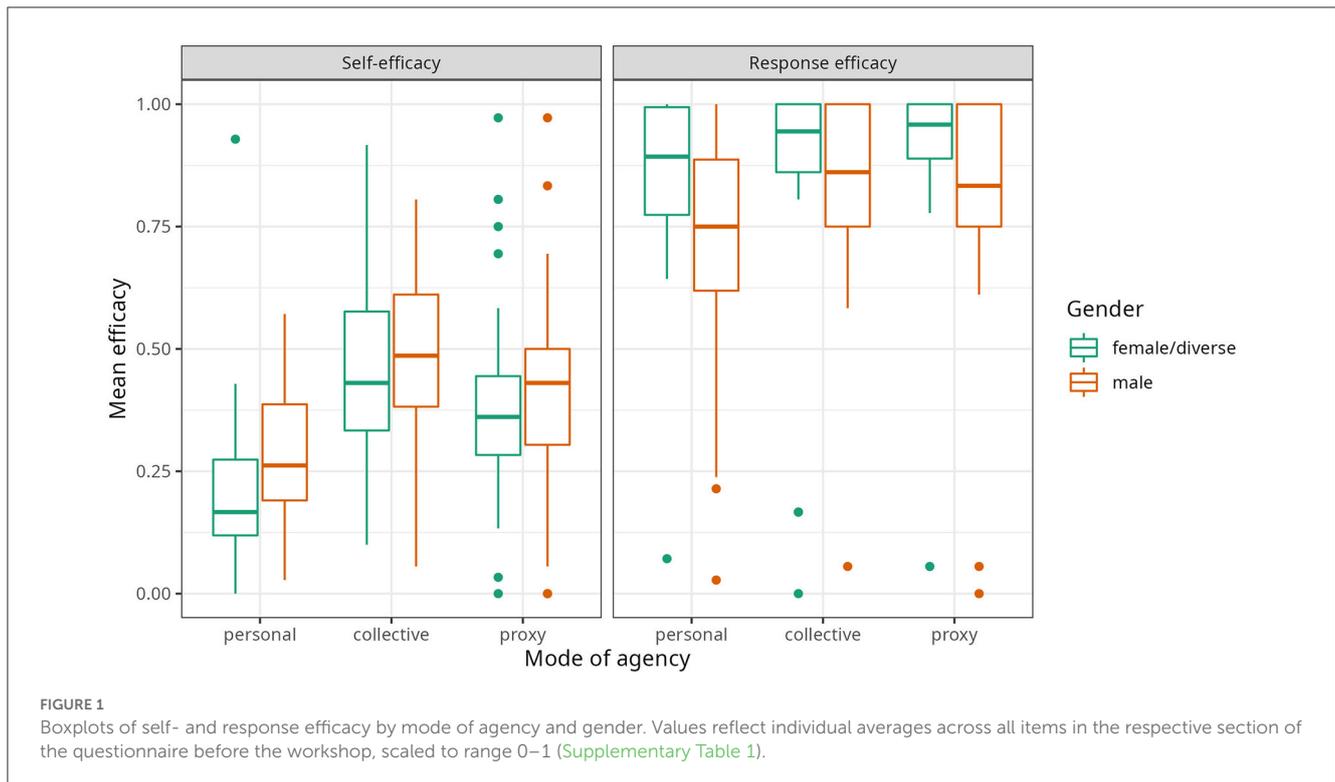
| Variable         | Population | Survey 1<br>( <i>n</i> = 188) | Survey 2<br>( <i>n</i> = 62) |
|------------------|------------|-------------------------------|------------------------------|
| <b>Age</b>       |            |                               |                              |
| 15–29            | 0.27       | 0.14                          | 0.13                         |
| 30–44            | 0.33       | 0.19                          | 0.16                         |
| >45              | 0.41       | 0.67                          | 0.71                         |
| <b>Gender</b>    |            |                               |                              |
| Female/diverse   | 0.51       | 0.39                          | 0.42                         |
| Male             | 0.49       | 0.61                          | 0.58                         |
| <b>Education</b> |            |                               |                              |
| Lower secondary  | 0.22       | 0.12                          | 0.16                         |
| Upper secondary  | 0.52       | 0.35                          | 0.37                         |
| Tertiary         | 0.26       | 0.53                          | 0.47                         |
| <b>Community</b> |            |                               |                              |
| Rural            | 0.51       | 0.43                          | 0.40                         |
| Intermediate     | 0.49       | 0.56                          | 0.60                         |

model of the form

$$y_{it} = \alpha_i + \beta T_i \times Post_t + \delta_t + \varepsilon_{it} \quad (1)$$

where  $y_{it}$  is the efficacy measure of respondent  $i$  at time  $t$ ,  $T_i$  indicates treatment status, and  $Post_t$  is a post-workshop dummy.  $\alpha_i$  controls for any individual variables that do not vary between the pre- and post-workshop period, including demographic characteristics such as age, gender, education, and income level as well as values, beliefs, and attitudes such as baseline environmental concern.  $\delta_t$  is a period effect that captures any unit-invariant factors that could affect the overall level of climate efficacy in Styria such as state-wide media coverage of environmental issues.  $\beta$  compares the change in efficacy after the workshop in the treatment group (the workshop participants) to the change in efficacy in the control group (those applicants who were not invited to the workshop), controlling for the average change across both groups. Accordingly, the specification accounts for both the unobservable heterogeneity between individuals and the unobservable trend over time. We estimate linear ordinary least squares instead of ordinal logit models since the number of observations is low and the main results are based on averages over several survey items.

Web-based questionnaires are more prone to measurement error than printed ones ([Meade and Craig, 2012](#); [Leiner, 2019](#)). Accordingly, we screen the data for meaningless and careless responses. Since the survey elicits purely subjective evaluations of given policy measures that do not get easier with higher cognitive ability or expert knowledge, we assume that completion time is an indicator for effort. Based on an experiment, [Leiner \(2019\)](#) concludes the relative speed index (RSI), which captures the standardized deviation from the median completion time, can serve a proxy for data quality in such cases. Thus, more weight



is given to those respondents who spent relatively much time on the questionnaire in the regression analyses. As shown in Supplementary Figure 1, most responses are within one standard deviation around the median completion time, with only a few outliers who were much faster than the median completion time and are accordingly down-weighted.

Measurement error introduced by careless responses often increases the variance of the estimated parameters, potentially causing type II errors (not rejecting false null hypotheses) (Meade and Craig, 2012). In robustness checks, we find that unweighted models result in qualitatively similar point estimates with higher variance and usually worse model fit, suggesting that the weighting scheme alleviates random measurement error (Supplementary Tables 2, 3). Furthermore, we check for influential observations using Cook's distance and conclude that the results are not driven by single data points.

### 3.3. Participant feedback

In order to contextualize the quantitative results, we qualitatively evaluated feedback of participants that was collected by the organizers via email in the week after the workshop. They received 13 messages answering the question: "How did you experience the 24 h Challenge? What lingers? What did it provoke in you?". While these questions are broad and not specific to efficacy outcomes, they are also not suggestive of particular answers. We screen these messages for statements relevant to learning experiences and efficacy outcomes, namely any statements regarding the perception of (1) the other participants, (2) interactions in the group, and (3) personal outcomes of the

workshop. All quotes that meet any of these criteria are cited in Section 4.3. We then summarize common themes in the messages. Due to the small amount of qualitative data, which does not allow for a more in-depth analysis, it is only used to anecdotally corroborate the quantitative results.

## 4. Results

In the following section, we first present descriptives about levels of efficacy before the intervention, then the regression results based on the survey data, including average treatment effects and heterogeneity by age, gender, education, and urbanity. Against the background of these quantitative findings, we then briefly discuss participants' perception of their interaction with other participants.

### 4.1. Levels of efficacy

There are some considerable differences in levels of self- and response efficacy (Table 1). As shown in the left panel of Figure 1, respondents see the measures as relatively difficult to implement, in particular for them personally. Male respondents tend to have greater belief that the goals are achievable than respondents with female and non-binary genders. As shown on the right hand side, the goals are seen as effective to reach climate neutrality in Styria across all modes of agency. In contrast to self-efficacy, respondents with female and non-binary genders tend to have greater response efficacy than male respondents.

**TABLE 3** Effects of the workshop on average self-efficacy (SE) and response efficacy (RE) with regard to personal action, collective municipal action, and the Styrian government as proxy agent.

|                          | Personal |        | Collective |        | Proxy  |        |
|--------------------------|----------|--------|------------|--------|--------|--------|
|                          | SE       | RE     | SE         | RE     | SE     | RE     |
| Workshop                 | -0.05**  | 0.12*  | -0.00      | -0.02  | -0.03  | 0.03   |
|                          | (0.02)   | (0.07) | (0.05)     | (0.04) | (0.04) | (0.03) |
| Unit fixed effects       | ✓        | ✓      | ✓          | ✓      | ✓      | ✓      |
| Period fixed effects     | ✓        | ✓      | ✓          | ✓      | ✓      | ✓      |
| Weight                   | 1/RSI    | 1/RSI  | 1/RSI      | 1/RSI  | 1/RSI  | 1/RSI  |
| Observations             | 124      | 124    | 122        | 124    | 124    | 124    |
| R <sup>2</sup> (overall) | 0.95     | 0.75   | 0.81       | 0.87   | 0.89   | 0.87   |
| R <sup>2</sup> (within)  | 0.08     | 0.04   | 0.00       | 0.00   | 0.01   | 0.01   |

The outcome variables are scaled to a range of 0–1. The regressions are weighted with the inverse relative speed index (RSI) as a proxy for data quality (cf. [Supplementary Table 2](#) for results with equal weights). Standard errors in parentheses are clustered by unit. The overall R<sup>2</sup> refers to the fraction of variance captured by the fixed effects and the treatment, while the within R<sup>2</sup> refers to the fraction of variance explained by only the treatment.

\*\*\* $p < 0.01$ ; \*\* $p < 0.05$ ; \* $p < 0.1$ .

## 4.2. Regression results

In order to gauge the overall self- and response efficacy with regard to the three modes of agency, we create indices as the mean of the items in each of the six sections. The average treatment effects on these indices are reported in [Table 3](#) and average effects on the efficacy regarding each particular policy outcome in [Table 4](#). The appendix provides further regression results for each survey item on municipality and state level ([Supplementary Tables 4, 5](#)) and heterogeneity of treatment effects by demographic characteristics ([Supplementary Tables 6–8](#)).

The results indicate that the workshop affected personal efficacy measures more than the ones regarding collective or a proxy action ([Table 3](#)). It reduced average personal self-efficacy by 5 percentage points (pp) with the treatment accounting for 9% of the observed variance in the outcome, implying that participants perceived personally achieving climate goals as more difficult after the workshop. There are on average no significant effects on collective or proxy efficacy. Looking more closely at the separate items at the personal level in [Table 4](#), the aggregate result seems to be driven by significant decreases with regard to the reduction of car use and the voting for pro-environmental candidates in elections. Similarly, we find a reduction in proxy self-efficacy regarding the transformation of the transport sector by the Styrian state government ([Supplementary Table 5](#)).

However, the treatment increased some measures of personal response efficacy, with an average effect of 12 pp. In particular, workshop participation significantly raised response efficacy with regard to green voting. Accordingly, participants had greater belief that their personal voting decision is effective in reaching carbon neutrality in Styria. Notably, there are no significant effects on the perceived ease or effectiveness neither of developing a vision of a sustainable society nor of discussing climate change with people who do not share one's opinion.

To investigate whether the intervention affected subgroups differently, we test for heterogeneity of treatment effects by age, education, community type, and gender. Indeed, there is some

heterogeneity of different demographic groups. In particular, participants who are younger than 35 experienced a decrease in personal self-efficacy by 10 pp, an effect approximately twice as strong as for older participants ([Supplementary Table 6](#)). Also the negative impact on participants with tertiary education is stronger than on participants with upper secondary or lower education. While the positive effect on response efficacy is also more pronounced in the younger and highly educated group, it is mostly driven by participants from rural communities.

The heterogeneity analysis reveals some differences also for collective efficacy on municipal level and proxy efficacy with regard to the state government. There is a significant decrease in collective self-efficacy for participants from rural municipalities but not for those from more urban areas ([Supplementary Table 7](#)). Proxy self-efficacy declined particularly for participants who have attained tertiary education. Proxy response efficacy increased significantly only for men ([Supplementary Table 8](#)), presumably because women already viewed the measures as highly effective before the workshop ([Figure 1](#)).

## 4.3. Participant feedback

Participants made the following statements regarding their perception of other participants, experience in the group, and perceived personal outcome of the workshop (emphasis added):

I perceived the [Climate Modernity] as an exciting opportunity and interesting new way of working, as quite *a challenge and sometimes frustrating* – precisely because I *learned to appreciate the other participants*, it was *difficult to bear that we had little understanding regarding the content*. But my *big picture is that we agreed on the vision* – and that is nice.

[...] The workshop was a quite intense experience regarding a pressing issue of our time. The *different visions of the participants are thought-provoking*.

TABLE 4 Effect of the workshop on personal self-efficacy (SE) and response efficacy (RE).

|                          | Personal self-efficacy |                |                    |                 |                 | Personal response efficacy |                   |                |                 |                |                 |                |                |                   |
|--------------------------|------------------------|----------------|--------------------|-----------------|-----------------|----------------------------|-------------------|----------------|-----------------|----------------|-----------------|----------------|----------------|-------------------|
|                          | Fly                    | Energy         | Car                | Meat            | Discuss         | Vision                     | Vote              | Fly            | Energy          | Car            | Meat            | Discuss        | Vision         | Vote              |
| Workshop                 | 0.01<br>(0.08)         | 0.02<br>(0.06) | -0.14***<br>(0.05) | -0.07<br>(0.04) | -0.06<br>(0.04) | -0.05<br>(0.06)            | -0.09**<br>(0.04) | 0.03<br>(0.09) | 0.16*<br>(0.09) | 0.14<br>(0.09) | 0.15*<br>(0.08) | 0.13<br>(0.10) | 0.03<br>(0.10) | 0.22***<br>(0.08) |
| Unit FE                  | ✓                      | ✓              | ✓                  | ✓               | ✓               | ✓                          | ✓                 | ✓              | ✓               | ✓              | ✓               | ✓              | ✓              | ✓                 |
| Period FE                | ✓                      | ✓              | ✓                  | ✓               | ✓               | ✓                          | ✓                 | ✓              | ✓               | ✓              | ✓               | ✓              | ✓              | ✓                 |
| Weight                   | 1/RSI                  | 1/RSI          | 1/RSI              | 1/RSI           | 1/RSI           | 1/RSI                      | 1/RSI             | 1/RSI          | 1/RSI           | 1/RSI          | 1/RSI           | 1/RSI          | 1/RSI          | 1/RSI             |
| Observations             | 121                    | 124            | 123                | 124             | 124             | 123                        | 121               | 123            | 123             | 123            | 122             | 122            | 122            | 122               |
| R <sup>2</sup> (overall) | 0.80                   | 0.82           | 0.92               | 0.94            | 0.90            | 0.85                       | 0.93              | 0.77           | 0.72            | 0.75           | 0.78            | 0.64           | 0.68           | 0.77              |
| R <sup>2</sup> (within)  | 0.00                   | 0.00           | 0.14               | 0.04            | 0.04            | 0.02                       | 0.10              | 0.00           | 0.05            | 0.04           | 0.05            | 0.03           | 0.00           | 0.11              |

The outcome variables are scaled to a range of 0–1. The regressions are weighted with the inverse relative speed index (RSI) as a proxy for data quality (cf. Supplementary Table 3 for results with equal weights). Standard errors in parentheses are clustered by unit. The overall R<sup>2</sup> refers to the fraction of variance captured by the fixed effects and the treatment, while the within R<sup>2</sup> refers to the fraction of variance explained by only the treatment. \*\*\*p < 0.01; \*\*p < 0.05; \*p < 0.1.

[...] the feeling to have a common goal but nevertheless experienced partly unexpected resistance that gives me food for thought.

I got to know new interesting people with a common goal: the common dreaming of our future and developing visions of the future for a livable society in Styria. I was impressed by what we achieved in one and a half days. There was a lot of communication, a strong connection, a lot of collaboration, and the different opinions gave me lots of inspiration.

[...] It was a wonderful experience in respectful exchange with other Climate Modernity pioneers that you are not standing alone but that there are others who think alike.

To stop climate change is only possible together and unfortunately not completely without sacrifice. But I got to know some young, dedicated people who reignited my hope that we can still make it.

What still lingers: The contributions of younger participants show confidence and responsibility. They strive for reachable goals and have dreams that can be fulfilled. [...] What the workshop provoked in me: To think more optimistically again and, where possible, to contribute to Climate Modernity.

Two themes emerge from these statements. On the one hand, participants reported a sense of commonality as the result of developing a vision together. Partly, there was also the impression of having agreed on a joint vision, with explicit reference to a positive effect on self-efficacy, hope, and optimism. On the other hand, the controversies and resistance during the workshop were salient for several participants, partly also with regard to the vision itself. Participants, however, perceived these arguments differently. Some found them inspirational and thought-provoking, while others perceived them as challenging and frustrating.

## 5. Discussion and limitations

In the following section we discuss the quantitative and qualitative findings. Importantly, our analysis comes with certain limitations that are important to consider when interpreting the results.

### 5.1. Discussion

The negative effect on personal self-efficacy, partly also on collective and proxy self-efficacy, could suggest that the workshop drew attention to particularly controversial aspects of possible mitigation measures with high conflict potential, making their implementation seem less feasible. In the Climate Modernity, participants were arguing in particular about mobility and private cars which is reflected in the estimates. Fossil modes of transport are particularly important for rural municipalities with limited access to public transportation, potentially contributing to the decrease in collective self-efficacy for participants from rural communities. Several participants explicitly report such differences in opinion as salient in their feedback.

The exposure of participants to different perspectives may have also highlighted other trade-offs that are relevant for voting decisions, making it seem harder to choose pro-environmental candidates. However, the workshop markedly improved the response efficacy of voting for candidates who prioritize environmental policy, implying that this behavior is perceived as more effective in reaching climate targets. This could suggest that the intervention fostered trust in the democratic process and perceived representation of voter interests by proxy actors.

Young participants' self-efficacy consistently responded more strongly to the intervention. From a cohort perspective, this could imply that the younger generation, that is socialized into a different ideology with greater emphasis on embeddedness in ecosystems (Xiao et al., 2018), experienced the workshop differently in the context of their worldview. From a life course perspective, individuals tend to become more accepting of the status quo as they grow older and less flexible in their worldview (Johnson and Schwadel, 2019). Accordingly, they could be less susceptible to policy interventions in general. More research is needed, however, to better understand possible age differences specifically in the context of participatory processes.

Overall, the feedback of the participants suggests that the workshop was a learning experience with regard to other participants' positions and values. While differences in the group were perceived mostly as interesting and thought-provoking, they also led to frustration and unexpected resistance for some. In the light of these statements, it seems plausible that enhanced learning is related to the decline in self-efficacy. The strengthened sense of commonality despite the differences in the group could be related to the increase in response efficacy.

## 5.2. Limitations

Participatory processes differ in many characteristics, implying a limited external validity of the results. First, the institutional context of participation can vary depending on the organization that initiates and manages it. For instance, there may be differences between private and public institutions and the degree to which stakeholders are involved in the decision-making process, ranging from mere placation and information to the delegation of power (Arnstein, 1969; Few et al., 2007). Second, the concrete aims of participatory processes can vary greatly. In the case of the Climate Modernity, the goal was a relatively broad and far-reaching vision of a sustainable future but in many other cases the focus is on more specific outcomes, for instance, the implementation of a particular climate change adaption project (Cattino and Reckien, 2021). Third, the facilitation methods employed in the participatory process can shape the impact it has on the participants. More comparative research is needed to better understand these and other differences.

More research is also needed to better understand the effects founds here. Since we only provide reduced form estimates, explicitly modeling the channel of impact could provide insights into the underlying psychological mechanisms. In particular

enhanced learning could play a moderating or mediating role in the relationship of stakeholder participation and efficacy outcomes. Second, it remains unclear how efficacy evolves over time, since here we only present short-term effects. In the longer term, however, the impact could be attenuated or amplified depending on how the output of stakeholder involvement is incorporated in the decision-making process. Third, studies with larger, representative samples would allow to gauge the internal and external validity of our results. The conceptual considerations, the methodological approach, and the findings nevertheless contribute to the literature on the evaluation of participatory processes in an exploratory sense, drawing attention to climate efficacy as a so far understudied outcome of participation and providing an agenda for future research. Fourth, we did not actively collect qualitative data so we rely on feedback collected by the facilitators of the workshop. More specific qualitative data in future studies could provide more in-depth insights that are tailored to the research question, for instance regarding the awareness of conflicts around specific mitigation policies.

## 6. Conclusion

In conclusion, the findings indicate that participatory processes can have ambivalent effects on perceived efficacy. This highlights the need for a sufficiently specific conceptualization of efficacy measures, including both self- and response efficacy with regard to different modes of agency. Notably, the Climate Modernity primarily affected how participants perceived their own efficacy but less their efficacy as part of their local community or regarding the state government. In groups with diverse backgrounds and perspectives conflicts are likely to occur and in this case seem to have been detrimental to self-efficacy across modes of agency, particularly for younger participants. Regardless of this, the workshop raised perceived effectiveness of climate change mitigation efforts, including the participation in the democratic process.

The results imply some tentative recommendations for public and private organizations that intend to employ participatory processes to facilitate the transition to net zero emissions. First, organizers should anticipate some degree of reasonable disagreement that is based on normative judgments, not factual knowledge. While participatory processes have the potential to foster mutual understanding, they can also lead to the entrenchment of positions and a decline in self-efficacy. Second, organizers should not entirely focus on the instrumental goals of a process but also consider how it affects the participants themselves. Age, gender, education are likely sources of heterogeneity with regard to these effects and should be taken into consideration in the facilitation of the process. Third, rigorous evaluation should be considered to be part of the process from the beginning. Evaluation requires to clarify aims in advance, to specify the scope and process of data collection, and to earmark part of the budget for its implementation. Not only could this help to improve future interventions, it also creates accountability of the organizer for the outcome of the participatory process and signals to participants and other actors that their involvement is taken seriously.

There is still need for more systematic evaluation of similar policy interventions. This requires further development of conceptual frameworks that could help clarify the intended outcomes and allow collecting the respective data. Furthermore, comparative case studies and studies with larger sample sizes are so far missing, precluding a generalization of findings. Filling this literature gap could provide important policy conclusions to promote a socio-ecological transformation in line with the values of procedural justice.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

## Author contributions

JP and TS contributed to conception and design of the study. JP reviewed the literature, organized the data collection, performed the statistical analysis, and wrote the first draft of the manuscript. TS wrote sections of the manuscript. Both authors contributed to manuscript revision, read, and approved the submitted version.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fclim.2023.1129789/full#supplementary-material>

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