

**Investigating the Impact of Climate Change Hope on Pro-Environmental
Behaviour among UT Students**

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Abstract

This study aimed to examine the impact of Climate Change Hope on Pro-Environmental Behaviour among students enrolled at the University of Twente in the Netherlands. Additionally, the study investigated the antecedents of Climate Change Hope, including Climate Change Perception, Self-Efficacy beliefs, and Trust in Policymaking. Thereby, it is also tested how these factors affect students' hope and their involvement in climate change mitigation behaviours. A total of 83 participants completed a self-developed online questionnaire that measures their level of hope, Self-Efficacy beliefs, Climate Change Perception and Trust in Policymaking regarding climate change, and assessed the frequency of their engagement in Pro-Environmental Behaviours. The results of the factor analysis revealed that both variables Pro-Environmental Behaviour and Trust in Policymaking are multidimensional, consisting of three subconstructs each. The following analyses were conducted with the whole scale of Pro-Environmental Behaviour and the subconstructs Community Actions, Individual Actions and Sustainable Transport Actions. Additionally, the whole scale for Trust in Policymaking was used as well as the subconstructs of Government Integrity, Government Competence and Government Efficacy. The findings indicate relatively low levels of Climate Change Hope among university students. However, contrary to previous research, there was no significant impact of Climate Change Hope on any subconstructs or the whole scale of Pro-Environmental Behaviour. Nevertheless, this study shows that Climate Change Hope serves as a mediator between students' level of trust in the Government's Integrity and the Pro-Environmental Behaviour of engaging in Sustainable Transport Actions. Therefore, the effect of trust in the Government's Integrity on Pro-Environmental Behaviour is influenced by Climate Change Hope. Even though, due to several limitations, the results need to be interpreted with caution, the findings suggest that further examining Climate Change Hope and Trust in Policymaking among students is crucial in understanding factors that influence their engagement in Pro-Environmental Behaviour.

Keywords: Climate Change, Climate Change Hope, Pro-Environmental Behaviour, PEB, Climate Change Perception, Self-Efficacy, Trust in Policymaking, Government Integrity, Sustainable Transport, University Students, Netherlands

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“When I’m taking action, I don’t feel like I am helpless and that things are hopeless, because then I feel like I’m doing everything I can (...)”

Greta Thunberg in an interview with Earth.org in October 2021

Over the past few decades, climate change has become one of the most critical problems modern societies have to face (Cummings & Rosenthal, 2018). Especially, the consequences of climate change have become far more apparent to societies in Europe and all over the world. The rising temperature of the earth, contributing to climate change, is primarily caused by the increased production of gases like methane and carbon dioxide in both personal and industrial contexts (United Nations, n.d.). The dimensions of climate change are enormous and not only affect the environment but society as they include “(...) intense droughts, water scarcity, severe fires, rising sea levels, flooding, melting polar ice, catastrophic storms and declining biodiversity” (United Nations, n.d.).

An example of the far-reaching consequences of climate change is the increased frequency of extensive heatwaves in Europe in 2022 (Copernicus, n.d). The impacts of more extreme heatwaves have been visible as they include a broad range of consequences like an increased number of periods of drought and conflagration and most strikingly thousands of additional deaths all over Europe (Copernicus, n.d, Federal statistical office, 2023).

Scientists all over the world agree to the fact to minimise the consequences and impacts of climate change and maintain a planet where living is possible, it is crucial to limit the world’s temperature rise to no more than 1.5 °C. Therefore, many global agreements and guidelines have been developed by the United Nations to be able to work unitedly to stop impacts of the global warming (United Nations, n.d.). These guidelines aim to restrict carbon dioxide emissions by implementing adjustments like increasing the number of sustainable energy sources and generally adapting to possible consequences of climate change to protect society (United Nations, n.d.).

One of the main global frameworks agreed on by the United Nations is the Paris Agreement, which was signed by 196 parties in 2015. The Paris Agreement can be seen as one of the biggest successes of the United Nations by being the first binding consensus to limit the world's temperature to less than 1.5 °C that was signed by all nations (Paris

Agreement, 2015). Nevertheless, criticism of society towards governments increased in a lot of countries over the past few years. Many individuals, especially in Europe, feel like the executives responsible for combatting climate change take too little action to reach common goals of the Paris Agreement (Paddison, 2023).

Criticism towards European governments and their policymaking is especially seen in younger generations and their involvement in several climate change organisations and protests for climate protection, for example in the Fridays for Future movements (Wallis & Loy, 2021). This generation exhibits a strong inclination towards actively engaging in environmental protection initiatives. This can be attributed to the fact that they are widely recognised as the generation most profoundly impacted by environmental changes and their subsequent consequences (Faustini, 2014).

The remarkable level of engagement displayed by young generations in climate protection demonstrations is evident worldwide. One notable instance occurred at the onset of 2023 in Lützerath, Germany, where the authorized destruction of the village by RWE to gain access to a coal mine, raised concerns about potential violations of the goals set by the Paris Agreement (Paddison, 2023). The demonstrations in the village and surrounding cities in Germany were of great interest and animated a lot of young adults from all over Europe including climate activist Greta Thunberg to join. The increased and extensive involvement of young adults in protests like those seen in Lützerath shows the impact climate change has especially on this generation (Paddison, 2023).

The large involvement of especially young generations in political discussions and demonstrations like those seen in Lützerath can be explained by research executed by Babugura (2016), which shows that the consequences of climate change on the public are not homogenous but have a far more intense impact on younger generations' physical and psychological health. These findings are also supported by a study conducted by Searle and Gow (2010), which indicates that the consequences and influences of climate change led to increased stress levels among the general population. However, it is noteworthy that young generations are particularly vulnerable to these effects. In general, individuals under 35 years' experience the most profound levels of concern and distress related to climate change (Lewis et al., 2019). The increasing amount of suffering and discomfort can lead to the experience of symptoms like feeling sad, helpless, and anxious which are related to higher levels of anxiety, stress, and depression in young adults (Hickman et al., 2021; Searle & Gow, 2010).

Reasons for young individuals being especially affected by despair and climate change concerns can be partly explained by the fact that climate change hopelessness and

anxiety are mostly experienced by those who feel like the climate change threats are uncontrollable and unmanageable by themselves (Stevenson & Peterson, 2015). It is suggested that the feeling of climate change consequences being out of their control is especially encountered by young individuals because they “(...) generally have lower perceived and actual control than adults in political and personal arenas” (Stevenson & Peterson, 2015). A study by Hickman et al. published in 2021 suggests that more than 50% of young adults from ten different European and non-European countries experience feelings of concern and worry when being confronted with climate change. This study emphasises the high levels of concern relating to climate change in adolescents and young adults. Additionally, this study suggests that these feelings largely affect the individuals’ life by harming their functioning and the thoughts they have about climate change during their daily life (Hickman et al., 2021).

Research suggests that both young adults who experience climate change concerns and those who feel hopeful that the more severe consequences of climate change can still be averted engage in Pro-Environmental Behaviour (Balundè et al., 2020; Stevenson & Peterson, 2015). Thereby, the variables of Climate Change Hope and concern in young adults can be identified as drivers for climate change mitigation and pro-environmental action taking (Stevenson et al., 2018).

Theoretical Framework

Pro-environmental behaviour (PEB)

It is crucial to define Pro-Environmental Behaviours (PEB) to recognise the specific actions individuals’, undertake. All individual behaviours contribute to climate change, and adopting sustainable actions can have a significant impact on mitigating global warming (Lange & Dewitte, 2019). Previous studies define PEB as “(...) green-, sustainable-, or environmentally-friendly (eco-friendly) behavior (...)” (Lee & Khan, 2020), that is used by individuals to take foresighted operations to protect and save the environment. Examples of this can be protesting at demonstrations like those seen in Lützerath, Germany or other behaviours like buying sustainable food and products, preserving energy or water at home or adapting travel behaviour towards environmentally friendly options like biking or using public transport (Lee & Khan, 2020). More generally, PEB is seen as a part of climate change adaptive behaviour which follows the goal of engaging in behaviour that decreases the consequences of climate change and thereby has positive effects on the climate and sustainability in general (Lee & Khan, 2020).

It is suggested that young adults react to being concerned about climate change by engaging in sustainable behaviours and therefore, promoting those forms of PEB seems crucial (Stevenson & Peterson, 2015). It can be stated that the generation of young adults largely makes use of environmental activism like participating in demonstrations like those organised by Fridays for Future to form a shared global unit, where they can share experiences and feelings about Climate Change with individuals who find themselves in similar situations (Pickard, 2022). Nevertheless, this generation also proposes and acknowledges that these global actions are not sufficient to combat the consequences of climate change but can have an impact by raising political and social attention towards those topics to generate increased PEB in the general society (Pickard, 2022).

Climate Change Hope

Studies suggest that PEB can be increased by several factors with one of the most important and effective contributors being Climate Change Hope (Ojala, 2022; Stevenson et al., 2018). It is crucial to mention that most research bases the definition of Climate Change Hope on constructive hope. According to Marlon et al. (2019), constructive hope refers to the belief that collective efforts can solve problems, rather than relying on fatalistic views or a higher power. This social phenomenon is critical to defining Climate Change Hope, as it acknowledges the agency of individuals and society in addressing the crisis.

Climate Change Hope operates as a motivator promoting behaviour by encouraging sustainable actions (Stevenson & Peterson, 2015). This observation aligns well with Snyder's cognitive model of Hope Theory (Snyder, 1994), which suggests that hope plays a pivotal role in motivating behaviour by incorporating two key cognitive tools: pathways and agency thinking. Both of these cognitive tools are essential for achieving a desired goal. Thus, hope evolves through an individual's Waypower, which reflects their perceived capacity to navigate various pathways and overcome boundaries to attain their goals. Furthermore, the development of hope is influenced by an individual's Willpower, which encompasses their motivation and goal-directed energy in pursuing their objectives (Snyder, 1994).

Studies conducted by Marlon et al. (2019) and Ojala (2012) indicate that constructive hope fosters PEB and political involvement, especially in younger generations. When individuals acknowledge the significance of their actions, they become empowered to take action and assume responsibility for combating climate change. Furthermore, Ojala (2015) emphasises the importance of considering individual actions as part of a larger collective effort towards sustainability. Additionally, the importance of hope is not only seen in its

influence on behaviour but also in its effects on increasing people's physical and psychological wellbeing (Neves, 2003).

Hence, it becomes imperative to identify Climate Change Hope, drawing from the concept of constructive hope, and understand its role in fostering positive action towards addressing climate change. Recognizing the capacity of individuals and society to contribute to climate change solutions, Climate Change Hope serves as a motivator for PEB and political engagement. Thus, the current study aims to examine and answer the research question "Does Climate Change Hope contribute to an increased engagement in Pro-Environmental Behaviour and what are the antecedents of Climate Change Hope?"

Antecedents of Climate Change Hope

Extensive research has been undertaken to identify the antecedents of Climate Change Hope among individuals contributing to them having higher hope in combatting climate change. The main predictors of hope can be identified as individuals' Self-Efficacy beliefs, their level of Climate Change Perception and the extent to which they trust the Government and Policymakers in combatting climate change (Li & Monroe, 2019; Ratinen and Uusiautti, 2020; Thaker et al., 2019). Despite this, there has been no investigation or verification of whether these antecedents can also enhance the sense of hope regarding climate change among younger adults.

Self-Efficacy

Self-Efficacy beliefs are among the most significant predictors of Climate Change Hope (Li & Monroe, 2019; Rand & Cheavens, 2009). Self-Efficacy is defined as an individual's belief in their capacities and abilities to perform and accomplish an action to reach a specific goal (Bandura, 1977). Research has demonstrated that strong Self-Efficacy beliefs are associated with positive perceptions of hope and can increase feelings of hope among individuals (Li & Monroe, 2019). Reasons for Self-Efficacy beliefs increasing feelings of hope can be attributed to the fact that the consequences of strong Self-Efficacy are that individuals perceive tasks as simpler to manage and invest more activity in actions leading to achieving a specific goal. Thereby, with high levels of Self-Efficacy, individuals feel more hopeful that they have the resources and abilities to solve a specific problem (Riopel, 2022). The significance of Self-Efficacy beliefs can be attributed to individuals' perception of climate change as a personal challenge, wherein they hold the belief that their actions can make a meaningful contribution to mitigating climate change. (Van Zomeren et al., 2010)

Climate Change Perception

Another factor that is assumed to have a large influence on an individual's feelings of Climate Change Hope is the perception of climate change. Climate Change Perception is composed of the nature and consequences of climate change, which describes if individuals perceive causes of climate change as being natural or caused by humans and if they perceive consequences as negative or positive (Van Valkengoed et al., 2021). Additionally, Climate Change Perception also includes people's perception of spatial and temporal distance to climate change (Van Valkengoed et al., 2021).

Additional research studying the influences of knowledge about climate change also suggests that higher levels of knowledge about climate change led to people accepting and believing in global warming and also increase their hope in climate change mitigation (Gazzaz & Aldeseet, 2021; Stevenson et al., 2014). These findings can be further supported by a study conducted by Stevenson et al. (2018). The study indicates that knowing the nature, effects, and consequences of climate change, which are also concepts encompassed in the Climate Change Perception scale, is associated with a higher level of hope. Moreover, this Climate Change Hope in turn significantly predicts PEB (Stevenson et al., 2018). Thereby, it is suggested that a person having both profound knowledge and a faceted perception of the nature of climate change and how close consequences of global warming appear to them not only understands their role in being sustainable but also the influence of policymakers (Ratinen & Uusiautti, 2020). As the influence of Climate Change Perception on feelings of Climate Change Hope has been investigated in previous studies, especially in children or adults a lack of research on the population of young adults is existing (Gazzaz & Aldeseet, 2021; Ratinen & Uusiautti, 2020; Stevenson et al., 2014).

Trust in Government and Policymakers

A third predictor of Climate Change Hope is the level of Trust in Policymakers and the Government (Thaker et al., 2019). Research by Kitt et al. (2021) suggests that the level of trust citizens have in the Government depends on how they perceive the competence and integrity of the executives. The importance of Trust in Policymaking is shown by research executed by Nabi et al. (2018), which suggests that decisions by governments leading to climate goals not being reached can harm people's perception of hope. Thereby, it can be expected that when people have more Trust in Policymaking, they might be more hopeful that climate change can be addressed effectively. Especially younger generations feel disappointed in the current climate change decisions of policymakers and also in the general worldwide course of action governments and authorities take (Pickard, 2022). The perception

of decisions of policymakers about Climate Change being insufficient and the decreased trust in the governments is associated with higher levels of stress, especially in children and young people (Hickman et al., 2021).

Current Study

Previous research has indicated that climate change hope is one of the most important contributors to an increased engagement in Pro-Environmental Behaviour (PEB) (Stevenson et al., 2018). As younger generations in recent years are experiencing increased levels of pessimism and hopelessness towards climate change (Hickman et al., 2021), their engagement in PEB is impeded (Searle & Gow, 2010). Self-Efficacy beliefs (Li & Monroe, 2019), Climate Change Perception (Valkengoed et al., 2021), and Trust in Policymakers (Thaker et al., 2019) have been identified as the key predictors that positively influence Climate Change Hope, thereby promoting PEB. Therefore, it is crucial to investigate whether these predicting variables positively influence the perception of Climate Change Hope in a sample of young adults. The current study investigates whether the previously found effects also remain significant in a sample of university students.

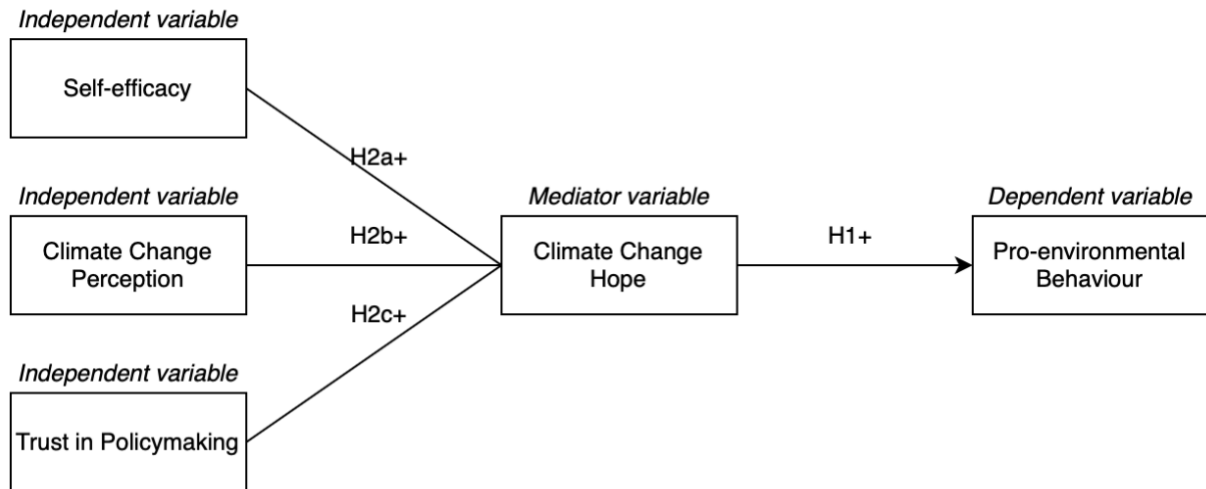
By testing the following hypotheses based on the previously presented research question, the study can help to understand how to promote Pro-Environmental Behaviour among young adults and increase their engagement in actions to combat future consequences of climate change.

These are the Hypotheses formulated based on previous research that will be tested in this study. The Hypotheses are also displayed in Figure 1.

H1: Students who have higher levels of Climate Change Hope show higher levels of Pro-Environmental Behaviour.

H2: Students who have higher levels of (a) Self-Efficacy beliefs, (b) Climate Change Perception and (c) Trust in Policymaking have higher levels of Climate Change Hope.

H3: Climate Change Hope mediates the effect of (a) Self-Efficacy, (b) Climate Change Perception and (c) Trust in Policymaking on Pro-Environmental Behaviour.

Figure 1*Conceptual Framework***Methods****Participants**

For this study, 115 students at the University of Twente were recruited to participate in a self-assessment questionnaire. Beforehand, to ensure that the questionnaire was approved ethically, it was examined by the ethics committee of the BMS faculty of the University of Twente. Out of the 115 initial participants, 33 students were excluded due to non-response, unserious answers, or not being students at UT. Five participants were excluded from the study because they were identified as climate change deniers. This decision was based on previous research that suggests individuals who deny climate change are motivated by different factors and experience different emotions compared to those who believe in global warming (Stanley et al., 2021; Myers et al., 2012). For instance, a study has shown that climate change deniers often feel frustrated because they believe climate change is not real, and therefore they see no reason to engage in pro-environmental behaviour (Stanley et al., 2021). Considering these findings, the decision was made to exclude climate change deniers from the study. It is hypothesised that individuals who deny climate change experience different emotions that may not support engagement in Pro-Environmental Behaviour.

The final dataset therefore, contained 83 observations and 62 variables. The mean age of the participants was 22.8 years (SD=4.23). Most of the respondents were female German psychology students and most of the participants were pursuing a bachelor's degree. A more detailed representation of the demographics of the respondents is displayed in Table 1. The results should be interpreted with caution due to the overrepresentation of female BMS students in the sample.

Table 1*Demographic Statistics of the Respondents*

Demographics	Characteristics	N	Percentage
Gender	Male	23	28.1%
	Female	58	70.7%
	Non-Binary	1	1.2%
Age	18-20	19	23.2%
	21-23	39	47.6%
	24-26	18	22%
	28-30	4	4.9%
	>30	2	2.4%
Nationality	Dutch	16	19.5%
	German	48	58.5%
	Other	18	22.0%
Study Field	ET	6	7.3%
	EWI	8	9.8%
	TNW	6	7.3%
	ITC	1	1.2%
	BMS	63	76.8%
BMS Study Field	COM	15	18.3%
	IEM	0	0
	IBA	2	2.4%
	MS&T	2	2.4%
	PSY	34	41.5%
	Not BMS	22	26.8%
Educational degree	Bachelor	66	76.1%
	Master	12	16.6%
	PhD	1	1.2%
	Not pursuing a degree	5	6.1%

Note. Engineering Technology = ET, Electrical Engineering, Mathematics & Computer Science = EWI, Science and Technology = TNW, Geo-information Science and Earth observation = ITC, Behavioural, Management and Social Science = BMS, Communication Science = COM, Industrial Engineering and Management = IEM, International Business Administration = IBA, Management, Society and Technology = MS&T, Psychology = PSY

Measures

In this study, the procedure involved two steps. First, a prototype questionnaire was sent out to 10 students to evaluate its feasibility based on the analysed literature. Secondly, recommendations and comments from the participants were used to review and adjust the questionnaire, ensuring its appropriateness and clarity. As no major changes were required and all participants completed the survey in under 20 minutes, the survey was finalised and published on Qualtrics.

All of the questions that focused on measuring the independent and dependent variables have been adapted to a five-point Likert scale to ensure consistency and later on the scales for all variables were computed by averaging the items. The full questionnaire can be found in Appendix B.

Filter out Climate Change Deniers

To ensure the accuracy of the results regarding the effect of Climate Change Hope on PEB, it was necessary to exclude participants who deny climate change. This is because their lack of belief in the impact and consequences of global warming could bias the results. Two items from the Climate Change Perception Scale (Van Valkengoed et al., 2021) were used to filter out climate change deniers.

The students are asked to indicate how much they agree with the statements “I believe climate change is real.” and “Human activities are a major cause of climate change.” ranking their answers from 1 (strongly disagree) to 5 (strongly agree). Thereby, students who do not believe climate change is real and do not believe in human causes being the reason for climate change are filtered out, when they score less than three on both items (Van Valkengoed et al., 2022).

PEB

The dependent variable PEB was measured with eight items from an existing scale developed by Ogunbode et al. (2022), with items like “cycle or walk instead of driving”. Additionally, six self-developed items about environmental activism and engagement such as “Join a local environmental initiative to help speed up the transition to a more climate neutral society, such as a sustainable energy citizens' initiative or recycling initiative” (see Table 2 for all items) were included. The participants are asked to indicate on a scale from 1 (never) to 5 (always) how often they engage in the proposed PEB.

The factor analysis conducted on the PEB scale revealed that three factors were identified, based on the eigenvalues over 1 (Appendix C). Most of the items displayed strong loadings on a single factor, except for item 3, which showed high loadings on all three factors.

Due to the thematic similarity between item 3 and the two other items that primarily loaded on factor 3, it was decided to group item 3 “Choose not to fly” with factor 3. In Table 2, the factor analysis results revealed three distinct factors related to three different types of PEB. “Community Actions” (factor 1) were represented by six items ($M=2.20$, $SD=0.87$, $\alpha=.85$). “Individual Actions” (factor 2) consisted of five items ($M=3.40$, $SD=0.87$, $\alpha=.79$). Lastly, “Sustainable Transport Actions” (factor 3) encompassed three items ($M=3.80$, $SD=1.00$, $\alpha=.80$). The three subconstructs of the PEB scale showed a good reliability. Additionally, the whole PEB scale also showed an acceptable Cronbach’s alpha with internal reliability of $\alpha = .88$ ($M=2.80$, $SD=0.75$). Consequently, the subsequent analysis will involve regression and mediation analysis using the whole pro-environmental behaviour scale, namely “Pro-Environmental Behaviour” (PEB) as well as each construct of the three constructs examined separately.

Table 2*Factor Analysis of the PEB Scale: Rotated Factor Loadings*

Pro-environmental behaviour	Factor 1 (Community Actions)	Factor 2 (Individual Actions)	Factor 3 (Sustainable Transport Actions)
Engaging in a climate change protest organization	.80	.13	.00
Taking part in a protest related to environmental issues	.78	.00	.00
Join a local environmental initiative to help speed up the transition to a more climate neutral society.	.65	.26	.22
Sign a petition given out by climate change organization about taking climate protective actions	.57	.13	.25
Ask my friends & family to engage more in behaviours that will save CO2 emissions	.57	.48	.20
Choose courses or programs at the university that focus on combating climate change	.54	.23	.24
Choose not to fly	.38	.29	.33
Save energy in the household	.11	.86	.12
Try to influence family and friends to act more pro-environmentally	.47	.57	.00
Avoid food waste	.00	.57	.20
Make climate-friendly food choices	.44	.53	.20
Restrain oneself from buying unneeded new clothes	.00	.46	.34
Take public transportation instead of the car	.22	.14	.79
Cycle or walk instead of driving	.12	.12	.76

Note. Components analysis with VARIMAX rotation. Numbers in Boldface indicate the highest factor loadings.

Climate Change Hope

The mediator variable Climate Change Hope was measured by using a scale developed by Böhm (2003) which asks participants to respond to the question “When thinking about climate change, how intensely do you experience the following emotions?”. All the emotions provided in the scale are a good starting point to measure participants' emotional states about environmental concerns and are therefore included in the questionnaire (Böhm, 2003). The participants were provided with 11 different emotions, provided in alphabetical order, like anger, fear, hope and hopelessness, and are asked to indicate from 1 (not at all) to 5 (very much), how much they experience these emotions (Appendix B). In this study, Cronbach's alpha was not computed for the scale comprising 11 emotions. Since the focus of the investigation was solely on the emotion of hope, the reliability of the entire scale was not of interest.

The scale was used to measure the emotions associated with climate change, specifically examining the concepts of hope and hopelessness. By executing a factor analysis, the goal was to determine if these two emotions could be analysed together or if they represented distinct concepts. The results of the factor analysis revealed that hope and hopelessness were measured by separate underlying factors, indicating their unique nature. This analysis confirmed that hope and hopelessness are independent constructs, representing different aspects of emotional experience. Since the research focus was solely on the effects of Climate Change Hope, consequently only the item of hope was used for further analysis.

Self-Efficacy Scale

The variable Self-Efficacy measuring participant's individual beliefs in their capacities in engaging in behaviours combatting climate change was investigated with a scale developed by Van Zomeren et al. (2010). Participants were asked to indicate how much they agree to five different statements like the item “There are simple things I can do that reduce the negative consequences of the climate crisis” (Appendix B), using answer options ranging from 1 (strongly disagree) to 5 (strongly agree). For the independent variable Self-Efficacy beliefs, the eigenvalues identified one underlying factor (Appendix C). The measure in the present study showed internal reliability of $\alpha = .90$ ($M=3.50$, $SD=1.00$).

Climate Change Perception

Additionally, Climate Change Perception was measured by making use of four items used in the Climate Change Perception scale (Van Valkengoed et al., 2021). The participant's level of Climate Change Perception was measured by asking them to indicate on a scale ranging from 1 (strongly disagree) to 5 (strongly agree) how much they agree with different statements. The scale measured to what extent participants perceive natural causes, positive consequences, and spatial and temporal distance to climate change with one item each (Appendix B). In the current study, it was necessary to remove the fourth item, which assessed the perceived time it takes for the consequences of climate change to be felt by participants. This decision was made because the questionnaire software, Qualtrics, encountered problems, resulting in the majority of responses for this item not being recorded. Consequently, these unrecorded responses could not be utilized for further analysis. The scale used in this study consisted of three items but showed a low level of reliability with a Cronbach's alpha coefficient of .17 ($M=2.20$, $SD=0.77$). However, by removing item three from the scale, the reliability was improved to .48 ($M=1.70$, $SD=0.75$). As this revised scale would only consist of two items and the low levels of Cronbach's alpha indicated that the results of the hypothesis would not be sufficiently reliable, the variable Climate Change Perception was excluded from further analysis¹.

Trust in Policymaking

The degree of participants' Trust in Policymaking and the government concerning climate change was measured with a self-developed scale, because previously valid and reliably tested scales only use statements targeted at specific interventions developed by the government. The self-developed scale aimed to measure participants' general trust towards government and policymakers in the climate change context. The scale included 10 items and the participants were asked to indicate how much they agree or disagree with these statements on a scale from 1 (strongly disagree) to 5 (strongly agree) (Appendix B). The items were inspired by a scale developed by Kitt et al. (2021) which measured adults' perception of the Government's Competence and Integrity.

¹ Even though, the variable has been excluded from the analysis, the results from the conducted regression analysis with the items from the Climate Change Perception scale indicated that Climate Change Perception does not significantly affect Climate Change Hope and hypothesis H2b is rejected.

The results of the factor analysis indicated that three factors needed to be extracted (Appendix C). Table 3 summarises the findings of the factor analysis for three distinct constructs related to Trust in Policymaking. The first construct, labelled "Government's Integrity," included four items, which exhibited strong loadings on factor 1 ($M=2.20$, $SD=0.94$, $\alpha=.89$). The construct with the identical associated items has also been found in the analysis of Kitt et al. (2021) and is in the previous study described as individuals trust that the intentions of the government and policymakers related to climate change are honest and fair and that they work in the best interest of the population. The second construct, named "Government's Competence" is primarily represented by two items, demonstrating high loadings on factor 2 ($M=2.90$, $SD=1.10$, $\alpha=.82$). The items loading high on factor 2 were identical to the items found in the study executed by Kitt et al. (2021). The construct describes the government and policymakers' knowledge and proficiency in dealing with public issues related to climate change (Kitt et al., 2021). Lastly, the third construct, referred to as "Government's Efficacy" encompasses four items, which display notable loadings on factor 3 ($M=4.00$, $SD=0.74$, $\alpha=.64$). The whole scale had an internal reliability of $\alpha = .70$ ($M=2.50$, $SD=0.57$). The items loading high on this factor were the items self-developed and described the government and policymakers' capability, authority, and willingness to effectively address and tackle issues such as climate change. The upcoming analysis will involve the complete "Trust in Policymaking" scale, as well as three distinct constructs.

Table 3*Factor Analysis of the Trust in Policymaking Scale: Rotated Factor Loadings*

Trust in policymaking	Factor 1 (Government Integrity)	Factor 2 (Government Competence)	Factor 3 (Government Efficacy)
The governmental organizations intend to act in the best interest of the public	.91	.11	.00
The governmental organizations are open and honest with the public, even if it's not in their favour	.91	.18	-.10
The governmental organizations intend to act fairly	.83	.16	-.11
I think governmental organizations worldwide are working hard towards addressing the problems related to climate change	.61	.12	.00
The governmental organizations have the necessary experience and knowledge (...)	.21	.87	.11
Governmental organizations are competent enough to deal with climate change	.21	.74	.11
Governmental organizations will be able to halt climate change if they work together	.00	.34	.67
I expect governmental organizations to take sufficient government action (...)	-.12	.00	.60
Governmental organizations worldwide are able to take appropriate climate action	.00	.00	.50
Governmental organizations have the power to address climate change if they want to	-.11	.00	.50

Note. Components analysis with VARIMAX rotation. Numbers in Boldface indicate the highest factor loadings.

Procedure

The final questionnaire was approved by the University of Twente BMS Ethics Committee (request number: 230292, date: 30.03.2023) and data collection took place from March 28, 2023, until April 25, 2023. The questionnaire was distributed through convenience and snowball sampling methods, as well as QR codes on posters distributed in different faculty buildings to reach a diverse range of students. The questionnaire was additionally published on the Sona System platform of the University, and distributed directly to students via WhatsApp and email.

Participants needed to agree to informed consent before answering the questionnaire. In the informed consent, they were provided with information about the option to withdraw from the study at any point (Appendix A). First, the participants' demographics such as gender identity, age, nationality, study field, and educational degree were collected. Next, questions were posed for constructs not directly related to climate change (generalized anxiety, mindfulness, and nature-relatedness). These variables were included in the questionnaire but were not part of the current study.

Following this, questions were presented to identify climate change deniers, and the remaining questions measured constructs involving climate change (climate anxiety, climate concern, information seeking, Self-Efficacy, Climate Change Perception, trust in policymakers, and Pro-Environmental Behaviour (PEB)). The survey concluded with a page thanking participants and provided contact information of the researchers, the ethics committee, climate activist groups, and support resources in case the survey caused any discomfort for the participant.

Data analysis

The data generated through Qualtrics and Sona was analysed making use of the statistical software R Studio. All analyses were conducted using the statistical software R, version 2023.03.0+386 (R Core Team, 2023) and the level of statistical significance was set at $p < 0.05$. The following packages “haven”, “tidyverse”, “broom”, “foreign”, “psych” “corner”, “janitor”, “might”, “dplyr”, “Lambda4”, “Hmisc”, “mediation”, “corr” and “car” were downloaded and installed to perform the analysis. Afterwards, the data obtained through the questionnaire on Qualtrics was exported and altered within R-Studio to exclude invalid and none responses, people who did not agree to the informed consent and participants who indicated that they are not students at the University of Twente.

All the answers on the five-point Likert scale were coded as 1 for “strongly disagree” and 5 for “strongly agree”. On the scale for Climate Change Hope, the answers for how much

participants experience the different emotions were coded as 1 for “not at all” and 5 for “very much”. Additionally, on the scale for PEB, the answers were coded as 1 for “never” and 5 for “always”.

Climate change deniers

After the descriptive statistics and frequency distributions of the items assessing participants' belief in climate change were examined, a total of five participants were identified who answered either strongly disagree or disagree on one or both items. These participants were excluded from the dataset.

Descriptive statistics

For all variables included in the data set descriptive statistics, measures of central tendency and variability were calculated. In addition to that, correlations between variables were also examined using correlation coefficients such as Pearson's correlation.

Checking for assumptions and conditions for regression analysis

To ensure the validity of the linear regression analysis, four assumptions were checked. The linearity assumption was assessed by visually examining scatterplots of the independent variables against the dependent variable to determine if a linear relationship existed. The normality assumption was evaluated by examining the distribution of each variable using histograms. The homoscedasticity assumption was tested using the Breusch-Pagan test, where a p -value < 0.05 indicated heteroscedasticity. Finally, the independence assumption was examined using the Durbin-Watson test to detect autocorrelation in the residuals. A p -value < 0.05 indicated autocorrelation, suggesting a violation of the independence assumption.

Main Effect of Climate Change Hope on Pro-Environmental Behaviour

Before conducting the mediation analysis, a regression analysis was performed to test the direct effect of Climate Change Hope on Pro-Environmental Behaviour (PEB) and to test Hypothesis H1. By examining the coefficients, standard errors, t-values and p -values of the model, it was determined whether the null hypothesis, suggesting no significant effect of Climate Change Hope on PEB, can be rejected. A p -value < 0.05 indicated that Climate Change Hope is a valuable addition to the model and has a significant impact on PEB. Additionally, a scatterplot was generated to visualise the relationship between Climate Change Hope and PEB, with a linear model incorporated to depict the association.

Multiple regression analysis with Climate Change Hope as Dependent Variable

Multiple linear regression analysis was performed to assess the impacts of Self-Efficacy beliefs and Trust in Policymaking on the outcome variable Climate Change Hope. By examining the influence of the antecedents on Climate Change Hope the hypotheses H2a and H2c were tested. If the effects of the predictors on the outcome variable were found to be statistically significant with a p -value < 0.05 , mediation analysis is carried out, with Climate Change Hope serving as the mediator.

Mediation Analysis with Climate Change Hope as Mediator

Finally, mediation analysis was performed with the independent variables that affect the outcome variable Climate Change Hope. The role of the mediator variable, Climate Change Hope, in the relationship between the independent variable (Self-Efficacy and Trust in Policymaking) and the dependent variable (Pro-Environmental Behaviour (PEB)) was investigated. The analysis calculated the Average Direct Effect (ADE), representing the direct influence of an independent on the dependent variable while controlling for the mediation. Additionally, the Total Effect was determined. The Total Effect captured the overall impact of an independent variable on the dependent variable, regardless of whether it is mediated or not. Lastly, the Average Causal Mediation Effect (ACME) was measured to test Hypothesis H3a, H3b and H3c. The ACME value showed the impact of the mediator Climate Change Hope on the relationship between the independent variables and the dependent variable PEB. For all factors a p -value < 0.05 indicated a significant effect.

Results

Descriptive Statistics

To provide a summary of the descriptive statistics, each variables' frequencies, means, standard deviations and intercorrelations were computed (Table 4 and Table 5). Among the respondents, 48% reported experiencing Climate Change Hope sometimes or never in their daily lives. (Table 4). Among the respondents, the levels of Climate Change Hope and Pro-Environmental Behaviour (PEB) were low, as the mean was smaller than 3. For the variables Self-Efficacy and Trust in Policymaking, the means were larger than 3, which indicated higher levels of Self-Efficacy and Trust in Policymaking in the sample (Table 4). Additionally, the statistical analysis revealed that the intercorrelations coefficients among the variables were found to be low and insignificant. (Table 4).

Table 4*Frequency Table Hope*

Variable	Answers	n	Percentage
Climate Change Hope	Never	10	12.2%
	Sometimes	30	36.6%
	About half the time	20	24.4%
	Most of the time	21	25.6%
	Always	1	1.2%

Table 5*Descriptive Statistics and the Intercorrelations for Study Variables*

Variable	M	SD	1	2	3	5
1.Climate Change Hope	2.7	1.0	-			
2.Pro-environmental Behaviour	2.8	0.8	.03	-		
3.Self-Efficacy beliefs	3.5	1.0	.20	.20	-	
4.Trust in Policymaking	3.1	0.6	.38	.08	.27	-

Note. Measured on 5-point Likert Scale * $p < .05$, ** $p < .001$

Checking Assumptions for Linear Regression Analysis

Upon examining the scatterplots depicting the distributions of PEB and Climate Change Hope, it was evident that both variables adhere to the assumption of normality (Appendix D). Furthermore, the assumption of linearity was not met as the scatterplot of Climate Change Hope and PEB did not indicate a linear relationship (Appendix D). The results of the *bptest()* and *dwtest()*, which tested the assumption of homoscedasticity and independence indicated an insignificant *p*-value for both tests, meaning that both assumptions were met. In conclusion, it can be stated that the assumption of normality, homoscedasticity and independence were met but the assumption of linearity was violated. As not all assumptions were met the results of the linear regression analysis needed to be interpreted with caution.

Regression Analysis Climate Change Hope and Pro-Environmental Behaviour

The main effect of Climate Change Hope on the PEB was tested by running a linear regression analysis. The results showed that Climate Change Hope did not significantly affect PEB, and thus hypothesis 1 was not supported (Table 5). Separate testing of the hypothesis with three separate constructs Community Actions, Individual Actions and Sustainable Transport Actions also produced insignificant results (Table 5).²

Table 5

Regression of the Complete Pro-Environmental Behaviour Scale and Behavioural Subconstructs on Climate Change Hope

Effect of hope on	B ^a	SE	t	p	R ²
PEB	.03	.08	0.31	.75	.001
Community Actions	-.14	.12	-1.11	.27	.003
Individual Actions	.18	.14	1.30	.19	.008
Sustainable Transport Actions	.18	.11	1.63	.12	.019

Note. Measured on 5-point Likert Scale * $p < .05$, ** $p < .001$

^a Unstandardized regression coefficient

Checking the Assumptions for the Independent Variables

The scatterplots used to assess the linearity between the antecedents of Climate Change Hope, Self-Efficacy, and Trust in Policymaking and Climate Change Hope, indicated that none of the variables met the assumption of linearity. The normality plots for the variables indicated that all variables were normally distributed (Appendix E). The assumption of homoscedasticity was met for Self-Efficacy beliefs and Trust in Policymaking. The assumption of independence of the residuals was met for all variables. Nevertheless, as none of the independent variables sufficiently met all assumptions, the results of the mediation analysis should be interpreted with caution.

² As the assumptions for a linear regression cannot be met, the analysis has also been conducted with the method of Bootstrapping, but the results suggest that the effect remains insignificant.

Multiple Regression Analysis with Climate Change Hope as Dependent Variable

The results of the multiple linear regression analysis with the independent variables Self-Efficacy, and the whole Trust in Policymaking scale showed that only Trust in Policymaking significantly affects Climate Change Hope (Table 6). Therefore, hypothesis H2a was rejected and hypothesis H2c was supported.

Since only the effect of Trust in Policymaking on Climate Change Hope was found to be significant, it was appropriate to focus solely on trust in the mediation analysis. By examining only the significant relationship between Trust in Policymaking and Climate Change Hope, the analysis provided a more focused understanding of the mediating effect. This approach allowed for a clearer examination of the specific role of Trust in Policymaking in shaping Climate Change Hope, without the confounding influence of non-significant subconstructs.

Table 6

Multiple Regression Analysis with the antecedents of Climate Change Hope as independent variable and Climate Change Hope as dependent variable

	B ^a	SE	t	p	R ²
Intercept	.23	.63	0.37	.71	.13
Self-Efficacy	.08	.11	0.69	.49	.03
Trust in Policymaking	.61	.19	3.28	<.05*	.13

Note. Measured on 5-point Likert Scale * $p < .05$, ** $p < .001$

^a Unstandardized regression coefficient

The results suggested that Government Integrity and Government Competence, but not Government Efficacy, significantly affected Climate Change Hope (Table 7). Given that only the relationships between the whole Trust in Policymaking scale and the subconstructs Government Integrity, and Government Competence with Climate Change Hope were found to be significant, the mediation analysis focused solely on these variables as independent variables.

Table 7

Multiple Regression Analysis with the Government Integrity, Government Competence and Government Efficacy as Independent and Climate Change Hope as Dependent Variable

	B ^a	SE	t	p	R ²
Government Integrity	0.49	.11	4.49	<.001**	0.19
Government Competence	0.35	.10	3.58	<.001**	0.13
Government Efficacy	-1.15	.15	-0.95	.34	0.00

Note. Measured on 5-point Likert Scale * $p < .05$, ** $p < .001$

^a Unstandardized regression coefficient

Mediation Analysis with Climate Change Hope as a Mediator

Trust in Policymaking as the Independent Variable

The mediation analysis using the whole scale of Trust in Policymaking as the independent variable and Climate Change Hope as Mediator showed insignificant results for the values of Average Causal Mediation Effect (ACME), Average Direct Effect (ADE) and Total Effect across the dependent variable of the whole PEB scale and the three subconstructs Community Actions, Individual Actions, and Sustainable Transport Actions (Appendix F). Thus, hypothesis H3c can be rejected, suggesting no significant mediating effect of Climate Change Hope on the relationship between Trust in Policymaking and PEB.

In mediation analysis using the three subconstructs of Trust in Policymaking independently, the ACME value was found to be insignificant, revealing no significant mediation effect of Climate Change Hope on the relationship. However, the ADE coefficient was found to be significant, indicating a direct effect when controlling for the mediation between government integrity and PEB. Additionally, the total effect, which combines the direct and indirect effects, was found to be significant (Table 8).³

³ The mediation analysis has also been conducted with the variables Self-Efficacy and Climate Change Perception, but identical to the results of the linear regression analysis measuring the effects of the antecedents of climate change hope on PEB, no significant relationship with these variables can be observed

Table 8

Quasi-Bayesian Confidence Intervals with Government Integrity as the Independent Variable, PEB as the Dependent Variable and Climate Change Hope as the Mediator

	B	<i>p</i>	95% CI
ACME	.07	.14	[-0.07, 0.14]
ADE	-.27	< .05*	[-0.61, -0.18]
Total Effect	-.20	< .05*	[-0.57, -0.17]
Proportion Mediated	-.31	.15	[-0.46, 0.22]

Note. Measured on 5-point Likert Scale * $p < .05$, ** $p < .001$, ACME= impact of mediator on the relationship of the independent on the dependent variable, ADE= relationship of the independent on dependent variable, Total effect= overall impact of independent on the dependent variable regardless of whether it is mediated or not

A similar insignificant ACME value was observed when using Climate Change Hope as a mediator in the relationship between the dependent variable Community Actions and the independent variable Government Integrity, suggesting that Climate Change Hope was also not mediating this relationship. Additionally, the significant values ADE and the total effect, revealed that government integrity had a significant impact on Community Actions when controlled for hope (Table 9).

Table 9

Quasi-Bayesian Confidence Intervals with Government Integrity as the Independent Variable, Community Actions as the Dependent Variable and Climate Change Hope as the Mediator

	B	<i>p</i>	95% CI
ACME	.03	.58	[-0.03, 0.06]
ADE	-.40	< .001**	[0.10, 0.43]
Total Effect	-.38	< .001**	[0.12, 0.45]
Proportion Mediated	-.06	.58	[-0.11, 0.29]

Note. Measured on 5-point Likert Scale * $p < .05$, ** $p < .001$, ACME= impact of mediator on the relationship of the independent on the dependent variable, ADE= relationship of the independent on dependent variable, Total effect= overall impact of independent on the dependent variable regardless of whether it is mediated or not

The results of using the items measuring Individual Actions as a dependent variable and Climate Change Hope as a mediator showed no significant results in the executed mediation analysis with the whole Trust in Policymaking scale and the three subconstructs as predictors. In the mediation analysis, examining the role of Climate Change Hope as a mediator and focusing only on the Trust in Policymaking items related to the Government's Competence and Government Efficacy, the findings revealed no significant effects between the independent variable and the three constructs or the whole PEB scale (Appendix F).

Only the findings of the mediation analysis involving Sustainable Transport Actions as a dependent variable and Government Integrity as an independent variable revealed a significant ACME value. This indicated a significant indirect relationship between Government Integrity and Sustainable Transport Actions mediated by Climate Change Hope. The ADE value was found to be insignificant suggesting no direct relationship between the variables when hope is controlled for. Therefore, a full mediation was suggested. Additionally, the total effect, which combines the ADE and the ACME effects, was found to be insignificant. However, the ACME being significant indicates that there is a significant indirect effect operating through the mediator (Table 10).

Table 10

Quasi-Bayesian Confidence Intervals with Government Integrity as the Independent Variable, Sustainable Transport Actions as the Dependent variable and Climate Change Hope as the Mediator

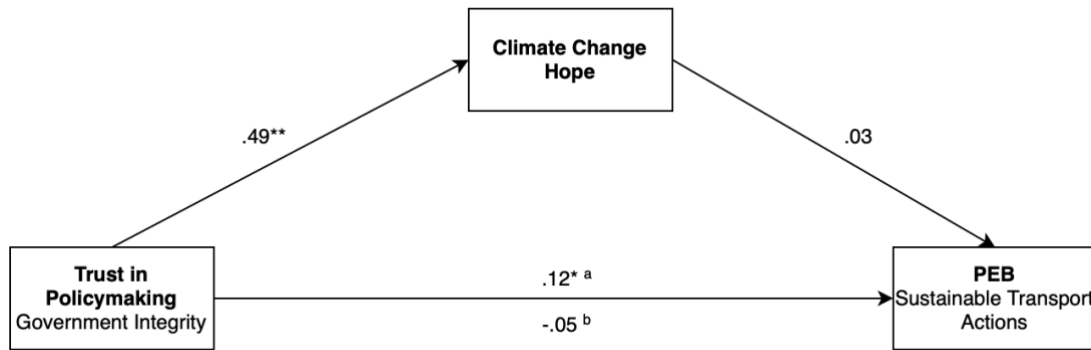
	B	<i>p</i>	95% CI
ACME	.12	< .05*	[0.01, 0.26]
ADE	-.17	.21	[-0.42, 0.09]
Total Effect	-.05	.68	[-0.29, 0.20]
Proportion Mediated	-.54	.70	[-12.94, 13.17]

Note. Measured on 5-point Likert Scale * $p < .05$, ** $p < .001$, ACME= impact of mediator on the relationship of the independent on the dependent variable, ADE= relationship of the independent on dependent variable, Total effect= overall impact of independent on the dependent variable regardless of whether it is mediated or not

Figure 2 shows the effects represented in Table 10 and displays the relationship between the independent variable Government Integrity and the dependent variable Sustainable Transport Actions, mediated by Climate Change Hope.

Figure 2

Standardised Regression Coefficients for the Relationship between the Independent Variable Trust in Policymaking (Government Integrity) and the Dependent Variable PEB (Sustainable Transport Actions) that is mediated by Climate Change Hope



Note. * $p < .05$, ** $p < .00$, ^a ACME (mediation effect), ^b Total effect (overall impact)

Table 11

Overview of the Results of the Tested Hypothesis

	Hypothesis	Results
H1	Students who have higher levels of Climate Change Hope show higher levels of Pro-Environmental Behaviour.	Rejected
H2a	Students who have higher levels of Self-Efficacy beliefs have higher levels of Climate Change Hope.	Rejected
H2b	Students who have higher levels of Climate Change Perception have higher levels of Climate Change Hope.	Not testable
H2c	Students who have higher levels of Trust in Policymaking have higher levels of Climate Change Hope.	Accepted
H3a	There is a significant mediating effect of Self-Efficacy on Pro-Environmental Behaviour through Climate Change Hope.	Rejected
H3b	There is a significant mediating effect of Climate Change Perception on Pro-Environmental Behaviour through Climate Change Hope.	Not testable
H3c	There is a significant mediating effect of Trust in Policymaking on Pro-Environmental Behaviour through Climate Change Hope.	Rejected

Extra Analysis

Regression Analysis Climate Change Hopelessness and Pro-Environmental Behaviour

Given that hope and hopelessness regarding climate change were found to be different constructs and a high proportion of more than 65% of the participants in the sample indicated that they experience hopelessness regarding climate change, it was imperative to perform an analysis with the item climate change hopelessness alone. Nonetheless, the results also needed to be interpreted with caution, as also for climate change hopelessness, not all assumptions were met.

The main relationship between climate change hopelessness and PEB was tested and the results showed an insignificant effect of climate change hopelessness on PEB ($\beta = 0.32$, $SE = .49$, $t(81) = 5.63$, $p = 0.06$) (Appendix G). Nevertheless, when analysing each of the three sub-constructs, the results for Individual Actions and Sustainable Transport Actions were insignificant (Appendix G), but results from the analysis only using the items including Community Actions as a dependent variable suggested a significant positive relationship ($\beta = .40$, $SE = .13$, $t(81) = 3.03$, $p < .001^{**}$) between climate change hopelessness and Community Actions.

When measuring the effect of the antecedents of Climate Change Hope as the independent variables on the dependent variable of hopelessness, the results indicate that only the subconstruct trust in Government Integrity has a significant effect ($\beta = .16$, $SE = .40$, $t(81) = 0.39$, $p < .001^{**}$) by negatively influencing hopelessness⁴.

⁴ The results with Climate Change Perception as an independent variable also indicate an insignificant relationship between Climate Change Perception and hopelessness ($\beta = -0.24$, $SE = .16$, $t(81) = -1.54$, $p = 0.13$).

Discussion

Main Findings

Engaging in Pro-Environmental Behaviours (PEB) is crucial for combating climate change and ensuring a sustainable world (Lee & Khan, 2020). Previous research highlights Climate Change Hope as a key factor in promoting PEB (Stevenson et al., 2018). It serves as a motivating force that encourages individuals to adopt environmentally-friendly actions (Stevenson & Peterson, 2015). However, an increase in hopelessness and pessimism among younger generations, impeding their involvement in PEB, has been observed in recent years (Hickman et al., 2021; Searle & Gow, 2010). Therefore, the purpose of this study was to examine the impact of Climate Change Hope on PEB among university students. Additionally, the study aimed to investigate how students' levels of Self-Efficacy beliefs, Climate Change Perception, and Trust in Policymaking influence their sense of hope concerning climate change. Moreover, the study examined whether Climate Change Hope acts as a mediator in the relationship between these predictors and PEB.

As the factor analysis indicated that the items hope and hopelessness measures two different constructs, it was possible to execute analysis with both constructs separately. It is interesting to note that among the participants, only a small number expressed feelings of hope regarding climate change, while the majority expressed a sense of hopelessness. This finding is consistent with recent research, which also highlighted an increase in hopelessness among young people when they face the challenges of climate change (Stevenson & Peterson, 2015). This indicates that the majority of students in the sample shared a common belief that the issue of climate change is overwhelming and difficult to address, while only a minority maintained a positive outlook and believed that effective actions can be taken to combat it.

The analysis examined the linear relationship between hope and PEB, including measurements of the entire PEB scale and its subconstructs (Community Actions, Individual Actions, and Sustainable Transport Actions). The results showed no significant relationship between Climate Change Hope and PEB, indicating that a stronger sense of Climate Change Hope does not lead to increased engagement in PEB among students. These findings are contradictory to previously conducted research, which suggests that Climate Change Hope can be defined as one of the most important factors increasing PEB, especially in younger generations (Ojala, 2012, Stevenson et al., 2018).

Previous research has identified Self-Efficacy beliefs, Climate Change Perception, and Trust in Policymaking as factors that contribute to increased Climate Change Hope (Nabi

et al., 2018). However, contrary to these findings, the results of this study indicate an insignificant relationship between Self-Efficacy and Climate Change Hope. Nevertheless, higher levels of Trust in Policymaking are associated with increased hope regarding climate change, aligning with previous research highlighting the impact of trust on hope (Nabi et al., 2018). The factor analysis indicates that the scale measuring Trust in Policymaking consists of three distinct underlying constructs, namely the trust in Government's Integrity, Competence, and Efficacy. These constructs partially align with the items adapted from the scale developed by Kitt et al. (2021), which emphasises that individuals' trust depends on their perception of the Government's Competence and Integrity. The results of the current study suggest that higher levels of trust in the Government's Integrity and Competence are associated with increased feelings of Climate Change Hope among university students. By definition, trust in Government Integrity refers to individuals' confidence in policymakers acting honestly, fairly, and in the best interest of society and trust in Government Competence describes policymakers' knowledge in dealing with public issues related to climate change (Kitt et al., 2021). This indicates that the level of hope people feel towards climate change is directly influenced by society's perception of authorities acting fairly and having profound knowledge to address the climate change crisis.

The results of the mediation analysis suggest that Climate Change Hope acts as a mediator between Government Integrity and Sustainable Transport Actions. Specifically, the findings indicate that individuals who have a greater level of Climate Change Hope are more likely to take part in mitigation behaviours, specifically by engaging in Sustainable Transport Actions. This relationship holds particularly true when these individuals also possess a higher level of trust in the Government Integrity. Therefore, higher levels of Climate Change Hope, positively influence the relationship of trust in Government Integrity and individuals' engagement in PEB, specifically by selecting sustainable transport options.

Consequently, Climate Change Hope serves as a mediator solely in the connection between trust in the Government Integrity and engagement in Sustainable Transport Actions, while it does not influence the relationship between other trust-related factors and various subconstructs of PEB. The significant effect observed could be attributed to the government's important role in providing affordable and sustainable transport options to society (European Conference of Ministers of Transport (ECMT), 2002). Additionally, the significant findings regarding the variable Sustainable Transport Actions may be attributed to the composition of the sample, which primarily comprises female students. Previous research has indicated that

female students tend to engage more frequently in sustainable transport options compared to their male counterparts (Vicente-Molina et al., 2018).

However, the results indicate that while Climate Change Hope plays a mediating role between Trust in Government Integrity and the choice of sustainable transport options, the overall effect suggests no significant relationship between the independent and dependent variables. Nonetheless, a direct effect remains when accounting for the mediator Climate Change Hope. This suggests that there may be another mediator influencing the relationship, with Climate Change Hope acting only as a partial mediator.

Contrary to previous research indicating that increased hopelessness hinders younger generations' engagement in PEB (Hickman et al., 2021; Searle & Gow, 2010), this study shows that climate change hopelessness is increasing students' engagement in Community Actions, such as protesting or joining climate change organisations. The contrasting findings can be attributed to research suggesting that engaging in Community Actions fosters a sense of collective unity, shared experiences, and heightened awareness of climate change's political and social aspects (Pickard, 2022). It is possible to hypothesise that young individuals who experience higher levels of hopelessness may engage in Pro-Environmental Behaviours, such as Community Actions, as a means to express their concerns about climate change and seek connection with peers who share similar feelings and ideas.

Additionally, increased Trust in Government Integrity correlates with lower levels of hopelessness in students. The significant results of the analysis which consider hopelessness as both a dependent and independent variable, and the hypothesis proposing Climate Change Hope as a partial mediator in the association between Trust in Government Integrity and Sustainable Transport Actions, indicate the necessity for future investigations incorporating hopelessness as a second mediator. Thereby, a more comprehensive examination of the mediation model is possible and the role of multiple mediators in the relationship between Trust in Government Integrity and Sustainable Transport Actions is examined.

The results of the study indicate, that cultivating trust among students in the integrity of government institutions is crucial, as it can be considered a significant predictor of Climate Change Hope, thereby influencing their decision to engage in Sustainable Transport Actions. Previous research shows that over one-fourth of CO₂ emissions are caused by non-sustainable transport options (Chapman, 2007). Therefore, increasing individuals' engagement in sustainable transport alternatives like driving electrical vehicles or using public transportation seems crucial as it has been shown to significantly reduce CO₂ emissions and thereby combat further consequences of climate change (Chapman, 2007).

Limitations and Future Recommendations

Throughout the data examination and analysis examining the relationship between the variables, several limitations of the study have been identified. These limitations serve as a basis for formulating future recommendations, which can significantly contribute to enhancing the outcomes of subsequent studies in this area.

First and foremost, it needs to be acknowledged that the results of the regression analysis and mediation analysis need to be interpreted with caution, as correlational research cannot prove causal directions. Significant correlational research indicates a meaningful relationship, but it does not provide evidence of a cause-and-effect relationship. Other unmeasured variables may influence the observed associations (Aldrich, 1995).

Another limitation was the exclusion of 33 participants which led to a final sample consisting of 83 participants, mostly Dutch or German Psychology students. This relatively small sample size could potentially account for a lack of significant results in the study. Although during recruitment it was actively tried to reach an even distribution between male and female students from different faculties, most of the participants indicate being students at the BMS Faculty and studying Psychology. One reason for this is the study's publication on the BMS faculty's platform, Sona, which facilitated recruitment due to the promotion of participation. Additionally, the predominance of female students in BMS study programs, especially Psychology, accounts for the observed sample distribution. The proportion of participants from the BMS faculty, particularly in the field of psychology, may have influenced the results concerning participants' engagement in Pro-Environmental Behaviour. Existing research suggests that women studying subjects related to the science sector are more prone to act pro-environmentally (Vicente-Molina et al., 2018). Therefore, a sample that included participants from the Science, Technology, Engineering, and Math (STEM) sector could have yield different results regarding the frequency of mitigation behaviour.

Additionally, the sample primarily represents a specific group of young adults, and the absence of a substantial number of males in the sample can potentially impact the observed results, as a gender difference in Pro-Environmental Behaviour has been suggested by previous research (Vicente-Molina et al., 2018). Results suggest that women are more likely to engage in Pro-Environmental Behaviour in private and public situations (Briscoe et al., 2019) and engage more often in mitigation behaviours related to choosing sustainable transport options (Vicente-Molina et al., 2018).

Furthermore, it can be hypothesised that different results in the perceived levels of hope and hopelessness between males and females could be observed. Previous research

shows that women tend to exhibit higher levels of climate concern (McCright, 2010) and a similar difference could be possible in their level of hope and hopelessness. The acknowledgement of the limitation associated with a biased sample is essential to ensure that in future research a more balanced sample is used. Research suggests that gender and study levels play a significant role in participants in engagement in Pro-Environmental Behaviour (Briscoe et al., 2019; Vicente-Molina et al., 2018).

Even though it is worth noting that the sample consisted of students, aged 18 to 26, which provides valuable insights into the opinions of young adults, University students predominantly represent a subset of individuals known as "Western, educated, industrialized, rich and democratic (WEIRD)" (Henrich et al., 2010). Previous research suggests that results making use of university samples do not represent the majority of the population and the findings should therefore be interpreted with caution (Henrich et al., 2010). It is crucial to recognise the importance of including individuals from marginalized populations. Groups such as those from lower socioeconomic backgrounds and people of colour often experience a disproportionate impact from climate change and generally higher levels of climate concern, which in turn could also lead to them experiencing different levels of Climate Change Hope (Psci, 2020). As the current study's sample predominantly comprises German or Dutch participants, representing limited diversity in nationalities, a more diverse sample could potentially yield different results, particularly regarding lower levels of Climate Change Hope. This in turn could also have an impact on the relationship between Climate Change Hope and Pro-Environmental Behaviour. Future studies should strive to include these populations and explore their unique perspectives to gain a comprehensive understanding of Climate Change Hope and engagement in PEB. This entails increasing the size and diversity of the sample, incorporating individuals from diverse socioeconomic backgrounds and ethnicities. By doing so, a broader range of perspectives and experiences related to climate change can be represented.

To address the issue that the Climate Change Perception scale could not be used due to non-responses and low reliability, it is advisable to consider either employing established and validated measurement scales or focusing on improving the Climate Change Perception scale itself. Conducting the research with an enhanced scale would allow for a more precise investigation into the impact of Climate Change Perception on Climate Change Hope.

Additionally, most of the four assumptions testing the suitability of the different variables were not met. Therefore, the output of the results needs to be interpreted with caution as the data initially is not suitable for the analysis that was conducted afterwards.

Reasons for the assumptions not being met can be attributed to the rather small sample size, which influences the normal distribution, linearity, multicollinearity and homoscedasticity of the data. It is important to acknowledge the limitations associated with not meeting assumptions for linear regression. Future analyses should thoroughly examine assumptions or change the analysis to other methods like non-linear regression or generalized linear models.

While acknowledging the presence of several limitations, it is essential to note that previous studies examining the impact of Climate Change Hope on Pro-Environmental Behaviour have predominantly focused on adults or children (Gazzaz & Aldeseet, 2021; Ratinen & Uusiautti, 2020; Stevenson et al., 2014). By introducing a sample comprising young adults and students, this study emphasizes on how this generation experiences and feels about climate change. It highlights the importance of including younger generations in research about emotions related to climate change and their influence on mitigation behaviour.

Conclusion

Bearing in mind the limitations, these findings contribute to the understanding of the role of Trust in Policymaking and Climate Change Hope as key drivers of Pro-Environmental Behaviour. In conclusion, the results of this study suggest Climate Change Hope as a mediator in the relationship between students' trust in Government Integrity and Sustainable Transport Actions as a specific form of PEB. Therefore, promoting the young generation's Climate Change Hope and increasing their Trust in Policymaking seems crucial for contributing to climate change mitigation efforts. According to the Organisation for Economic Cooperation and Development (OECD) (2020), the trust of younger generations in policymakers can only be increased through the strengthening of their relationship with political institutions. An effective strategy to achieve this is by facilitating the representation of youth in governmental bodies or committees. This approach enables the younger generation to feel acknowledged and involved in decisions that directly impact their future and further strengthening their engagement in Pro-Environmental Behaviour.

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Appendix

Appendix A: Informed Consent

Dear participant,

In this questionnaire, you will be asked to answer questions about your Pro-Environmental Behaviour, emotions in relation to climate change, and further psycho-social and demographic factors. The data will be used for our Bachelor theses about the influencing factors on Pro-Environmental Behaviour.

The questionnaire will take approximately 20 minutes to complete. Participating in this questionnaire is completely voluntary and you can withdraw at any time without consequences. All personal information will be anonymised before the data is analysed and it will not be possible to link your answers back to you. The data will only be used for research purposes. Information obtained within this questionnaire will remain confidential and will only be shared with the researchers of this study.

- I have read and understood the study information.
- I consent voluntarily to be a participant in this study and I know that I can withdraw from the study at any time.
- I understand that taking part in the study involves answering questions honestly.
- I understand that the information I provide will be used for research purposes only and that my participation is completely anonymous.
- Incomplete responses might be excluded during the data analysis.

Appendix B: Questionnaire

Demographics:

- Please, indicate your gender identity below
- Please, indicate your age below
- Please, indicate your nationality below
- Please, indicate your study field at the University of Twente below
 - Engineering technology (ET)
 - Electrical Engineering, Mathematics and Computer Science (EWI)
 - Science and Technology (TNW)
 - Behavioural, Management & Social Sciences (BMS)
 - Geo-Information Science and Earth Observation (ITC)

- Please, indicate your educational degree you are currently pursuing
 - Associate
 - Undergraduate (Bachelor)
 - Master degree
 - PhD
 - Teacher

Believe in climate change items developed by Van Valkengoed et al., 2021

For each of the following, please rate the extent to which these statements apply to you, using the scale as shown below. Please, respond as you really feel, rather than how you think most people feel.

- I believe that climate change is real.
- Human activities are a major cause of climate change.

Modified Pro-Environmental Behaviour Scale developed Ogunbode et al., 2022

Please indicate how often you engage in each of the following Pro-Environmental Behaviours, using the scale as shown below. Please, respond as you really feel, rather than how you think most people feel.

- cycle or walk instead of driving,
- restrain oneself from buying unneeded new clothes,
- choose not to fly,
- try to influence family and friends to act pro-environmentally,
- save energy in the household,
- take public transportation instead of the car,
- avoid food waste, and
- make climate-friendly food choices.
- Taking part in a protest related to environmental issues
- Engaging in a climate change protest organization. (Fridays for future, extinction rebellion, etc.)
- Sign a petition given out by climate change organization about taking climate protective actions (e.g. sign a petition to urge an organization or the government to take more climate protective action/to reduce CO2 emissions faster)
- Ask my friends & family to engage more in behaviors that will save CO2 emissions

- Choose courses or programs at the university that focus on combating climate change
- Join a local environmental initiative to help speed up the transition to a more climate neutral society, such as a sustainable energy citizens' initiative or recycling initiative

Modified Emotions scale developed by Böhm, 2003

For each of the following, please rate the extent to which you experience the following emotions when thinking about climate change, using the scale as shown below.

Please, respond as you really feel, rather than how you think most people feel.

- Anger
- Disappointment
- Indignation
- Regret
- Sadness
- Sympathy
- Guilt
- Shame
- Fear
- Hopelessness
- Hope
- Worry

Self-Efficacy Scale developed by Van Zomeren et al. (2010)

For each of the following, please rate the extent to which these statements apply to you, using the scale as shown below. Please, respond as you really feel, rather than how you think most people feel.

- There are simple things I can do that reduce the negative consequences of the climate crisis
- I can change my daily routines to combat the climate crisis
- There are things I can do that can make a difference in reducing the negative consequences of the climate crisis
- My Individual Actions will contribute to a solution of the climate crisis
- Changes in my daily routines will contribute to reducing the negative consequences of the climate crisis

Climate Change Perception Scale developed by Van Valkengoed et al., 2021

For each of the following, please rate the extent to which these statements apply to you, using the scale as shown below. Please, respond as you really feel, rather than how you think most people feel.

- Climate change is mostly caused by natural processes.
- Climate change will bring positive consequences to the world.
- Only regions far away from me will be influenced by climate change.
- It will be a long time before the consequences of climate change are felt.

Modified Trust in Policymaking Scale developed by Kitt et al., 2021

For each of the following, please rate the extent to which these statements apply to you, using the scale as shown below. Please, respond as you really feel, rather than how you think most people feel.

- Governmental organizations worldwide are able to take appropriate climate action.
- I expect governmental organizations to take sufficient government action in the near future to reduce the harmful consequences of climate change.
- I think governmental organizations worldwide are working hard towards addressing the problems related to climate change.
- Governmental organizations will be able to halt climate change if they work very hard on it together.
- Governmental organizations have the power to address climate change if they want to.
- Governmental organizations are competent enough to deal with climate change related issues
- The governmental organizations have the necessary experience and knowledge to make good decisions
- The governmental organizations intends to act in the best interest of the public (Integrity)
- The governmental organizations intends to act fairly. (Integrity)
- The governmental organizations are open and honest with the public, even if its not in their favor.

Appendix C: Scree Plots Showing the Eigenvalues of the Variables

Figure C1

Scree plot Emotion scale

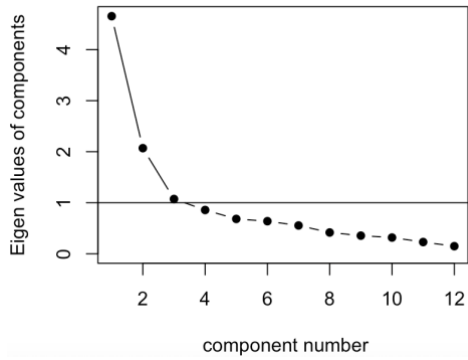


Figure C2

Scree plot Pro-Environmental Behaviour

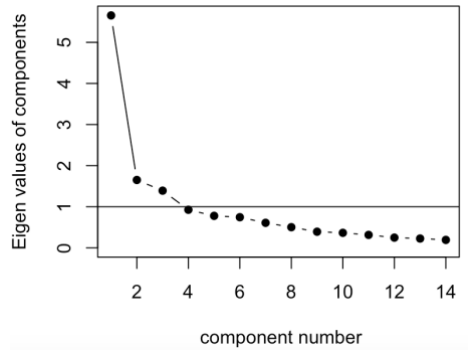


Figure C3

Scree plot Self-Efficacy beliefs

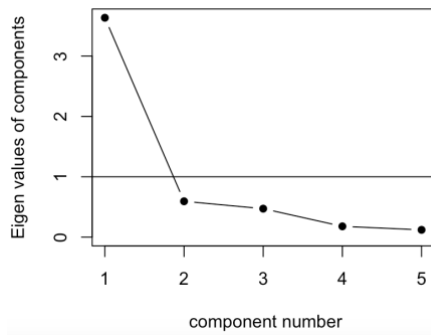


Figure C4

Scree plot Climate Change Perception

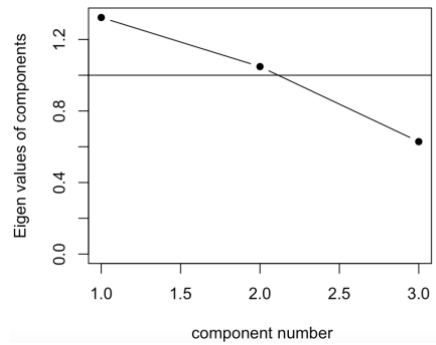
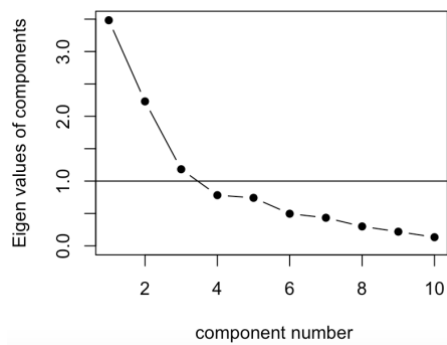


Figure C5

Scree plot Trust in Policy making



Appendix D: Plots for Checking the Assumptions of Climate Change Hope and Pro-Environmental Behaviour

Figure D1

Normality plot Pro-Environmental Behaviour

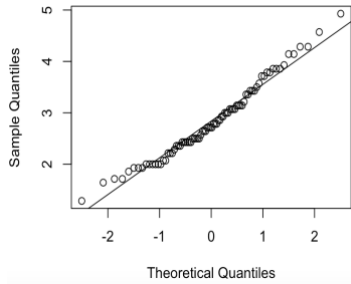


Figure D2

Normality plot Climate Change Hope

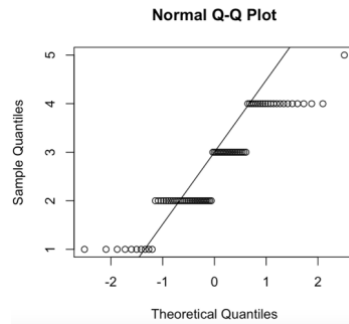
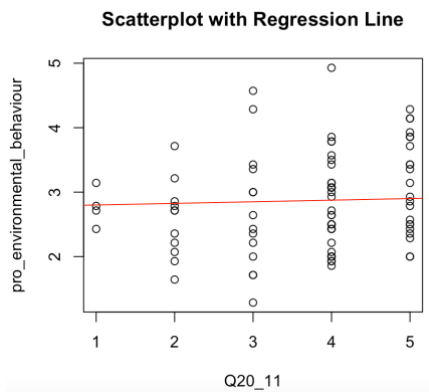


Figure D3

Linearity of Climate Change Hope and Pro-Environmental Behaviour



Appendix E: Plots for Checking the Assumptions of the Antecedents of Climate Change Hope and Climate Change Hope

Figure E1

Normality Self-Efficacy

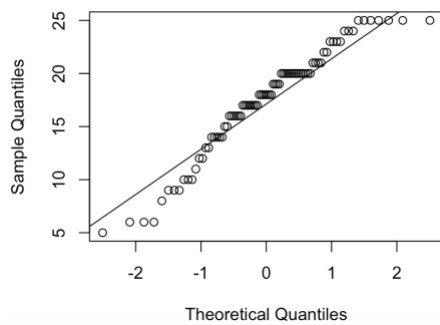


Figure E2

Normality Climate Change Perception

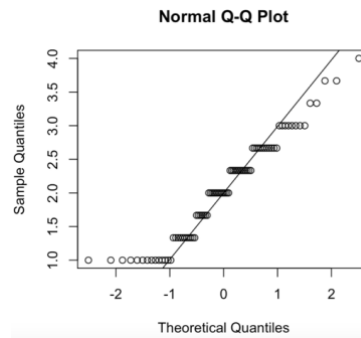


Figure E3

Normality Trust in Policymaking

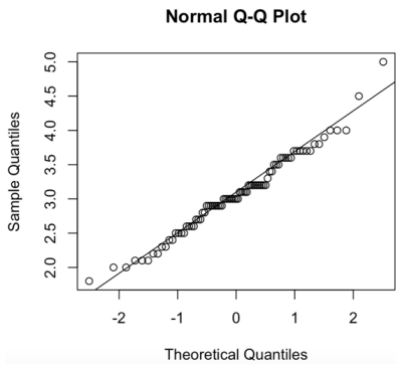


Figure E4

Linearity Hope and Self-Efficacy



Figure E5

Linearity Hope and Climate Change Perception

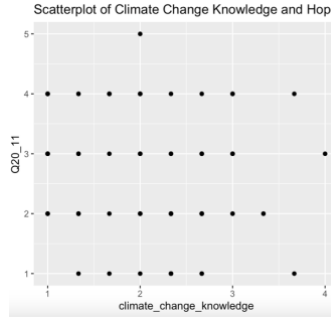
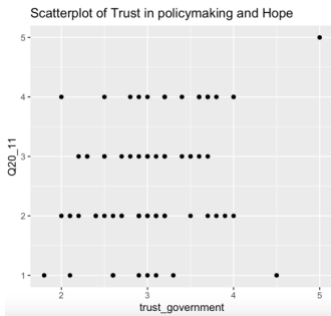


Figure E6

Linearity Hope and trust in policymaking



Appendix F: Insignificant Results of the Mediation Analysis with Trust in Policymaking as the Independent Variable

Table F1

Quasi-Bayesian Confidence Intervals with Trust in Policymaking (IV), Pro-Environmental Behaviour (DV) and Climate Change Hope (Mediator)

	Estimate	p	95% CI
ACME	.04	.57	[-0.08, 0.17]
ADE	-.14	.35	[-0.43, 0.17]
Total Effect	-.11	.46	[-0.38, 0.19]
Proportion Mediated	-.12	.79	[-4.68, 3.04]

Note. Measured on 5-point Likert Scale * $p < .05$, ** $p < .001$

Table F2

Quasi-Bayesian Confidence Intervals with Trust in Policymaking (IV), Community Actions (DV) and Climate Change Hope (Mediator)

	Estimate	p	95% CI
ACME	.04	.54	[-0.18, 0.10]
ADE	-.20	.25	[-0.54, 0.15]
Total Effect	-.24	.14	[-0.58, 0.08]
Proportion Mediated	-.16	.60	[-1.85, 2.59]

Note. Measured on 5-point Likert Scale * $p < .05$, ** $p < .001$

Table F3

Quasi-Bayesian Confidence Intervals with Trust in Policymaking (IV), Individual Actions (DV) and Climate Change Hope (Mediator)

	Estimate	p	95% CI
ACME	.09	.13	[-0.02, 0.24]
ADE	-.14	.39	[-0.45, 0.20]
Total Effect	-.04	.79	[-0.34, 0.26]
Proportion Mediated	-.23	.84	[-10.95, 7.02]

Note. Measured on 5-point Likert Scale * $p < .05$, ** $p < .001$

Table F4

Quasi-Bayesian Confidence Intervals with Trust in Policymaking (IV), Sustainable Transport Actions (DV) and Climate Change Hope (Mediator)

	Estimate	p	95% CI
ACME	.16	.06	[-0.003, 0.35]
ADE	-.29	.15	[-.71, 0.11]
Total Effect	-.14	.48	[-.53, 0.23]
Proportion Mediated	-.47	.52	[-10.95, 9.46]

Note. Measured on 5-point Likert Scale * $p < .05$, ** $p < .001$

Table F5

Quasi-Bayesian Confidence Intervals with Government Integrity (IV), Individual Actions (DV) and Climate Change Hope (Mediator)

	Estimate	p	95% CI
ACME	.09	.06	[-0.01, 0.21]
ADE	-.19	.08	[-0.39, 0.03]
Total Effect	-.10	.32	[-0.28, 0.09]
Proportion Mediated	-.60	.34	[-11.79, 8.96]

Note. Measured on 5-point Likert Scale * $p < .05$, ** $p < .001$

Table F6

Quasi-Bayesian Confidence Intervals with Government Competence (IV), Pro-Environmental Behaviour (DV) and Climate Change Hope (Mediator)

	Estimate	p	95% CI
ACME	.00	.91	[-0.06, 0.06]
ADE	.06	.46	[-0.09, 0.21]
Total Effect	.06	.42	[-0.08, 0.21]
Proportion Mediated	.02	.93	[-3.12, 3.38]

Note. Measured on 5-point Likert Scale * $p < .05$, ** $p < .001$

Table F7

Quasi-Bayesian Confidence Intervals with Government Competence (IV), Community Actions (DV) and Climate Change Hope (Mediator)

	Estimate	p	95% CI
ACME	-.06	.11	[-0.14, 0.01]
ADE	.16	.11	[-0.04, 0.34]
Total Effect	.10	.29	[-0.09, 0.27]
Proportion Mediated	-.34	.37	[-7.11, 4.59]

Note. Measured on 5-point Likert Scale * $p < .05$, ** $p < .001$

Table F8

Quasi-Bayesian Confidence Intervals with Government Competence (IV), Individual Actions (DV) and Climate Change Hope (Mediator)

	Estimate	p	95% CI
ACME	.04	.23	[-0.02, 0.12]
ADE	-.03	.77	[-0.20, 0.14]
Total Effect	.02	.83	[-0.14, 0.18]
Proportion Mediated	.16	.87	[-8.94, 8.05]

Note. Measured on 5-point Likert Scale * $p < .05$, ** $p < .001$

Table F9

Quasi-Bayesian Confidence Intervals with Government Competence (IV), Sustainable Transport Actions (DV) and Climate Change Hope (Mediator)

	Estimate	p	95% CI
ACME	.07	.08	[-0.01, 0.16]
ADE	-.07	.54	[-0.28, 0.15]
Total Effect	.00	.99	[-0.20, 0.20]
Proportion Mediated	-.07	.98	[-9.93, 10.17]

Note. Measured on 5-point Likert Scale * $p < .05$, ** $p < .001$

Table F10

Quasi-Bayesian Confidence Intervals with Government Efficacy (IV), Pro-Environmental Behaviour (DV) and Climate Change Hope (Mediator)

	Estimate	p	95% CI
ACME	-.01	.79	[-0.05, 0.03]
ADE	.09	.41	[-0.13, 0.31]
Total Effect	.08	.44	[-0.14, 0.31]
Proportion Mediated	-.01	.89	[-1.33, 1.07]

Note. Measured on 5-point Likert Scale * $p < .05$, ** $p < .001$

Table F11

Quasi-Bayesian Confidence Intervals with Government Efficacy (IV), Community Actions (DV) and Climate Change Hope (Mediator)

	Estimate	p	95% CI
ACME	.02	.54	[-0.02, 0.07]
ADE	.11	.43	[-0.18, 0.37]
Total Effect	.12	.36	[-0.16, 0.39]
Proportion Mediated	.05	.66	[-0.97, 1.61]

Note. Measured on 5-point Likert Scale * $p < .05$, ** $p < .001$

Table F12

Quasi-Bayesian Confidence Intervals with Government Efficacy (IV), Individual Actions (DV) and Climate Change Hope (Mediator)

	Estimate	p	95% CI
ACME	-.02	.46	[-0.09, 0.02]
ADE	.10	.41	[-0.14, 0.34]
Total Effect	.08	.49	[-0.16, 0.33]
Proportion Mediated	-.05	.74	[-3.15, 2.01]

Note. Measured on 5-point Likert Scale * $p < .05$, ** $p < .001$

Table F13

Quasi-Bayesian Confidence Intervals with Government Efficacy (IV), Sustainable Transport Actions (DV) and Climate Change Hope (Mediator)

	Estimate	p	95% CI
ACME	-.02	.46	[-0.11, 0.03]
ADE	-.13	.40	[-0.42, 0.18]
Total Effect	-.15	.33	[-0.45, 0.15]
Proportion Mediated	.07	.58	[-1.09, 1.79]

Note. Measured on 5-point Likert Scale * $p < .05$, ** $p < .001$

Appendix G: Insignificant Results from the Additional Analysis with Climate Change Hopelessness

Table G1

Results Regression with the complete Pro-Environmental Behaviour scale

	Estimate	Std. Error	t value	p
Intercept	2.34	.27	8.58	<.001**
Climate Change Hopelessness	0.14	.07	1.93	.06

Note. Measured on 5-point Likert Scale * $p < .05$, ** $p < .001$

Table G2

Results Regression with Hopelessness and Individual Actions

	Estimate	Std. Error	t value	p
Intercept	3.15	.31	10.30	<.001**
Climate Change Hopelessness	0.08	.08	1.07	.29

Note. Measured on 5-point Likert Scale * $p < .05$, ** $p < .001$

Table G3

Results Regression with Hopelessness and sustainable transport options

	Estimate	Std. Error	t value	p
Intercept	4.23	.48	8.79	<.001**
Climate Change Hopelessness	-0.14	.12	-1.17	.24

Note. Measured on 5-point Likert Scale * $p < .05$, ** $p < .001$