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FROM PERCEIVING THE RISK OF CLIMATE CHANGE TO PRO-ENVIRONMENTAL BEHAVIOR

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Abstract: In the first study we examined whether knowledge, social norms, value orientations and emotional affect about climate change (climate change) predict climate change risk perception among Transylvanian students. In the second study we examined whether climate change risk perception, psychological adaptation, mitigation beliefs and behavioral intention predict, both directly and indirectly, pro-environmental behavior (PEB). We also examined whether knowledge, deep engagement and affective involvement influence PEB. In the first study $N = 84$ (age $M = 19.43$, $SD = 1.03$), while in the second study $N = 72$ ($M = 19.79$, $SD = 1.47$), and $N = 31$ ($M = 19.61$, $SD = 1.17$) individuals participated. The participants filled the scales online. Internal consistency of the scales was found to be good. During the intervention the research group received brief synopses on climate change in writing, through e-mail, for five days. The results show that biosphere values and demographics significantly predict climate change risk perception. The intervention significantly increased PEB in the research group and this effect persisted for over a month.

Keywords: climate change, pro-environmental behavior, risk perception, deep engagement

1. Introduction

Climate change has been the subject of research in psychology in the past decades (Reser et al., 2012; Swim et al., 2009; van der Linden, 2015). The ways that pro-environmental behavior can be encouraged has been the subject of many previous researches. Most of them consider the importance of information about climate change in both risk perception and pro-environmental behavior (Clayton et al., 2015; Masud et al., 2016; Truelove & Parks, 2012). Its effects have a large range in both space and time that cannot be perceived directly (Weber, 2010). Due to this it is very different from risks perceived by our ancestors (Gifford, 2011; van der Linden, 2015) and people usually see climate change as a distant event that will happen to others at a different time and location (Spence et al., 2012). On the other hand, those that do perceive climate change as a risk can get caught up in all the negative sides of it. When knowledge about climate change is mainly negative, people can go into excessive worrying and despair, and therefore they will concentrate their energy on solving the emotional pressure that arises. This can often lead to avoiding the topic or even denying the existence of climate change (Stevenson, 2015).

With so many barriers the question remains: how can we make people be conscious and act on climate change?

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1.1. Key constructs

Risk perception is a process through which we notice and understand signals coming from different sources and then, based on these, we judge the present and future probability and severeness of events (Bradley et al., 2020). Van der Linden (2015) defines two dimensions of climate change risk perception: global (which affects humanity as a whole, on a societal level) and personal (which endangers the individual itself, during its lifetime). In order to unravel the constructs that affect climate change risk perception, van der Linden (2015) created a comprehensive model. This comprises cognitive, socio-cultural and experiential factors as sources of risk perception.

In the present context, *holistic affect* means mild emotions, when judging an external stimuli, that can be categorized either as positive (like) or as negative (dislike) (Slovic et al., 2007). It can elicit an automatic response which can later help us by giving a direction to information processing and judgement making (Zajonc, 1980).

Despite the fact that the effects of climate change can hardly be experienced directly, previous research has shown that many people notice the changes in their local climate (Swim et al., 2009) and that warmer days influence people's perception of climate change (Truelove & Parks, 2012). In the last few years, research has shown that individuals' *personal experience* with extreme weather influences their perception of risk on the topic of climate change (Brody et al., 2007; Reser et al., 2012; Spence et al., 2012).

Van der Linden (2015) considered three *broad value orientations* in the case of climate change risk perception: egoistic, social and biospheric values (Stern et al., 1993). An egoistic person is interested in protecting the environment mainly for personal interests (Karpudewan, 2019). Social values, broadly speaking, mean that the individual cares about other people. People with high biospheric values care about the non-human environment, nature itself (van der Linden, 2015).

Social norms are the environment's expectations about how we should behave, think and feel in certain situations (Popenoe et al., 1998). Van der Linden (2015) proposed that in the climate change risk perception model prescriptive and descriptive norms should be used. Prescriptive social norms mirror the individual's sense of being compelled to see climate change as risky. Descriptive norms, on the other hand, reflect the degree that the individual's environment makes steps toward limiting the risk of climate change.

Stern (2000) notes that **pro-environmental behavior** means acts that are pointed towards protecting nature and its resources. This can happen in many different ways. Bradley et al. (2020), in their research, when speaking of pro-environmental behavior, they mean actions that can be done on individual or household level. During our research, when referring to pro-environmental behavior, we will use it in the same meaning.

Previous research has shown that **behavioral intention** has a focal role in reducing the effects of climate change, by facilitating pro-environmental behavior, in the case of individuals, companies and governments. Most of these researches base their assumption on the Theory of Planned Behavior (Imran et al., 2014; Lin et al., 2012; Sirivongs & Tsuchiya, 2012).

Psychological adaptation means an interaction between cognitive, emotional and motivational processes, through which the individual pays more attention to climate change, tries to understand its consequences and has a problem solving attitude towards the issue (Bradley et al., 2020).

Van der Linden and collegues (2017) say that there has to be a general intention towards mitigating climate change, that precedes psychological adaptation. Bradley and collegues (2020) when speaking about **mitigation beliefs**, define it as a belief that the individual's own actions will be efficient for reaching a goal. Mitigation beliefs are an assurance that it's possible to find effective solutions in the context of climate change and that these solutions can be implemented individually (Duchi et al., 2020).

The **growth mindset about the world** tells us whether the individual perceives the world around them, its groups and their qualities as changeable and developable, or not (Duchi et al., 2020).

Identity can be defined as a label that we use to describe ourselves (Cook et al., 2002). While it can serve the purpose of differentiating one from another, it also helps the individual identify themselves as part of a group and meet its norms (Christensen et al., 2004). The validation of an identity can be viewed as an attempt to create and maintain a consistency between our attitudes and actions, and so it plays a vital role in pro-environmental behavior (Whitmarsh & O'Neill, 2010).

1st Study

Considering the model proposed by van der Linden (2015) that proved to significantly predict climate change risk perception through the demographics, knowledge about climate change causes effects and mitigation, descriptive and prescriptive norms, biosphere, socio-altruistic and egocentric value orientations, holistic affect, as well as personal experience with extreme weather, we formulated the following hypothesis: D*emographics, value orientations, social norms, holistic affect, personal experience and knowledge about climate change predict climate change risk perception among Transylvanian youth.*

2. Materials and methods

2.1. Participants

From an initial number of 89 participants, a number of 84 participants remained after excluding the outliers. Their ages were between 18 and 24 (M = 19.43, SD = 1.03). The gender distribution was the following: 94% females and 6% males. The participants were all doing their Bachelor's degree, the distribution among study years was the following: 43% first year psychology students, 7% second year psychology students, 22% first year special education students, 4% first year and 4% second year biology students, 2% first year and 1% second year ecology students and 1% first year social work students.

2.2. Measures

Climate change risk perception (van der Linden, 2015)

This scale contains a total of 8 items that are split into two subscales: personal risk perception (4 items) and global risk perception (4 items). Answers are measured on a 7-point Likert scale where: 1 = not concerned at all/very unlikely/not serious at all/very rarely/major/likely to decrease, 7 = very concerned/very likely/very serious/very frequently/no contribution to climate change/likely to increase, depending on the question.

Personal experience with extreme weather events (van der Linden, 2015)

The scale measures the number of times participants experience extreme weather events (e.g. flood, heat wave, drought), with the help of 2 items. The possible answers were: (a) never, (b) once, (c) twice, (d) thrice or more and (e) I don't remember.

Holistic affect (van der Linden, 2015)

The scale contains 3 items. Responses were measured on a 7-point Likert scale, where: 1 = very pleasant/very favorable/very positive, 7 = very unpleasant/very unfavorable/very negative, depending on the item.

Broad value orientations (van der Linden, 2015)

The broad value orientations of the participants were measured with the help of this 12 item scale. The scale is made up of 3 subscales: biosphere values (4 items), socio-altruistic values (4 items) and egocentric values (4 items). Responses were measured on a 9-point Likert scale, where: 1 = goes against my values, 9 = completely in line with my values.

2.3. Procedure

After the translation process, the participants filled the questionnaires online. Psychology and special education students in their first year filled them during experimental psychology and applied statistics course, while biology and ecology students were approached during the introduction to biology seminar. The rest of the participants were asked through the online medium to take part. Participation was voluntary, before the questionnaires participants received a statement of agreement. No gratification was offered in exchange for the participation. Filling out the questionnaires took about 10-15 minutes altogether.

3. Results

3.1. Descriptive statistics

Descriptive statistics of the climate change risk perception, knowledge about climate change, holistic affect, social norms and value orientation scales can be viewed in Table 1.

Table 1. *Descriptive statistics of climate change risk perception, knowledge about climate change, holistic affect, social norms and value orientation*

	N	M	SD	Min.	Max.	α
Climate change risk perception	84	5.26	0.96	2.25	7.00	0.897
Personal risk perception	84	4.87	1.25	1.25	7.00	0.872
Global risk perception	84	5.66	0.74	3.25	7.00	0.730
Holistic affect	84	6.38	0.79	4.00	7.00	0.679
Social norms	84	4.43	1.25	1.17	7.00	0.861
Descriptive norms	84	4.05	1.42	1.00	7.00	0.894
Prescriptive norms	84	4.61	1.26	1.25	7.00	0.763
Value orientation	84	6.87	0.73	5.00	8.25	0.668
Social values	84	8.22	0.78	5.75	9.00	0.732
Biospheric values	84	7.72	1.32	2.75	9.00	0.910
Egoistic values	84	4.79	1.50	1.25	7.25	0.720

3.2. Multiple hierarchical regression

To examine the first hypothesis, we conducted multiple hierarchical regression. According to it, demographics contributed 20.5% significantly to the model's variance. In the second step, value orientations contributed another 31.4% significantly to the model's variance ($\Delta R^2 = 0.314$, $F(7,74) = 16.136$, $p = .001$). As a third step we included experience that explained 2.7% of the variance of the model, although this change was not significant ($\Delta R^2 = 0.027$, $F(12,69) = 2.120$, $p = .127$). Lastly we included the social norms that explained 1.3%, non-significantly, of the model's variance ($\Delta R2 = 0.018$, $F(14,67) = 0.994$, $p = .375$), thus the model explained a total of 55.9% of risk perception. The effect size of participants ($N = 84$) was Cohen's $f^2 = 1.267$, in other words it was high. The results of the multiple hierarchical regression can be viewed in Table 2.

Table 2. *Results of the multiple hierarchical regression on climate change risk perception*

	1. model			2. model			3. model			4. model		
	B	**β**	**SE**	**B**	**β**	**SE**	**B**	**β**	**SE**	**B**	**β**	**SE**
(Constant)	6.74**		1.94	.98		2.19	.78		2.12	.58		2.13
gender	-1.07*	-.26	.42	-1.06*	-.26	.35	-1.01*	-.25	.35	-.99*	-.35	.33
age	-.05	-.06	.10	-.03	.03	.08	-02	.02	.08	.02	.02	.08
study subject	.32*	.31	.10	.15	.15	.09	.13	.12	.08	.13	.13	.09
study year	.21	.07	.31	.19	.07	.25	.03	.01	.26	.007	.003	.26
egocentric values				-.03	-.05	.05	-.03	-.05	.05	-.03	-.05	.05
social values				.17	.14	.12	.08	.06	.13	.06	.05	.13
biospheric values				.37**	.50	.07	.35**	.47	.07	.34**	.39	.07
personal experience							.14	.03	.30	.21	.05	.31
holistic affect							.23	.19	.11	.21	.17	.12
descriptive norms										.08	.08	.10
prescriptive norms										.01	.02	.07
R^2		.205*			.519**			.546			.559	
adj. R^2		.164			.474			.489			.489	
ΔR^2					.314			.027			.013	

4. Discussion

The aim of this study was to repeat the model proposed by van der Linden (2015), to test the predictive power of its elements, like demographics, broad value orientations, knowledge, experiential processing and social norms as predictors of climate change risk perception.

We found that our study was mostly consistent with the original research: demographics and value orientation were significant predictors of climate change risk perception. However, in our research, holistic affect, personal experience and social norms did not have a significant contribution to the explaining power of the model, despite the fact that in the original research, conducted by van der Linden (2015), these were the main contributors in explaining climate change risk perception. The difference between our findings and his may be due to cultural differences, since his study was conducted in the United Kingdom, whilst ours was in Transylvania. Despite the differences, our model had a 55.9% explaining power, being close to the 68% of the original research.

In line with previous research (Bord et al., 2000; Reser et al., 2012; Stevenson, 2015; van der Linden, 2015) the results show that there is a difference between genders: women's risk perception was higher than men's. Previous research has also shown that women have more knowledge about climate change than men (Reser et al., 2012). At the same time, we found that women, compared to men, tend to be more affected emotionally about climate change, that can also give us some explanation about our previously mentioned findings. Another variable that seemed to have a major predictive power is the branch that the participants were studying, which is no surprise, since we had both biology and ecology students among our participants. Compared to the other students (like psychology and special education students), they had more knowledge about climate change and the issue of climate change was in line with their values too. The role of values will be discussed further on, but it's important to note that previous researches also showed their importance in explaining climate change risk perceptions (Hidalgo & Pisano, 2010; Karpudewan, 2019; Reser et al., 2012; van der Linden, 2015).

The research also shed light on the importance of value orientations when predicting climate change risk perception. These findings are in line with previous studies (de Groot et al., 2012; van der Linden, 2015). We found that egocentric and social values weren't as important, but biospheric values more so. Due to the fact that we are limited by cognitive capacity, when it comes to how many things we can get worried about and to what extent (Stevenson, 2015), it is no surprise that those with high egocentric values will be worried about things that endanger their own well-being, thus their personal risk perception will be higher, compared to global risk perception. Since social values and biospheric values seem to be present together, and since biospheric values already explain most of the variance in the model, social values cannot explain much more of the variance (van der Linden, 2015). Van der Linden (2015) also found biospheric values to have the highest predictive power, compared to all the other variables. This should not come as a surprise, since values like "protecting the Earth" and "harmony with nature" will naturally result in considering climate change as riskful.

In case of experiential processing neither holistic affect, nor personal experience had not had a significant explanatory power in the model. Further investigations proved that holistic affect was correlating with the participants' specialty area, which was controlled, and so the affect could not add more explaining power. A possible explanation of the lack of predictive power of the personal experiences could be that it is not enough to have experiences with heat waves, drought or floods, people also have to attribute these extreme weather event to climate change in order to perceive risk (Helgeson et al., 2012).

Among the social norms neither the prescriptive nor the descriptive ones seemed to predict risk perception. Despite this fact, it had a strong correlation with biospheric values, which were controlled, thus they could not contribute further to the explaining power.

We can conclude that Transylvanian youth females have more knowledge about the ways to mitigate climate change. Additionally, those individuals that value the biosphere will tend to perceive climate change as more riskful.

2nd Study

Van der Linden (2015) came to the conclusion that demographics and value orientations play an important role in the individual's perception of risk. Bradley et al. (2020) pointed out that if individuals have a green identity, they will feel more at risk when it comes to climate change. In the same study, they found that there is a strong predictive link from psychological adaptation to climate change risk perception.

Bradley et al. (2020) came to the conclusion that the higher the risk perception of an individual, the more likely it is that they will think and talk about, share their feelings about it, in other words psychological adaptation will appear. This same research pointed out that risk perception indirectly predicts psychological adaptation, if the individuals believe that their actions will have a meaningful impact in mitigation. A possible explanation to this is that the feeling of helplessness bores worry, that in exchange will probably result in avoidance, while feeling able to change will result in higher engagement in the topic of climate change

Bradley et al. (2020) found that mitigation beliefs (both directly and indirectly), and psychological adaptation (directly) predicted pro-environmental behavior. Further sources note that behavioral intention plays an important role in pro-environmental behavior (Imran et al., 2014; Lin et al., 2012; Sirivongs & Tsuchiya, 2012).

Numerous previous research points out the importance of gathering knowledge in changing attitudes and behaviors regarding climate change (Clayton et al., 2015; Masud et al., 2016; Truelove & Parks, 2012). Further sources highlight that it's not enough to process information superficially, suggesting that deep engagement plays a crucial role in the long-term effects of information gathering (Kruglanski et al., 2012; Petty & Cacioppo, 1986; Rogers et al., 1983). Goldberg et al. (2020) found that it is important to process information not only cognitively but affectively too. In order to achieve the mentioned affective processing, considering the findings of Carlson et al. (2020) we used affective images (mostly positive ones) and looked at their effect too. Along with these findings and considering the model proposed by Bradley et al. (2020), that presupposes mitigation beliefs and psychological adaptation as predictors of pro-environmental behavior. Considering the aforementioned we concluded the following hypotheses:

Demographics, green identity and value orientations predict risk perception among Transylvanian youth;

Mitigation beliefs mediate the link between risk perception and psychological adaptation;

Mitigation beliefs - through the mediation of behavioral intention – and psychological adaptation predict pro-environmental behavior among youth;

Knowledge, emotional affect and deep engagement have a positive effect on mitigation beliefs, psychological adaptation and pro-environmental behaviors among youth.

5. Materials and methods

5.1. Participants

For the regression we used data from 72 participants, while in the experiment data of 31 of these participants was used (during the posttest and follow-up). The age of participants in the experiment was between 18 and 24 (M = 19.61, SD = 1.17), their gender was: 84% female and 16% male. The participants had differing specialty areas, such as: 45% first year psychology students, 29% second year psychology students, 10% 12th grade mathematic-informatics students, 7% second year ecology students, 3% second year biology students, 3% tourism-geography students and 3% first year geography students.

5.2. Measures

Growth mindset about the world (Measure of world theories, Chiu et al., 1997)

The scale consists of 3 items. The answers ranged from 1 to 6, where: 1 = strongly disagree, 6 = strongly agree.

Mitigation beliefs (Beliefs about mitigation, Soliman & Wilson, 2017)

The scale consists of 3 items. The responses ranged between 1 and 7, where: 1 = strongly disagree, 7 = strongly agree. The scale contains the following reversed item: "I feel like any action I take to be environmentally responsible is only a 'drop in the bucket' and won't make a difference"

Behavioral intention (Behavioral intention, Masud et al., 2016)

This scale contains 6 items. Answers range on a Likert-scale between 1 to 5, where: 1 = strongly disagree, 5 = strongly agree. The scale contains the following reversed item: "I am not willing to change my lifestyle to counteract global warming and climate change."

Pro-environmental behavior (pro-environmental behavior scale, Whitmarsh & O'Neill, 2010)

This scale contains 17 items of which we used 14 items. The participants had to judge the frequency of activities such as "I recycle", "I eat less meat". Answers ranged between 0 to 3, where: 0 = never, 1 = sometimes, 2 = frequently, 3 = always.

Psychological adaptation (Psychological adaptation measure in the context of climate change, Reser et al., 2012)

This scale contains 6 items of which we used 5. Responses ranged between 1 and 6, where: 1 = strongly disagree, 6 = strongly agree. The scale contains the following reversed item: "Increasingly I find myself less likely to attend to media reports, articles and discussions about the nature or impacts of climate change"

Climate change risk perception (Risk perception, van der Linden, 2015)

We used the same questionnaire as in the previous study.

Green identity (Pro-environmental self-identity, Whitmarsh & O'Neill, 2010)

This scale consists of 4 items. Possible answers range from 1 to 5, where: 1 = strongly disagree, 5 = strongly agree. Two of the items are reversed: "I would be embarrassed to be seen as having an environmentally-friendly lifestyle" and "I would not want my family or friends to think of me as someone who is concerned about environmental issues".

Value orientations (Broad value orientations, van der Linden, 2015)

The same scale was used as in the previous study, but only extracting the biosphere and social value orientations subscales.

5.3. Procedure

After translating the scales, the participants filled them out in Google Forms, that contained a short description of the study and the statement of agreement. A randomly distributed prize of 100 lei was offered, also 100 and 50 lei for those that scored the highest on the quiz. Subsequently participants were divided into the control and experimental groups.

Those in the control group received a daily e-mail, for five days, that contained information about the causes, effects, mitigation and psychological dimensions of climate change. The text was accompanied by a positive affective image, a quote from a well-known person, a small daily task (e.g. turning off the lights when not in use or making a vegan dish) and a quiz about the information contained in the e-mail.

After one week, then one month has passed the participants filled out the questionnaires once again. Control group participants then have a chance to participate in the intervention themselves.

6. Results

6.1. Descriptive statistics

Descriptive statistics of the climate change risk perception, value orientation, pro-environmental behavior, behavioral intention, psychological adaptation, mitigation beliefs, growth mindset about the world and green identity scales can be viewed in Table 3.

Table 3. *Descriptive statistics of climate change risk perception, value orientation, pro-environmental behavior, behavioral intention, psychological adaptation, mitigation beliefs, growth mindset about the world and green identity*

	N	M	SD	Min.	Max.	α
Climate change risk perception	31	5.27	0.89	2.75	6.75	0.891
Personal risk perception	31	4.87	1.19	1.75	6.75	0.835
Global risk perception	31	5.67	0.71	3.75	6.75	0.783
Value orientation	31	7.84	0.81	5.13	9.00	0.900
Biospheric values	31	7.55	1.14	3.75	9.00	0.900
Social values	31	8.13	0.72	6.50	9.00	0.848
pro-environmental behavior	31	2.64	0.33	2.00	3.29	0.639
Behavioral intention	31	3.58	0.67	1.33	4.83	0.713
Psychological adaptation	31	4.40	1.04	1.4	6.0	0.811
Mitigation beliefs	31	4.94	1.15	1.33	6.66	0.653
Growth mindset about the world	31	3.21	1.10	1.33	6.00	0.830
Green identity	31	4.10	0.54	2.50	5.00	0.622

6.2. Examining the hypotheses

To test the first hypothesis, we conducted a multiple hierarchical regression. The results showed that demographics contributed 10.2% to the model, although not significantly. In the second step green identity contributed an additional 14.1% significantly ($\Delta R^2 = 0.141$, $F(5,66) = 4.225$, $p = .001$). In the third step, including value orientations, further explained 18.1% of the model's variance, significantly ($\Delta R^2 = 0.181$, $F(7,64) = 6.725$, $p < .001$). Thus, the total effect size of the model, among participants ($N = 72$), was that of Cohen's $f^2 = 0.47$, which is considered high. The results can be viewed in Table 4.

To test the second hypothesis, we conducted regression and mediation tests. To test the predictive link between risk perception and psychological adaptation we conducted a regression, omitting the mediator. We found that risk perception significantly predicted psychological adaptation ($b = .762$, $t(69) = 9.076$, $p < .001$), so the first condition of the mediation was met. In the next step we conducted a regression between mitigation beliefs and risk perception, the predictive power was significant ($b = .592$, $t(69) = 4.956$, $p < .001$), thus the second condition of the mediation was met. In the third step we conducted a regression between mitigation beliefs and psychological adaptation, while controlling for risk perception. Mitigation beliefs significantly predicted psychological adaptation ($b = .242$, $t(68) = 3.042$, $p = .003$), thus the third condition

of the mediation was met. In the fourth step we tested the predictive power of risk perception upon psychological adaptation while the mediator was controlled for. In this case risk perception also had a significant predictive power upon psychological adaptation (b = .619, $t(68)$ = 6.706, p < < .001), thus the last criteria for the mediation was also met.

Table 4. *Hierarchical regression predicting climate change risk perception*

	1. model			2. model			3. model		
	B	**β**	**SE**	**B**	**β**	**SE**	**B**	**β**	**SE**
(Constant)	5.332*		1.669	1.682		1.863	1.037		1.756
gender	-.673*	-.265	.312	-.597*	-.236	.290	-.366	-.144	.264
age	.077	.115	.088	.089	.133	.082	.028	.041	.074
study subject	.082	.180	.056	.025	.054	.054	-.041	-.089	.051
educational level	-.519	-.172	.410	-.435	-.144	.381	-.131	-.043	.345
green identity				.798*	.394	.228	.166	.082	.246
biospheric values							.523**	.611	.135
social values							-.037	-.040	.115
R^2		.102			.242*			.424**	
adj. R^2		.048			.185			.361	
ΔR^2					.141			.181	

The Sobel test certified the partial mediation (z = 2.60, p = .009). The confidence interval of the indirect effect was 95% CI (0.036, 0.260).

The results of the regression showed that risk perception, mediated by mitigation beliefs, explained 59.5% of the variance of the model. The effect size among participants (N = 72) was Cohen's f^2 = 0.41, that is considered high. The results can be viewed in Table 5.

Table 5. *The results of the mediation in predicting psychological adaptation*

Outcome variables	Predictor	B	SE	t	p
1. regression					
psychological adaptaptation	risk perception	0.762	0.084	9.076	< .001
2. regression					
mitigation beliefs	risk perception	0.592	0.120	4.956	< .001
3. regression					
psychological adaptation	risk perception	0.619	0.092	6.706	< .001
	mitigation beliefs	0.242	0.079	3.042	.003

To test the third hypothesis, in the first step we conducted a regression between mitigation beliefs and pro-environmental behavior, while omitting the mediator. Mitigation beliefs significantly predicted pro-environmental behavior (b = .143, $t(69)$ = 4.813, p < .001), thus the first condition of the mediation was met. As a second step we conducted a regression considering behavioral intention and mitigation beliefs. The results show that mitigation beliefs significantly predicted behavioral intention (b = .333, $t(69)$ = 6.330, p < .001), thus the second condition of the mediation was met. As a third step we tested the predictive power of behavioral intention upon pro-environmental behavior, while controlling for the mediator. We found that behavioral intention significantly predicted pro-environmental behavior (b = .180, $t(69)$ = 2.797, p = .007), thus the third condition of the mediation was met. Lastly, we tested the predictive power of mitigation beliefs upon pro-environmental behavior, while behavioral intention was held under control. The results show that mitigation beliefs still predicted significantly pro-environmental behavior (b = .083, $t(68)$ = 2.333, p = .023).

The Sobel test proved the partial mediation ($z = 2.55$, $p = .010$). The confidence interval of the indirect effect was 95% CI (0.014, 0.112). The results can be viewed in Table 6.

Table 6. *The results of the mediation in predicting pro-environmental behavior*

Outcome variable	Predictor	B	SE	t	p
1. regression					
pro-environmental behavior	mitigation beliefs	0.143	0.030	4.813	< .001
2. regression					
behavioral intention	mitigation beliefs	0.333	0.053	6.330	< .001
3. regression					
pro-environmental behavior	mitigation beliefs	0.083	0.036	2.333	.023
	behavioral intention	0.180	0.064	2.797	.007

To examine the effect of the intervention we conducted split-plot variance analysis, where time (pretest, posttest and follow-up) was the within group factor and the group (experimental and control) was the between group factor, while the dependent variables were either risk perception, mitigation beliefs or psychological adaptation.

Risk perception

Risk perception throughout the tests ($F(2,58) = 3.300$, $p = .044$) showed significant changes. This change tells us that if we do not consider the group of the participants, their perception of risk changes throughout time. Compared to this in the time*group interaction we did not find significant results ($p = .452$). These findings mean that there was no important difference between the experimental and the control group during the three different measurements (pretest, posttest and follow-up). The effect of the groups ($F(1,29) = 0.739$, $p = .397$) wasn't significant, in other words this means that if we don't consider other variables, the values of the control and the experimental group did not differ significantly.

Further analyses showed no significant difference between the groups during pretest ($p = .261$). The values of the experimental group significantly grew between the pretest and the posttest ($p = .012$), and during the follow-up decayed, although not significantly ($p = .339$). The values of the control group grew between pretest and posttest ($p = .938$), and decayed between posttest and follow-up ($p = .907$), although not significantly in either of the cases. The results can be viewed in Table 7.

Table 7. *SP ANOVA results. The changes in climate change risk perception*

					Between measures			Between groups		
	group	**N**	**M**	**SD**	**F**	**p**	**η_p^2**	**F**	**p**	**η_p^2**
pretest	experimental	14	5.07	0.94						
	control	17	5.44	0.86						
	all	31	5.27	0.90						
posttest	experimental	14	5.37	0.81						
	control	17	5.53	0.86	.805	.452	.027	.739	.397	.025
	all	31	5.46	0.83						
follow-up	experimental	14	5.15	0.87						
	control	17	5.40	0.95						
	all	31	5.29	0.91						

Mitigation beliefs

The mitigation beliefs during the three measures ($F(2,58) = 3.381$, $p = .069$) did not show significant difference, and the same goes for time*group interaction (p = .063). This means that independently of group, during the pretest, posttest and follow-up there was no significant difference among results, and among groups and measurements there also was no significant difference. Between the groups ($F(1,29) = 0.382$, $p = .514$) there wasn't a significant difference. In other words, if we don't take into consideration the three times of measurement, there wasn't a significant difference between the groups.

Further analyses show that there wasn't a significant difference between groups ($p = .154$) during the pretest. The values of the experimental groups changed significantly between the pretest and posttest ($p = .012$), also between pretest and follow-up ($p = .003$), but was not significant between the posttest and the follow-up ($p = .830$). In the control group there was a slight change between pretest and posttest and between posttest and follow-up, but these changes were not significant. The results can be viewed in Table 8.

Table 8. *SP ANOVA results. The change in mitigation beliefs*

					Between measures			**Between groups**		
	group	**N**	**M**	**SD**	**F**	**p**	**η_p^2**	**F**	**p**	**η_p^2**
pretest	experimental	14	4.62	1.28						
	control	17	5.22	0.99						
	all	31	4.95	1.15						
posttest	experimental	14	5.14	1.25						
	control	17	5.25	0.84	2.902	.063	.091	.382	.541	.013
	all	31	5.20	1.02						
follow-up	experimental	14	5.19	1.39						
	control	17	5.18	1.01						
	all	31	5.18	1.17						

Psychological adaptation

Psychological adaptation through time ($F(2,58) = 4.359$, $p = .017$) showed significant changes. In other words, all of the participants' values were different throughout the three measurements. In the same way, in the time*group interaction ($p = .003$) also showed significant difference, meaning that if we analyze the values between groups and measurement times, we can observe a considerable difference. The effect of the groups ($F(1,9) = 0.000$, $p = .997$) did not show significant differences. Based on these findings we can say that if we only consider the division of groups, but not that of measurement times, we will see no significant changes in the values obtained.

During the pretest there wasn't a significant difference between groups ($p = .379$). The experimental group showed a significant growth between pretest and posttest ($p = .004$) and so did between pretest and follow-up ($p < .001$). Although between posttest and follow-up the experimental group's values decreased, this change wasn't significant ($p = .479$). The values of the control group decreased between pretest and posttest ($p = .497$), then they increased between posttest and follow-up ($p = .592$), but none of these changes was significant. The results can be viewed in Table 9.

Table 9. *SP ANOVA results. The changes in psychological adaptation*

						Between measures			Between groups	
	group	**N**	**M**	**SD**	**F**	**p**	**η_p^2**	**F**	**p**	**η_p^2**
pretest	experimental	14	4.21	1.27						
	control	17	4.55	0.83						
	all	31	4.40	1.05						
posttest	experimental	14	4.63	1.09						
	control	17	4.47	0.94	6.347	.003	.180	.000	.997	.000
	all	31	4.54	1.00						
follow-up	experimental	14	4.71	1.14						
	control	17	4.53	0.99						
	all	31	4.61	1.05						

Pro-environmental behavior

Pro-environmental behavior through time ($F(2,58) = 2.763$, $p = .071$) didn't show significant changes. In other words, all of the participants' values weren't different throughout the three measurements. The time*group interaction ($p = .008$) showed significant difference, meaning that if we analyze the values between groups and measurement times, we can observe a considerable difference. The effect of the groups ($F(1,29) = 0.030$, $p = .864$) did not show significant differences. Based on these findings we can say that if we only consider the division of groups, but not that of measurement times, we will see no significant changes in the values obtained.

Further analyses showed that there wasn't a significant difference between groups during the pretest ($p = .507$). In the experimental group the values increased significantly between pretest and posttest ($p < .001$) and between pretest and follow-up too ($p = .039$), but between posttest and follow-up the values somewhat decreased. Based on these findings we can safely say that the intervention, that was aimed at increasing pro-environmental behavior through gathering knowledge, deeply engaging with it and being emotionally affected was effective both on short- and long-term. The values of the control group slightly decreased between the pretest and posttest ($p = .271$), then increased between posttest and follow-up ($p = .162$) but none of these changes was significant. The results can be viewed in Table 10.

Table 10. *SP ANOVA results. Changes in pro-environmental behavior*

					Between measures			Between groups		
	group	**N**	**M**	**SD**	**F**	**p**	**η_p^2**	**F**	**p**	**η_p^2**
pretest	experimental	14	2.60	0.35						
	control	17	2.68	0.34						
	all	31	2.64	0.34						
posttest	experimental	14	2.77	0.34						
	control	17	2.64	0.34	5.217	.008	.152	.030	.864	.001
	all	31	2.70	0.34						
follow-up	experimental	14	2.72	0.30						
	control	17	2.71	0.31						
	all	31	2.71	0.30						

7. Discussion

Broadly speaking the roles of the second study were to unravel the background mechanisms of pro-environmental behavior and creating an intervention that would encourage it.

The first three hypotheses aimed at analyzing the background mechanisms predicting pro-environmental behavior. First of all, we wanted to know to what extent the demographic data, green identity and social norms explain climate change risk perception. The findings show that our presumptions were mainly right: both green identity and social norms had an important role to play.

Considering the model created by Bradley et al. (2020) we analyzed whether mitigation beliefs mediates the predictive link between risk perception and psychological adaptation. The findings show that beyond perceiving climate change as a risk, it is important to also view our actions as useful, before we can meaningfully deal with the matter at hand on a mental level.

As a last step in unraveling the background mechanisms of pro-environmental behavior we examined to what extent do demographic data, psychological adaptation and mitigation beliefs (this last one mediated by behavioral intention) predict pro-environmental behavior. We once again considered the model proposed by Bradley et al. (2020), adding behavioral intention as a mediator based on the theory of planned behavior and previous findings (Imran et al., 2014; Lin et al., 2012; Sirivongs & Tsuchiya, 2012). We found that behavioral intention is a necessary addition to beliefs about mitigation, in other words, it does work as a mediator between mitigation beliefs and pro-environmental behavior. This finding can be explained by the fact that for a behavioral intention to appear, and later convert into behavior itself, it is necessary for the individual to see their actions as meaningful contributions. Psychological adaptation did not have a significant role in explaining pro-environmental behavior, to which a possible explanation is that, much like mitigation beliefs, the effect of psychological adaptation will be mainly indirect, mediated by behavioral intention. In other words, after processing the information and weighting the risks of climate change a behavioral intention will appear first and foremost, which later will be converted into the behavior itself.

When examining the effect of the intervention upon participants we found that risk perception didn't show a significant difference between groups. This goes against van der Linden's (2015) findings, since he found a strong predictive power of knowledge, which was the main variable in our research.

In the same way, mitigation beliefs did not show a significant difference, only when we took a closer look. We found that the experimental group came to believe that their actions mattered, much more than the control group did. Not only did their beliefs about their individual power of mitigation grew on the short-term, this effect remained almost the same on the long-term too. A possible explanation to this finding is that over time, the individuals acted upon climate change, mitigated it in some way, thus they tended to see these actions as doable, and in the end, even more useful.

In the case of psychological adaptation, we observed a growth throughout time among all participants. This is probably due to the fact that completing the survey encouraged every participant to be more mindful about climate change in their day-to-day lives. If we only consider the values of the experimental group, we can see that there was a significant growth in how much they think and talk about climate change. This effect lasted over long-term too. This is not only due to the fact that they gathered knowledge, which was later dealt with on a mental level, they had more information to talk about with their close ones, but also sue to the section of the intervention that dealt with the psychological aspects of climate change.

Lastly, we examined whether gathering knowledge, then deep engagement with it, and adding emotional affectivity encouraged participants to behave pro-environmentally. Considering the values of the experimental group, there was a notable growth in pro-environmental behavior immediately after the intervention and it persisted over long-term too. Many times, what's stopping people for acting in a pro-environmental manner is that they don't have enough knowledge about possible ways to mitigate climate change. It is also probable that after learning why these actions are necessary and how they might help, participants become more mindful in situations where it comes to a choice of considering the environment (e.g. when shopping – buying plastic bags or not). In order to prevent participants from being overworked with actions, we accentuated the role of small daily actions and encouraged them to do only little in the beginning, thus these actions stood the tide of time.

Broadly, we can come to the conclusion that gathering knowledge, deeply engaging in it and being emotionally affected, when it comes to climate change, helps pro-environmental behavior.

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