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Evaluation of online training to promote peer diffusion of climate change activism in the US

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Enacting policies to reduce greenhouse gas emissions requires climate change activism (CCA). CCA behaviors include volunteering/donating to organizations addressing climate change and lobbying policymakers. However, effective methods to promote CCA are not well understood. In August 2022, 622 US adults participated in a randomized control trial and one-month follow-up to assess the efficacy of the Climate Change Activism Peer Educator Training Program, a brief one-time training that aims to train people to talk to their social network members about engaging in CCA. Participants reported high levels of satisfaction. The CCA training increased self-efficacy in having conversations about CCA but did not significantly impact the frequency of communicating about or engaging in CCA. Study findings suggest that future CCA interventions target people motivated to take action about climate change for peer educators, tailor training modules to social network characteristics, integrate prompts to reinforce behavior change, and provide easy and specific targets for CCA.

KEYWORDS

climate change, climate change activism, behavior change intervention, peer diffusion, climate change communication

Introduction

Immediate action is critical to mitigating anthropogenic climate change caused by greenhouse gas emissions. Climate changes include increases in temperature, precipitation, sea level, ocean acidification, and frequency of extreme weather conditions. These weather events, in turn, affect every dimension of human health, including, but not limited to, heat-related death, infectious disease transmission, food insecurity, geopolitical tensions, human migration, and economic losses (Fawzy et al., 2020; Romanello et al., 2022). Human activities related to a carbon-based energy system and land use are the primary producers of greenhouse gas emissions. Despite adopting the United Nations Framework Convention on Climate Change (UNFCCC) in 1992 and Paris Agreement in 2016, in 2021, greenhouse gas emissions hit a historical high (Fawzy et al., 2020; Romanello et al., 2022). A 2022 Lancet climate change and health report projects that “current policies put the world on track to a catastrophic 2.7°C increase by the end of the century” (Romanello et al., 2022). It is critical to quickly mobilize public support for equity-focused climate change policies. In the US, the majority of residents (64%) express high concern for climate change, yet relatively few (11%) are involved in climate change activism (Latkin et al., 2022; Leiserowitz et al., 2020). Individuals can promote climate change mitigation through collective climate change activism (CCA; e.g., volunteering/

donating to organizations addressing climate change, protests, and lobbying policymakers). However, effective methods to promote CCA are not well understood.

A primary focus of climate change interventions to date has focused on increasing individuals' perceptions of the severity of climate change. For example, Sunstein et al. (2016) assessed if providing new information on the severe impact of climate change changed beliefs (Sunstein et al., 2016). The study found that shifts in climate change beliefs varied according to participants initial levels of concern. Findings from Sunstein and colleagues support the theory of motivated reasoning, which asserts that people often make decisions that align with their previously held beliefs rather than the accuracy of new information and highlights a potential limitation of information-based interventions (Kunda, 1990; Sunstein et al., 2016). Another study that assessed the effectiveness of different types of messaging on changing climate change beliefs found that personal stories of how climate change is currently harming communities were most effective, with these changes moderated by emotional responses of worry and compassion (Gustafson et al., 2020).

Climate change-related interventions focused on behavior change have primarily concentrated on changing individual-level behaviors such as recycling. Although individual-level behaviors are not able or designed to have a major impact on reducing greenhouse gas emissions, they may increase support for climate change policies (Sparkman et al., 2021). A systematic review found that social modeling was the most effective intervention strategy to promote recycling behaviors, where community members were recruited to demonstrate and encourage peers to recycle (Lin et al., 2016; Maddox et al., 2011; Varotto and Spagnoli, 2017). Social modeling involves passing information to peers through demonstration or discussion, during which the initiator indicates that they are personally engaged in the behavior (Bandura, 1977; Varotto and Spagnoli, 2017). This strategy draws from Bandura's social learning theory, which posits that people learn behaviors through observation of others conducting the behavior (Varotto and Spagnoli, 2017). Additionally, social modeling can communicate to others that a behavior is normative. Behavioral norms can lead peers to engage in the same behavior due to awareness that similar others are engaging in the behavior, a desire for social approval, and/or concern about disapproval (Reno et al., 1993; Varotto and Spagnoli, 2017). We do not know if the mechanisms for behavior change for individual-level pro-environmental behaviors are the same as those for CCA. Prior research suggests that many people do not know what to do or feel overwhelmed (Latkin et al., 2023), so increasing motivation to engage in CCA may not lead to behavior change. However, social modeling of behavior may provide both social influences for behavior change as well as provide information on specific methods of CCA.

Social media, recognized as a digital forum for communication, discussion, and engagement, provides a virtual platform for communication and social modeling. Digital media, including social media, facilitates environmental behaviors by providing access to information that fosters positive attitudes towards environmental engagement (Melville, 2010). Additionally, social media can connect users to social networks and community settings which can provide personalized guidance and social support (Bandura, 2002). It can also be leveraged to encourage specific environmental actions and impact pro-environmental behaviors and engagement (Oakley and Salam, 2014).

Previous social network studies have found that peers can influence their network members' attitudes, opinions, and behaviors (Huckerfeldt et al., 2005). Peer discussions are key to many social modeling and norms interventions. Engaging in dialogues about climate change can also reach individuals less exposed to climate information and promote acceptance that climate is happening (Mycoo, 2015). Yet, about six out of ten Americans report never or rarely engaging in conversations about climate change with family or friends (Leiserowitz et al., 2021). This has perpetuated a spiral of silence where people do not talk about climate change because they do not hear other people talking about it—leading to a belief that it is not a socially acceptable conversational topic and creating a silencing effect (Maibach et al., 2016). In fact, people underestimate how much others are concerned about climate change (Geiger and Swim, 2016). Interventions that promote climate change communication can help normalize discussion about climate change and climate change action. A peer education approach may be able to effectively increase conversations about climate change activism. Peer education has been found to be effective for a range of behavior change outcomes (Boyle et al., 2011; Bagnall et al., 2015; Medley et al., 2009). Such approaches may lead to behavior change by increasing self-efficacy through modeling, heightening social norms of the desired behavior, as well as providing attitude change through persuasive communications.

However, only a few studies have assessed strategies to increase climate change communication. The Talk Climate Change campaign, an online campaign designed to increase communication about climate change, successfully promoted conversations about climate change (Ettinger et al., 2023). The campaign was linked to a website that provided conversation starters, conversation advice statements, and a guide for educators to use in the classroom. Participants were not given specific topics to discuss, and conversational prompts provided on the website ranged from topics such as climate justice to nature-based solutions. The campaign solicited descriptions of the climate change conversations and received 500 submissions. The top themes that participants used to describe their conversations were education and politics. Other themes included recycling and weather. While this study showed the feasibility of promoting conversations about climate change, only about 10% of the conversations focused on engaging in climate change activism.

One factor likely affecting both communication about CCA and engagement in CCA is self-efficacy, defined as one's belief in their ability to engage in communication about climate change (Geiger et al., 2017). Self-efficacy is a critical component of behavior change theories, such as the social cognitive theory (Bandura, 1986). A study conducted by Geiger, Swim, and Fraser found that a knowledge-based intervention that provided factual information about climate change implications could promote self-efficacy in communicating about climate change (Geiger et al., 2017). In this study, participants were recruited based on their concern about climate change and watched three short videos that the New England Aquarium had previously developed. These videos briefly explained causal mechanisms influencing climate change and examples of solutions to address the problem. Study findings suggested that self-efficacy mediated the relationship between learning about climate change and willingness to discuss climate change. Notably, climate change actions focused on individual-level actions such as biking to work. Similarly, Bieniek-Tobasco and colleagues found that participants who watched a climate change documentary that showed examples of actions that audiences

could do to encourage climate change solutions had increased self-efficacy to take climate change action (Bieniek-Tobasco et al., 2020). Yet, some researchers argue that climate change-related self-efficacy is not generated by deliberative reasoning but rather impacted by non-analytical reasoning (Hornsey et al., 2021). For example, a non-analytical form of reasoning that the authors suggest can impact climate change self-efficacy is imagery. Hart and Feldman found that an image of a solar panel increased self-efficacy relative to no image (Hart and Feldman, 2016).

The current study builds on this previous research on willingness to engage in CCA to focus on specific behaviors, namely communication with social network members, to encourage CCA engagement. It was anticipated that social influence processes embedded in these communication acts may help increase collective actions for climate change mitigation. Engaging in CCA behaviors, such as advocacy to support policies reducing deforestation and transitioning to renewable energy to reduce fossil fuel, can lead to governments enacting policies that impact greenhouse gas emissions significantly more than individual-level behavior change (Emissions Gap Report, 2020). Therefore, we designed the Climate Change Activism Peer Educator Training Program to address the gaps in studies of experimental interventions to promote climate change activism. Drawing from social modeling and self-efficacy theories, this training program was designed to train US residents to become peer educators and talk to their peers about what they could do to help address climate change through collective action. In the current study, we evaluate the Climate Change Activism Peer Educator Training Program using a randomized control study design to assess the efficacy of online training on communication with peers to encourage CCA compared to an equal attention control condition in the US.

Methods

Study participants were recruited through the Prolific platform in August 2022. Prolific is an online platform to recruit participants for social science experiments (Palan and Schitter, 2018). Researchers have extensively used Prolific, which exhibits high reliability and client diversity (Palan and Schitter, 2018). All study protocols were approved by the Johns Hopkins Bloomberg School of Public Health Institutional Review Board.

Participants were randomized with equal allocation to the CCA training condition or an equal attention control condition, which provided training on how to be a COVID-19 peer educator. The CCA training condition consisted of a survey to assess current behavior and four modules: (1) Why talk about CCA, (2) Who to talk to about CCA, (3) Methods of communicating about CCA and, (4) How to use social media to communicate about CCA. Each module consisted of videos lasting two to 3 min and questions to check comprehension. At the end of the training session, participants completed a planning exercise to prepare for their next conversation about CCA. Participants were also provided with graphics and messages they could share with peers about CCA via face-to-face communication or via social media (see [Supplementary material](#)). The control COVID-19 peer educator condition received modules tailored to promoting COVID-19 vaccination. The two conditions were equal attention, with those in the control condition receiving the same amount of time in the session as those in the experimental group. To develop the CCA intervention

materials, the research team designed over 30 messages across seven messaging domains (e.g., risk frame, trust in climate science, social norms, empathy/understanding, shared experience, hope, and collective efficacy) to increase communications about and encourage CCA. The seven messaging domains to increase communications about and encourage CCA were chosen based on peer education and climate change communication literature (Maibach et al., 2008; De Meyer et al., 2021; Sanderson et al., 2020; Dickinson et al., 2013). These initial messages were piloted with 719 US residents of diverse races, ethnicities, genders, and ages. The top messages were selected for inclusion in the CCA training graphic and message collection using standard message assessment rating techniques (Donovan et al., 2006; Murukutla et al., 2015; Niederdeppe et al., 2011). As this study was conducted during the COVID-19 pandemic, the intervention did not promote engagement in climate protests to avoid increasing COVID-19 transmission risks.

To evaluate the program, 622 individuals participated in the experimental/control training, passed attention checks, and completed the follow-up survey 1 month after the intervention (86% retention from the original sample). To enhance the racial diversity of the sample, Black participants were oversampled as research suggests that the membership of organizations that address climate change is primarily white (Taylor, 2014); hence, we wanted to ensure that interventions would be culturally appropriate for other racial groups. There were no differences by income, climate change worry, randomization, or race between those who did and did not complete the follow-up survey. However, participants in the follow-up were statistically significantly ($p < 0.05$) more likely to be older and male than those who did not remain in the study. Interestingly, compared to the control condition, participants in the climate change intervention were less likely to recall what training they had received, with only 50% having a correct recollection of which training they had received at the one-month follow-up. One reason for the lack of accurate recall might be that both conditions completed the same survey before the training, which asked detailed questions on COVID-19 vaccine and climate change attitudes and behaviors.

Sociodemographic

Participants reported their age in years, sex at birth, and race/ethnicity. Participants were asked, "Which political party do you identify with?" with response options of "Republican," "Democrat," "Independent," "Libertarian," and "Other." Respondents were also asked, "How important is the issue of climate change to you personally?" with response options of "Extremely important," "Very important," "Somewhat important," "Slightly important," "Not at all important." Responses of "Extremely important" and "Very important" were compared to "Somewhat important," "Slightly important," and "Not at all important."

Climate change peer communication self-efficacy and engagement

Two variables assessed communication about climate change. To assess self-efficacy in starting a conversation about climate change activism, participants were asked, "How difficult is it to start

conversations with family/friends about what actions they can take to encourage climate change action? (For example, voting/letter writing/volunteering with/donating to organizations working to curb climate change)” Responses included “Very difficult,” “Somewhat difficult,” “Neither difficult nor easy,” “Somewhat easy,” and “Very easy.” For the analyses treating self-efficacy as a dichotomous variable, responses of “Very difficult” and “Somewhat difficult” were compared to “Neither difficult nor easy,” “Somewhat easy,” and “Very easy.”

To assess actual communications about climate change activism, participants were asked pre- and post-intervention, “When did you last talk to your family/friends about climate change action? (For example, voting/letter writing/volunteering with/donating to organizations working to curb climate change).” Response options included “Never,” “More than a year ago,” “Past year,” and “Past month.” To assess communication about climate change activism, response options were dichotomized and compared “Past month” to all other response options.

Engagement in climate change activism behaviors

To examine change in engagement in climate change activism behaviors, a sum score was created at baseline and follow-up that included seven climate change actions. The seven climate change actions assessed included having: (1) written letters, emailed, or phoned government officials to urge them to take action to reduce climate change, (2) voted for candidates who support measures to reduce climate change, (3) signed an online petition or provided my name and email address to an environmental organization to curb climate change, (4) provided my name and email address to an environmental organization to send an email to a policy maker about climate change, (5) volunteered with organizations working to curb climate change, (6) donated money to organizations working to reduce climate change, (7) attended protests or rallies to reduce climate change (Doherty and Webler, 2016). Response options included “Never,” “More than a year ago,” “Past year,” and “Past month.” The analysis compared the past month’s engagement to all other responses.

Satisfaction in climate change peer educator intervention

After completing the training session, participants in the peer educator CCA training were asked to report their satisfaction with the training. Participants were asked, “How satisfied are you with the training that you received about preventing climate change?” with response options of “Very satisfied,” “Somewhat satisfied,” “Somewhat unsatisfied,” and “Very unsatisfied.” Respondents were also asked whether, “This training has prepared me to talk with others about preventing climate change.” With response options of “Strongly agree,” “Agree,” “Neither agree nor disagree,” “Disagree,” or “Strongly disagree.” Response options of “Strongly agree” and “Agree” were compared to “Neither agree nor disagree,” “Disagree,” and “Strongly disagree.” Additionally, two open-ended qualitative questions were asked “Please

provide comments on what you liked about the training” and “Please provide comments on any issues you had viewing the videos or suggestions on how the training could be improved.”

Challenges communicating about climate change activism with peers

To inform future interventions to promote CCA, we assessed the challenges trained CCA peer educators faced in communicating with peers about climate change activism. At follow-up, we asked participants to respond to the open-ended question, “What challenges, if any, did you face when talking about actions to address climate change?”

Analysis

To evaluate the effectiveness of the Climate Change Activism Peer Educator Training Program, quantitative and qualitative methods were employed. Descriptive statistics were used to describe the study sample and training satisfaction. To assess the effectiveness of the training, behaviors and beliefs were measured pre- and post-intervention. Logistic and linear models were used to assess if beliefs and behaviors changed over time. The key outcomes were the behaviors of communication about climate change and engagement in climate change activism behaviors in prior month. We also assess correlates of participants reporting that starting a conversation about climate change activism was difficult. For the logistic regression models, Wald statistics were used to provide the level of statistical significance. Models were adjusted to account for experimental conditions, recollection of the training, and belief that climate change is an important issue. A supplemental analysis examined the impact of condition recall on the study outcomes using moderation analysis with condition recall as the moderator. A second supplemental analysis added an interaction term to the adjusted logistic and linear regression models to assess the impact of the intervention based on the belief that climate change is important. Qualitative open-ended responses were used to examine what participants reported liking and not liking about the training program as well as challenges experienced when talking with peers about climate change activism. Thematic analysis identified themes from the qualitative feedback on the training (Nowell et al., 2017). Peer debriefing and researcher triangulation were used to generate initial codes. Two coders coded responses, and a third member of the study team resolved discrepancies. Once all the data was coded, the research team sorted and collated coded data into themes.

Results

Over half of the participants (68.97%) reported that climate change was very or extremely important to them personally. On average, participants were 35 years old, and 44% were female (Table 1). About half (45.66%) had a household income greater than \$60,000. 38% of respondents reported their race as white, 39% as Black, 12% as Hispanic, and 11% as Other. Most participants (52.57%) identified as

TABLE 1 Demographics by experimental condition.

	Total (N = 622)	Climate change peer educator condition (N = 310)	Control condition (N = 312)
Age	34.50 ± 11.23	34.91 ± 11.44	34.90 ± 11.02
Gender (female)	273 (43.98)	133 (42.90)	140 (44.87)
Income (60 K+)	284 (45.66)	132 (42.58)	152 (48.72)
Race (White)	234 (37.62)	119 (38.39)	115 (36.86)
Black	244 (39.23)	119 (38.39)	125 (40.06)
Hispanic	77 (12.38)	38 (12.26)	39 (12.50)
Other	67 (10.77)	34 (10.97)	33 (10.58)
Political party (Republican)	80 (12.86)	35 (11.29)	45 (14.42)
Democrat	327 (52.57)	158 (50.97)	169 (54.17)
Independent	191 (30.71)	105 (33.87)	86 (27.56)
Other	24 (3.86)	12 (3.87)	12 (3.85)
Belief that climate change is very or extremely important	429 (68.97)	217 (70.00)	212 (67.95)

Democrats, 13% as Republicans, 30% as Independents, and 4% as Other.

Climate change peer communication and engagement in climate change activism

Change in self-efficacy talking about climate change activism, number of conversations about climate change activism, and engagement in climate change activism were examined to assess the effectiveness of the training. The adjusted logistic regression models for the outcomes of climate change communication self-efficacy [$\chi^2(4) = 80.1, p < 0.001$] and climate change communication [$\chi^2(4) = 123.51, p < 0.001$] were statistically significant (Table 2). A zero-order correlation matrix of study variables can be found in Appendix 1. In all bivariate and adjusted models, baseline levels of beliefs about difficulty starting a conversation about climate change activism, communication about climate change activism frequency, and engagement in climate change activism were significantly associated with their respective outcomes at the one-month post-intervention follow-up (Table 2). Likewise, concern about climate change significantly predicted climate change conversation variables and engagement in climate change activism at follow-up. The intervention had a significant effect on self-efficacy, as seen by a reduction in the belief that starting a conversation about climate change activism is difficult in both bivariate and adjusted models (OR:0.60, 95%CI:0.41, 0.88; adjusted OR [aOR]:0.62, 95%CI:0.41, 0.94) but did not have a significant association with the outcome variables of communications about climate change activism ($p = 0.435$) and engagement in climate change activism ($p = 0.214$) in the prior month.

Recall of training condition partially moderated several of the outcomes as shown in Appendix 2. Findings suggest that this training did not differentially impact people based on their belief in the importance of climate change (Appendix 3).

Satisfaction in climate change peer educator intervention

After completing the Climate Change Activism Peer Educator Training Program, participants reported high satisfaction with the training with 90.97% reporting being satisfied or very satisfied. Most participants (80.32%) felt that the training prepared them to talk with others about preventing climate change.

Five themes emerged from the qualitative response to what people liked about the training. As seen in Table 3, the most frequently expressed theme (42%) was an appreciation for the new information provided in the training, such as strategies to talk to others about climate change and resources that could be shared with peers. Participants also appreciated that it provided credible information and explained the causes of climate change and what is responsible for it. A theme stated by 14% of participants was an appreciation for the clear and simple messaging about how to talk about climate change and steps to take to mitigate climate change. Many participants (33%) reported that they liked the training format. Participants appreciated the interactive nature of the training, which included graphics, videos, checks for understanding, and resources to share with peers. It was reported that having multiple modules helped participants to retain the information. A quarter of respondents (24%) explicitly stated that they liked the graphics and videos in the training as they made the training more engaging, helped them focus, and aided in information retention. Another 6% of respondents reported that one of their favorite elements was the checks for understanding, as they helped them process the information, and they received an explanation when any wrong answer was selected.

Participants were also asked what could be improved with the training or if they had any technical issues. Most respondents (81%) reported no issues or suggested improvements (Table 4). Three themes emerged for improvements to the training. Some participants (12%) reported suggestions for the training format, but suggestions were inconsistent, with some reporting a desire for longer videos and others for shorter videos. A few people reported technical issues with the video not loading and needing to watch the video with the link provided. Additionally, 7% desired additional information, and a couple of participants wanted individual-level actions that they could take (e.g., recycling). Another participant requested more training on how to talk about controversial topics with people who do not care or believe in climate change or feel there is nothing they can do to prevent climate change.

Challenges communicating with peers about climate change activism

In the follow-up survey, about a quarter of participants trained to be peer educators to promote climate change activism reported challenges in communication about climate change (Table 5). Five themes arose from these qualitative responses. The most expressed theme was difficulty convincing people with opposing beliefs (10%). Peer educators felt that some of their peers did not believe in climate change or did not feel that they needed to take action to mitigate it. Some peer educators attributed these beliefs to propaganda, misinformation, and conservative news outlets. A second theme was difficulty starting a conversation (5%). Peer educators felt it was challenging to engage in

TABLE 2 Logistic and linear regression models of climate change communication and activism at follow-up (N = 622).

	Unadjusted models				Adjusted models			
	OR	SE	p	95% CI	aOR	SE	p	95% CI
Belief that starting a conversation about climate change activism is difficult								
Belief that starting a conversation about climate change activism is difficult at Baseline	5.89	1.25	<0.001	3.88, 8.94	5.79	1.25	<0.001	3.80, 8.84
Randomization	0.60	0.12	0.009	0.41, 0.88	0.62	0.13	0.025	0.41, 0.94
Training recall	1.24	0.25	0.275	0.84, 1.84	1.06	0.23	0.793	0.69, 1.64
Belief that climate change is important	0.61	0.12	0.014	0.42, 0.91	0.63	0.14	0.034	0.42, 0.97
Past month communication about climate change								
Past month communication about climate change at Baseline	7.20	1.47	<0.001	4.83, 10.75	6.09	1.29	<0.001	4.02, 9.23
Randomization	1.06	0.18	0.753	0.75, 1.48	0.85	0.17	0.435	0.57, 1.27
Training recall	1.15	0.21	0.433	0.81, 1.64	1.01	0.21	0.979	0.67, 1.51
Belief that climate change is important	4.24	1.00	<0.001	2.67, 6.74	3.05	0.76	<0.001	1.87, 4.96
	B	SE	p	95% CI	aB	SE	p	95% CI
Past month engagement in climate change activism behaviors								
Past month engagement in climate change activism behaviors at Baseline	0.62	0.04	<0.001	0.56, 0.69	0.61	0.04	<0.001	0.54, 0.68
Randomization	0.04	0.09	0.651	-0.14, 0.22	-0.10	0.08	0.214	-0.25, 0.06
Training recall	-0.02	0.09	0.862	-0.20, 0.17	-0.03	0.08	0.742	-0.18, 0.13
Belief that climate change is important	0.53	0.10	<0.001	0.34, 0.72	0.23	0.08	0.005	0.07, 0.39

*Randomization (1 = control condition, 2 = climate change peer educator condition).

OR = Odds Ratio; SE = Standard Error; p = p-value; CI = Confidence Interval; aOR = Adjusted Odds Ratio.

conversation as they were unsure how people would react. Another theme was that peer educators did not think they could make a difference (4%) and felt hopeless or doomed due to climate change. A fourth theme was the need for more training (3%). Peer educators did not feel that they could answer questions that arose from peers or were able to provide facts specific to their state. The final theme, expressed by 1% of peer educators, was that they did not care about climate change.

Discussion

Study findings suggest that a short one-time online training can effectively promote self-efficacy in starting conversations about climate change. This aligns with the findings from Geiger, Swim, and Fraser that a knowledge-based intervention promotes self-efficacy in communicating about climate change (Geiger et al., 2017). In addition to promoting self-efficacy, study participants were highly satisfied with the training, and participant feedback identified that clear and concise messaging and engaging visuals contributed to their satisfaction with the intervention. Participants shared that they appreciated the simple and consistent messaging, videos, and graphics that engaged them during the training. Suggestions to improve the intervention varied among participants suggesting that effective interventions should be structured to address multiple learning styles that engage participants visually and auditorily.

We found that concern about climate change at baseline predicted engagement in climate change activism and conversations at follow-up. The current study targeted an audience with a broad range of climate change beliefs and understandings of the impacts of climate change.

Qualitative results revealed that peer educators who do not believe climate change is an acute issue were less likely to communicate about climate change activism. These findings align with Sunstein and colleagues' study and the theory of motivated reasoning that people's baseline beliefs about climate change affect future attitudes and behaviors (Sunstein et al., 2016). Future studies should consider targeting individuals motivated to engage in climate change communication and activism.

While this intervention had high rates of satisfaction and successfully reduced participants' belief that starting a conversation about climate change activism was difficult, it did not demonstrate a significant increase in frequency in peer communication about climate change activism. These findings highlight that high satisfaction with training does not necessarily translate to behavior change. This may be due to conflicting priorities as many people have competing demands for their attention and limited time causing topics, even those deemed to be important, to recede into the background unless people are reminded to engage in the behaviors. This suggests that it may be important to cue behaviors and promote easy adoption strategies in order to increase climate change advocacy conversations and activism behaviors. One strategy could be texting or emailing individuals with easy options for starting conversations and for engaging in climate change activism.

Qualitative results suggest that it could be further effective to provide more robust information and tools to initiate and navigate difficult conversations about climate change, such as conversations with people who do not believe in climate change and people who feel doomed and do not believe they can do anything to mitigate climate change. In addition, as each person holds unique baseline views and social network characteristics, future interventions may benefit from

TABLE 3 Training satisfaction themes (N = 310).

Clear messaging (n = 44, 14%)	I liked how simple everything was and easy to understand (M, 26) I liked the videos made it simple to talk about climate change (M, 31) The training gave me concrete steps I can take. (F, 44)
Engaging graphics/videos (n = 73, 24%)	It was done with visuals, which helps me retain information (F, 33) It was visually appealing which helps to hold attention (M, 34)
Checks for understanding (n = 19, 6%)	I liked the interactive questions that did not penalize you for getting it wrong. Instead it tells you the answer and explains it properly (M, 18) I also appreciated the mini quizzes at the end of each video so I could process what I watched. (F, 22)
Informative (n = 131, 42%)	I liked this training because it teaches you some new strategies that you could use to talk to others about climate change prevention. (M, 36) I liked the way they explained to me the resources I have at my disposal to be able to talk to other people. (M, 36) Learn new information to talk about to others. (F, 47) I actually had no idea about the townhall feature on Facebook. I think more sources like that that get us directly in contact with officials makes it feel like we have more control. (F, 37) It was positive and upbeat. It dispelled SOME of my misery around the topic and gave me resources to share for positive action. (M, 31) I liked how it clarified and made things clear about what exactly the problems climate change causes and what is responsible for it. (M, 18) It contained credible information and it was extensive so I appreciate that. (M, 28)
Ease of use (n = 103, 33%)	the graphics, the fact that everything was read aloud, and the quizzes at the end helped me focus (F, 34) great pacing and giving info at a good level as not to overwhelm (M, 33) It is very simple and easy to follow. It is also easy to remember. The training also makes it interesting for not just me but it will make it interesting for other people (M, 38) I think that the short snippets of information really helps me retain the information that I need to know in order for me to talk to other people about climate change. (M, 73) I liked the interactive nature of the training and videos (M, 23) I loved all the information and resources to share the information. (M, 31)

Disliked/criticism (n = 12, 4%). Positive outcome? (n = 49, 16%). No changes (n = 33, 11%).

TABLE 4 Training critiques themes (N = 310).

Desire additional information (n = 23, 7%)	Maybe try talk about things we can do that do not involve speaking to friends, family, or elected officials. Like what are some actions we can take individually such as recycling or using public transportation instead. (M, 28) Explain how climate change is happening and what we can do on a personal level to reverse it (F, 49) I think more information on how to deal with doomers would be great. My friends are people that are aware of climate change but feel there's nothing that we can do due to the systems of the US Government. (F, 37) I think that maybe there could have been more resources about climate change itself and how its affecting our planet/how it will affect it (F, 19) I feel like the training was really basic and focused on things I already knew (M, 24) I feel it should have covered common issues encountered when talking about anything controversial. For example, as a Hispanic in a Hispanic community, many of them do not care or believe any of that stuff. (F, 34)
Training format (n = 38, 12%)	the second video did not load. I watched it with the link (F, 31) It would be nice, with how long it was to go through the videos, if you could pause them or re-watch them (F, 34) Longer videos (M, 24) It was a tad too long, not sure all the videos were necessary. (M, 37) I would suggest a more upbeat narrator and maybe adding some music. (M, 31)
Biased information (n = 8, 3%)	Present both sides of the issue and avoid bias and allow for alternative viewpoints (M, 33) Stop the propaganda. Climate change is a myth. (M, 51)

No issues (n = 250, 81%).

a personalized-training approach where participants are directed to modules relevant to their unique network. A module for talking to people who do not believe in climate change can draw from the work of Bain et al., who found that “climate deniers” can be motivated to

participate in climate activism by appealing to their desire to create a society that is more considerate of others and with more significant technological and economic advancement (Bain et al., 2012). Furthermore, people may perceive that it is difficult to engage in

TABLE 5 Challenges starting a conversation themes (N = 310).

Theme	Example quotes
Need more training/information (n = 10, 3%)	I just need to research more about climate change, so that I can accurately talk about it to others. (F, 35) Not being able to answer a lot of questions. Lack of facts that people in my state can relate to on my part. (F, 51) Not having all the facts on hand for any particular subject. Climate change bleeds over into so many other fields that it's kind of impossible to be well versed on all of them. (F, 37)
Difficulty starting the conversation (n = 14, 5%)	People ignoring my conversations or cut me off conversation. (F, 32) Getting myself to start speaking as I tend to have a hard time speaking up to others sometimes, especially if I'm not sure how they will react. (F, 19)
Difficult to convince people with opposing beliefs (n = 32, 10%)	The only challenges are usually people believe/disbelieve it's a thing or they choose to be inactive if they believe it. (M, 52) Some people just cannot be dissuaded from their beliefs or propaganda induced misinformation (M, 25) Some people did not believe that there really was a problem or they seemed to think that we did not have to worry too much about it yet. (F, 26) I faced challenges trying to convince my college educated grandparents that climate change was real. They watch Fox News all day and they think that climate change is just "woke" culture and not something that we need to worry about. Tucker Carlson should be put in prison for lying to this country. (F, 38) it is not a priority to many people. The thinking is that it will not effect living people. That it is more a future problem really. (F, 34)
Peer educator does not think they can make a difference (n = 11, 4%)	Finding a solution, becoming doomed. (F, 30) We felt helpless (F, 29)
Peer educator does not care about climate change (n = 2, 1%)	I do not care much about climate change (M, 18) I believe we still need stuff like coal and oil while other people want to take it all away which will kill the economy and hurt people (M, 23)

No challenges: n = 69, 22%. No response: n = 177, 57%.

conversations because they underestimate how many people care about climate change (Geiger and Swim, 2016). Providing information about the large percentage of population that care about climate change, across political parties, may help dispel some of these misperceptions.

Future studies should prioritize training individuals who are concerned or worried about climate change to promote CCA. As the majority of the US population is concerned about climate change and climate change deniers tend not to be influenced by providing them with scientific information about climate change, it is likely to be much more effective to foster collective action to address climate change among those who are concerned about climate change as compared to those who deny its severity and magnitude. Participants can also benefit from role-playing these types of conversations and receiving positive feedback after engaging in difficult conversations. Role playing conversations may be an effective strategy for increasing climate change communication, as Geiger and colleagues found that discussion experiences can increase perceived ability to discuss a topic and decrease discomfort (Geiger et al., 2023). Future studies may also benefit from the inclusion of measures that assess the perceived attainment of skills that promote climate change communication such "I know lots of ways to discuss climate change" (Geiger et al., 2019).

Hopelessness also presented a barrier for peer educators to engage in climate change activism conversations. Hopelessness and hope may stem from an individual's assessment of collective efficacy, or the belief that working together as a collective can produce the desired results (Bandura, 2000). Research has shown that this hopelessness may derive from a sense that various corporate and political forces will not collaborate to address climate change (Marlon et al., 2019). These individuals see greed and low prioritization as reasons that prevent

meaningful CCA. On the other hand, those who have great hope in CCA derive optimism from witnessing collective action and awareness around climate change (Marlon et al., 2019). These individuals may benefit from group interventions with other peer educators, which may provide support and behavioral models as they navigate CCA conversations and maintain collective efficacy. Van Swol and colleagues found that creating intimacy in group discussions was more effective than focusing on information, thus group interventions that focus on relationship building may be particularly effective as they can build a social identify and cohesion (Van Swol et al., 2022). According to Marlon et al., promoting constructive hope and doubt may be an approach to mobilize peer educators on climate change as these feelings were found to predict engagement in political behaviors and support for actions mitigating climate change (Marlon et al., 2019).

Future studies aimed at promoting pro-environmental behaviors must also focus on sustaining behaviors. Porter and colleagues' review of behavioral programs to increase recycling identified that few interventions determined behavioral maintenance after completing the intervention (Porter et al., 1995). The present intervention only measured behavior changes pre-and post-intervention. Future CCA intervention studies should be longitudinal to assess maintenance in behavior over time. In addition, future interventions should be designed to promote sustained engagement over time in CCA behaviors. For example, prompts and additional training may be effective tools to make the topic of CCA more salient and sustain engagement in peer communication and CCA over time. Additionally, to effect meaningful change to address the climate crisis in addition to mobilizing individuals to action, additional research is needed to bridge the gap between activism and enactment of climate promoting policies (Han and Barnett-Loro, 2018; Skocpol, 2013).

By using a peer educator approach, the study team was able to study changes to self-efficacy beliefs and changes in communication behaviors about climate change and engagement in CCA. The study benefited from a robust study design. The randomized control study design allowed assessment of the CCA intervention compared to a control condition. The mixed methods approach allowed investigation into statistical change and a more nuanced understanding of participants' experiences. Study limitations should also be noted. The study population was not a representative sample of US residents and future studies should develop and test intervention materials with diverse racial, ethnic, and socioeconomic groups. Additionally, all behaviors were self-reported and, hence, may not accurately reflect engagement in behaviors.

The present study is one of the first to assess an intervention's effectiveness in increasing engagement in CCA. Study findings identified that a short, interactive one-time training effectively increased self-efficacy beliefs in communicating with peers about CCA. While no significant change in peer climate communication frequency or engagement in CCA was identified, study findings highlight several suggestions for future intervention, namely: targeting people who are motivated to take action to address climate change to be peer educators, developing tailored training modules based on peer educators social network characteristics, integrating prompts and additional training in order to reinforce and maintain behavior change over time. Future research on promoting CCA should also examine the link between collective and self-efficacy and how social networks can bolster self-efficacy through collective efficacy.

Data availability statement

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

Ethics statement

The studies involving humans were approved by Johns Hopkins Bloomberg School of Public Health Institutional Review Board. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

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Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fcomm.2024.1429264/full#supplementary-material>

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