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Climate Change Concern among Youth: Examining the Role of Civics and Institutional Trust across 22 Countries

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Abstract: Although scholars have long documented perceptions of climate change and the public's evolving response to the perceived risk it poses, only more recently have these analyses begun to examine youth and their views of the issue. Given that education has traditionally been considered a long-term strategy to promote sustainability among youth, this article conducts a cross-national and comparative study of students from 22 countries to evaluate factors commonly associated with youth perceptions of climate change as a threat to the world's future. In doing so, this study finds that promoting institutional trust and civic knowledge may increase student climate change concern to a greater degree than other, more emphasized, curricular and co-curricular environmental school opportunities. These new findings reveal potential pathways for future climate change education research, policy, and practice to help promote greater climate awareness and action among youth.

Keywords: Climate; Environmental Education; Civic Engagement; Trust; International Assessment

Preocupación por el cambio climático entre los jóvenes: Examen del papel del civismo y la confianza institucional en 22 países

Resumen: La educación se ha considerado tradicionalmente como una estrategia a largo plazo para promover la sostenibilidad entre los jóvenes. Este artículo realiza un estudio comparativo y transnacional de estudiantes de 22 países para evaluar los factores comúnmente asociados con las percepciones de los jóvenes sobre el cambio climático como una amenaza para el futuro del mundo. Este estudio encuentra que promover la confianza institucional y el conocimiento cívico puede aumentar la preocupación de los estudiantes por el cambio climático en mayor grado que otras oportunidades escolares ambientales curriculares y co-curriculares. Estos nuevos hallazgos revelan vías potenciales para futuras investigaciones, políticas y prácticas de educación sobre el cambio climático para ayudar a promover una mayor conciencia y acción climática entre los jóvenes.

Palabras clave: Clima; Educación Ambiental; Compromiso Civil; Confianza; Evaluación Internacional

Preocupação com a mudança climática entre os jovens: Examinando o papel da cidadania e da confiança institucional em 22 países

Resumo: A educação tem sido tradicionalmente considerada uma estratégia de longo prazo para promover a sustentabilidade entre os jovens. Este artigo conduz um estudo comparativo e transnacional de estudantes de 22 países para avaliar os fatores comumente associados às percepções dos jovens sobre as mudanças climáticas como uma ameaça ao futuro do mundo. Este estudo conclui que a promoção da confiança institucional e do conhecimento cívico pode aumentar a preocupação dos alunos com as mudanças climáticas em um grau maior do que outras oportunidades escolares ambientais curriculares e extracurriculares. Essas novas descobertas revelam caminhos potenciais para futuras pesquisas, políticas e práticas em educação sobre mudanças climáticas para ajudar a promover uma maior conscientização e ação sobre o clima entre os jovens.

Palavras-chave: Clima; Educação Ambiental; Engajamento Cívico; Confiar; Avaliação Internacional

Climate Change Concern among Youth: Examining the Role of Civics and Institutional Trust across 22 Countries

Climate change is widely considered to be one of the most consequential threats facing humanity today (Cook et al., 2013; IPCC, 2018). Not only do the threats posed by this unprecedented problem endanger the sustainability and health of the planet, but they also exacerbate social, economic, environmental, and geographic inequality across generations (Caney, 2016; Ciplet et al., 2015; Hamman et al., 2018; IPCC, 2014; Meyer, 2017). Given that the current generation of young people will face the brunt of climate change's consequences as they reach adulthood in the next 10-20 years (IPCC, 2014; 2018), it comes as no surprise that youth-led movements have begun calling on governments and international organizations to address the issue now.

Scholars have documented perceptions of climate change and the public's evolving response to its risk or threat for decades (Brulle et al., 2012; Lazo et al., 2000; Nisbet & Meyers, 2007). Research reveals an individual's world values, knowledge, and experience with environmental issues all help build their perceptions of climate change risk (Bord et al., 1999; Capstick et al., 2015; Sevä & Kulin, 2018), which in turn helps activate their interest in climate change action and environmental

policies (Lazo et al., 2000; Franzen & Vogl, 2013; Sevä & Kulin, 2018; Stern et al., 2000). Along these lines, variations in an individual's age, gender, level of education, political ideology, trust, and civic engagement can either promote or decrease their perceptions of the impending risk (Bord et al., 1999; Capstick et al., 2015; Fairbrother, 2017; Sevä & Kulin, 2018).

Surprisingly, only more recently have scholars begun to examine youth and their perceptions of climate change (see, e.g., Stevenson et al., 2014, 2018, 2019; Ojala, 2007, 2016; Busch et al., 2019). These studies have shown that family, friends, peers, and teachers significantly shape student climate change attitudes and behavior (Ojala, 2015a, 2015b; Stevenson et al., 2014; Valdez et al., 2018). Yet while scholarly attention to youth and climate change concern has primarily focused on single case studies involving STEM curriculum and student views about climate change in relation to their social and familial networks, less attention has been given to aspects like civics education or other avenues which could elevate student climate change awareness.

Education has traditionally been viewed as a long-term strategy to promote sustainability among youth (Aikens et al., 2016; Gan et al., 2019; Henderson & Tilbury, 2004; Jickling & Wals, 2007; Pizmony-Levy, 2011; Stevenson, 2007). Since the 1960s, there have been educational movements to promote sustainability, such as environmental education (EE), education for sustainable development (ESD), and environmental and sustainability education (ESE) (McKeown & Hopkins, 2005, 2007; Tilbury, 1995). Perhaps due to its relative newness, climate change education (CCE) is often allocated a lower priority in environmental education research and policy discourse (Aikens et al., 2016; Benavot, 2014; UNESCO, 2019). Nonetheless, despite their emphasis, questions remain how effective EE, ESE, or ESD can be in elevating youth perceptions of climate change.

In this article, I evaluate factors associated with youth perceptions of climate change in order to better understand how curricular and co-curricular environmental opportunities in schools compare to other factors – such as promoting institutional trust and civic knowledge – in elevating student climate change concern. By doing so, this study makes three contributions to the literature, in which comparative evidence and understanding of youth concerns about climate change across different countries is lacking (Corner et al., 2015). First, exploring factors that elevate concern about climate change in young people across contexts may reveal how students develop pathways to participate in and address the issue in the future. Second, in studying this complex issue, the impact of additional social factors such as trust in national and international institutions has yet to be examined among youth. Third, by testing how indicators of EE/ESE/ESD are associated with perceptions of climate change as a threat, this paper offers insight into the best educational path forward.

Using data from the International Civics and Citizenship Survey (ICCS) 2016, this study evaluates youth perceptions of climate change as a threat to the world's future by conducting a cross-national and comparative analysis across 22 countries. To evaluate whether different environmental education experiences or levels of trust in national and international institutions affect youth climate change concern, I address the following research questions:

1. How do curricular and co-curricular opportunities to learn about the environment and climate change affect student perceptions of climate change as a threat to the world's future?
2. How does trust in national and international institutions as sources of information affect student perceptions of climate change as a threat to the world's future?

In what follows, I first present a review of the research that informed my analysis. I next explain the study's methodology and data, as well as potential limitations, before moving on to

describe my findings. The paper then concludes with a discussion of how curricular and co-curricular environmental opportunities in schools may in fact not contribute as significantly as other factors (such as promoting institutional trust and civic knowledge) when elevating student concern about climate change.

Literature Review

In this section, I provide a brief overview of climate change risk perception scholarship, before diving deeper into four factors associated with perceptions of climate change risk: (1) education, (2) civic knowledge (3) trust in institutions, and (4) sociodemographic characteristics.

Climate Change Risk Perception

Scholars assess climate change risk perception by measuring an individual's assessment of the potential environmental consequences or threats of climate change at local, regional, and global levels (Bord et al., 2000; Dietz et al., 2007; Leiserowitz, 2005, 2006; Luís et al., 2018; Spence et al., 2011; Upham et al., 2009). Although perception of climate change is described in various ways (e.g., concern, threat, or risk), these terms all generally measure how individuals worry about climate change and its consequences (Stevenson et al., 2019). In this paper, these terms will be used interchangeably to unpack youth concern about climate change and its impact on the future.

Research has shown that climate change concern among adults differs across contexts and time (Bord et al., 1999; Brechin & Bhandari, 2011; Capstick et al., 2015; Leiserowitz, 2007). Varied levels of concern can also be seen within countries and across groups based on characteristics such as education, ideology, and region (Brody et al., 2008; Lujala et al., 2015). Studies also suggest that although climate change awareness is now very high, perceived risk or threat of climate change is not necessarily as uniform at an individual level (Lee et al., 2015; Luís et al., 2018; Upham et al., 2009; Whitmarsh, 2011).

Factors Associated with Perceptions of Climate Change Risk

Public perceptions of climate change risk vary based on psychological and sociological factors. Studies on environmental attitudes and sociological approaches to climate change beliefs demonstrate that a wide variety of societal, environmental, and individual factors inform climate change risk perceptions (Sevä & Kulin, 2018). Specific individual and contextual features such as personal characteristics, climate change knowledge, levels of civic engagement, and trust in institutions can all affect levels of climate change concern (Bord et al., 1999; Brulle et al., 2012; Capstick et al., 2015; Sevä & Kulin, 2018). Factors such as education, trust in institutions, civic knowledge and engagement, and sociodemographic characteristics should therefore all be considered when evaluating climate change concern drivers among youth. Existing scholarship on each of these factors is outlined below.

Education

Over the past 50 years, education has been emphasized as a means to advance sustainability and solve environmental issues (Aikens et al., 2016; Jickling & Wals, 2007). Education is a long-term strategy. But although researchers have investigated how incorporating EE/ESD/ESE into schools increases student environmental knowledge, attitudes, and behavior (e.g., Bogner & Wilson 2014; Johnson & Činčera, 2015; Roczen et al., 2000), little is known about the ability of these approaches (which focus on developing environmentally friendly activities, clubs, and school curricula) to shape student beliefs about climate change.

Educational attainment strongly predicts climate change awareness among adults (O'Connor et al., 1999; Wolf & Moser, 2011), and elevated levels of climate change knowledge is one of the strongest links for increasing concern on the issue (Shi et al., 2016; Tobler et al., 2012). Yet when comparing different aspects of climate change knowledge, Luís et al. (2018) found that knowledge on the causes of climate change has a negative relationship with climate change risk perceptions. Luís et al. (2018) argue that there is a risk normalization effect in people, where individuals understand, eventually cope, and become used to the threat's presence. Studies on youth have found similar patterns (Ojala, 2012b, 2015a; Stevenson et al., 2014, 2018, 2019). Like adults, young people tend to psychologically and emotionally distance themselves from climate change in order to cope (Ojala, 2015a).

Despite these similarities, youth remain demonstrably distinct from adults. Young people tend to be interested in and worry about global problems at greater levels than older age groups (Corner et al., 2015). World views and political ideology (which have been shown to heavily mediate adult concern about climate change) appear to influence them less (Stevenson et al., 2014). And, unlike adults, higher levels of climate change knowledge among youth increases their levels of concern (Busch et al., 2019; Flora et al., 2014; Stevenson et al., 2014). Given these factors, scholars view emphasizing CCE as an essential approach to building youth climate change awareness and concern (Busch et al., 2019; Nisbet & Mooney, 2007; Stevenson et al., 2019).

Schools that offer environmental courses, activities, and clubs significantly increase climate change knowledge and social norms among students (Busch et al., 2019). Education efforts focused on climate change should aim to encourage intergenerational learning, while emphasizing local issues, providing in-depth lessons and student-centered projects, and involving parents (Lawson et al., 2018). Other studies suggest educational interventions should provide more entertaining lessons and foster greater trust in those who disseminate climate change information in order to engage youth more effectively on the issue (Corner et al., 2015).

Civic Knowledge and Engagement

Given that the process of generational cohort replacement will shape future democratic processes and policy decisions, socializing youth in meaningful civic engagement is crucial to help address issues such as climate change (Amnå et al., 2009; Blais & Rubenson, 2013; Marien et al., 2010; Miranda et al., 2017; Quintelier, 2015). Civic and climate change knowledge are both significant predictors of climate change awareness and perceptions of its risk (Barkan, 2004; Luís et al., 2018; Maibach et al., 2011). Higher civic knowledge and engagement is related to higher acceptance of specific attitudes and scientific issues (Galston, 2001). According to a recent study commissioned by UNESCO, the integration of civic knowledge with environmental and sustainability learning domains vary widely between countries and curricula (2019). Research is needed to understand how civic knowledge may enhance climate change perceptions in youth.

Trust in Institutions

Trust in climate change information provided by institutions is essential for individuals to not only become more aware about the impacts of climate change, but also care about its consequences. Previous studies emphasizing the role of trust among adults demonstrate that both generalized trust in people, and trust in social institutions, are associated with environmental attitudes and concern (Franzen & Vogl, 2013; Sevã & Kulin, 2018; Smith & Mayer, 2018). For instance, Whitmarsh (2005, 2011) found that trust in institutions as sources of climate change information is a significant and consistent predictor for building concern.

Trust is also a significant predictor across contexts. Smith & Mayer (2018) conducted a cross-national study considering the role of individual and national trust with risk perceptions of

climate change. At the individual level, they found trust is positively associated with risk perceptions of climate change, willingness to behave pro-environmentally, and support for policy preferences that address climate change. Low trust among adults is also related to the “social trap” of diminishing willingness to address climate change (Rothstein, 2005, as cited in Smith & Mayer, 2018). When comparing across contexts, however, trust in institutions and climate change perceptions is not as uniform (Sevä & Kulin, 2018; Smith & Mayer, 2018).

Trust in communication about climate change is considered integral for shaping views about climate change (Corner et al., 2015). For youth, evidence also suggests that trust in specific people such as scientists, parents, peers, celebrities, and teachers is important for raising climate change awareness (Chawla & Cushing, 2007; Ojala, 2012, 2013). Discussions with family, peers, teachers, and other adults can either increase concerns about climate change (Stevenson et al., 2019) or skepticism (Gardner & Steinberg, 2005; Mead et al., 2012; Ojala, 2013). Although youth who place trust in societal actors are more likely to engage in pro-environmental behavior (Ojala & Bengtsson, 2019), little research has explored how trust in national and international institutions affects youth climate change risk perceptions.

Sociodemographic Characteristics

Individual characteristics such as age, gender, and socioeconomic status significantly shape climate change risk perceptions (Buttel, 1979; Franzen & Vogl, 2013; Slovic, 2000; Whitmarsh, 2011). Among adults, studies show women are more likely than men to be concerned about the environment and climate change (McCright, 2010; Smith & Leiserowitz, 2012; Zia & Todd, 2010). Similar studies on youth, however, are mixed. Mead et al. (2012) found no relationship between student gender and climate change attitudes in the United States. By contrast, both Stevenson et al. (2018) and (2019) found female students in the United States had higher levels of concern about the environment than their male counterparts. Little research exists comparing the association between individual factors (like gender) and climate change attitudes across contexts. Despite the wide range of literature on climate change risk perceptions, few studies have evaluated if established patterns are consistent in youth (but see Busch et al., 2019; Stevenson et al., 2014; 2019) and cross-nationally.

Data and Method

In this section, I provide an overview of the data I relied upon before outlining the study’s measures, descriptive statistics, analytic strategy, and limitations.

Data

This study uses data from ICCS 2016, which is the most recent survey of students across 24 countries, clustered by geographic regions such as Latin America (five countries), Europe (16 countries), and Asia (three countries). Administrated by the International Association for the Evaluation of Educational Achievement, ICCS 2016 is of particular interest for scholars and researchers seeking to investigate youth participation in recent global developments such as the growing concern of human impact on the environment (Schulz et al., 2016, 2018).

The ICCS 2016 student population is composed of students who are in the eighth grade or eighth year of schooling (an average age of 14 years old). ICCS 2016 employs a stratified two-stage cluster sampling design, giving researchers the ability to conduct nested, multilevel analyses (Schulz et al., 2016). The first stage of sampling of ICCS 2016 was conducted to sample schools within a country using a probability proportional to size procedure (Schulz et al., 2016). In the second stage, for each sampled school in each country, ICCS 2016 selected and surveyed intact classrooms and all students in the class were assessed (Schulz et al., 2016).

The original ICCS 2016 dataset relevant to this study consisted of 90,285 eighth grade students from 3,693 schools across 24 democratic countries. This study, however, excludes two non-state regions originally included in the ICCS 2016 data – Belgium (Flemish) and North Rhine-Westphalia Germany – in an effort to reduce potential comparability problems (Schulz et al., 2018). Upon careful consideration of the dataset (and to determine the final sample), all omitted, invalid, and system-missing data were recoded (9.04%). After employing listwise deletion for missing data, the final dataset for this study's analysis therefore consisted of 82,123 eighth grade students in 3,595 schools across 22 countries.

Measures

Four separate measures were assessed as part of this study: (1) climate change as a threat to the world's future, (2) student background predictors, (3) curricular and co-curricular opportunities, and (4) trust in institutions. Each is discussed below.

Climate Change as a Threat to the World's Future

The study's dependent variable is student perception of climate change as a threat to the world's future. Surveyed students were asked, "To what extent do you think the following issues that are a threat to the world's future?" and then prompted with a set of issues such as poverty, food shortages, and climate change (Köhler et al., 2018, p. 115). Students could respond by choosing one of the following for each issue: "To a large extent"; "To a moderate extent"; "To a small extent"; or "Not at all" (Köhler et al., 2018, p. 117). Because my analysis is interested in student perception of climate change risk as either a large risk or a low risk, I recoded responses into binary form: climate change is a large threat (1 = large extent) or not a large threat (0 = none to a moderate extent). Table 1, below, provides definitions and metrics for all variables used in the analyses.

Student Background Predictors

Given that student background predictors have been shown to help shape student perceptions on climate change (e.g., Lombardi et al., 2014; McCright, 2010; Stenseth et al., 2016), this study explores the relationship between individual-level factors and perceived threat of climate change among individual students in each country. Student gender was coded as a dichotomous variable (0 = Male, 1 = Female). In line with previous studies, the home literacy resources variable was used as a proxy to measure students' socioeconomic status. Future educational goals were recoded and dichotomized (0 = secondary or lower; 1 = postsecondary). Student civics and citizenship achievement was standardized across countries and scaled based on 87 cognitive test items, which produced a nationally comparable indicator for student civic and citizenship knowledge (Schulz et al., 2016).

Curricular and Co-Curricular Opportunities

Because student experience with environmental learning significantly shapes their attitudes and beliefs about environmental issues (see, e.g., Chawla & Cushing, 2007; Corner et al., 2015; Hart, 2013), students were asked, "At school, to what extent have you learned how to protect the environment?" They could answer 1: To a large extent; 2: To a moderate extent; 3: To a small extent; or 4: Not at all. In my final analyses, this variable was recoded and dichotomized for better interpretability (0 = Small extent or not at all, 1 = Moderate to large extent; Schulz et al., 2016).

Table 1*Variables Included in Analysis*

Variables	Variable label	Definition and metrics
<i>Dependent variable</i>		
Climate Change	IS3G28I	To what extent do you think the following issues are a threat to the world's future? (0 = To a small extent or not at all; 1 = moderately to a large extent).
<i>Predictor variables</i>		
Female	S_GENDER	Male=0, Female=1
Civics & Citizenship Achievement	PV1CIV	First plausible value of achievement in civic and citizenship
Home Literacy Resources	IS3G11	About how many books are there in your home? Semi-continuous: 0 = None or very few (0-10 books); 1 = Enough to fill one shelf (11-25 books) 2 = Enough to fill one bookcase (26–100 books) 3 = Enough to fill two bookcases (101–200 books); 4 = Enough to fill three or more bookcases (more than 200 books)
Educational Goals	IS3G03	Which of the following levels of education do you expect to complete? (0 = Secondary or Lower; 1 = Postsecondary)
Opportunity to Learn about the Environment	IS3G18C	At school, to what extent have you learned about the following topics? - How to protect the environment (e.g., through energy-saving or recycling) (0 = None or small extent; 1 = Moderate to Large extent)
Participation in Environmental Activities at School	IS3G16F	At school, have you ever done any of the following activities? - Participating in an activity to make the school more environmentally friendly (e.g., through water saving or recycling) (0 = Never participated; 1= Participated before)
Environmental Club	IS3G15B	Have you ever been involved in activities of any of the following organizations, clubs or groups? - An environmental action group or organization (0 = Never participated; 1= Participated before)
Trust in UN	IS3G26K	How much do you trust each of the following groups, institutions or sources of information? – The United Nations (0 = Not at all or little; 1 = Quite a lot or completely)
Trust in National Government	IS3G26A	How much do you trust each of the following groups, institutions or sources of information? – The national government (0 = Not at all or little; 1 = Quite a lot or completely)
Trust in Local Government	IS3G26B	How much do you trust each of the following groups, institutions or sources of information? – The local government of your town or city (0 = Not at all or little; 1 = Quite a lot or completely)
Trust in Schools	IS3G26J	How much do you trust each of the following groups, institutions or sources of information? - Schools (0 = Not at all or little; 1 = Quite a lot or completely)

Because scholars have argued that active participation in environmental activities at school significantly shapes student attitudes and beliefs about the environment and climate change (Flora et al., 2014; Hickman & Reimer, 2016; Jorgenson et al., 2019; Reimer et al., 2010), students were also asked, “At school, have you ever participated in an activity to make school more environmentally friendly? (e.g., through water-saving or recycling).” Students could respond 1 = Yes, I have done this within the last twelve months; 2 = Yes, I have done this but more than a year ago; or 3 = No, I have never done this. This variable was recoded as a dichotomous variable (0 = Never participated, 1 = Have participated before) (Schulz et al., 2016).

I also examined whether prior student membership in environmental groups or clubs outside of school shapes student perceptions about the environment and climate change. Students were asked, “Have you ever been involved in activities of any of the following organizations, clubs, or groups?” (with “An environmental action group or organization” as a prompt). Students could respond 1 = Yes, I have done this within the last twelve months; 2 = Yes, I have done this but more than a year ago; or 3 = No, I have never done this. This variable, like the others, was dichotomized (0 = Never participated, 1 = Have participated before) (Schulz et al., 2016).

Trust in Institutions

Previous adult studies found trust in institutions is significantly related to an individual’s perception of climate change risk (Dietz et al., 2007; Whitmarsh, 2005, 2011). To investigate whether student trust in national and international institutions is related to their concerns about climate change, I included variables measuring student trust in the United Nations (UN), their national and local government, and schools. Students were asked to express their level of confidence in institutions, groups, and sources of information using the following scale: “completely,” “quite a lot,” “a little,” or “not at all” (Schulz et al., 2018). For each trust variable, I dichotomized responses of trust (0 = Not at all or a little; 1 = Quite a lot or Completely).

Descriptive Statistics

The study’s dataset sample included a variety of educational settings from Europe, Latin America, and East Asia. Table 2 provides descriptive statistics for all variables used in each setting of the analysis. For the purposes of this study, I am interested in individual-level factors related to how students learn and appreciate sources of information about the environment, and how these factors may shape student perceptions about climate change as a global threat.

In the majority of surveyed countries, the average proportion of male and female students was nearly even. For future educational goals, most countries showed roughly half of students planning to enroll in post-secondary education or higher. Students in Latin America countries reported the lowest averages of home literacy resources, while students from South Korea, Norway, Sweden, and Finland reported the highest. Average scores across schools for civics and citizenship achievement ranged between 404 points (the Dominican Republic) and 592 points (Denmark).

Student perceptions of learning about the environment in school vary across countries. Nonetheless, students from Latin America countries (such as Peru, the Dominican Republic, Colombia, and Mexico) generally reported higher levels of learning and engagement, while European students (from countries like the Netherlands, Estonia, Finland, and Sweden) reported lower levels. Students from the Dominican Republic, Bulgaria, Peru, and Russia reported higher averages of environmental group membership, while students from Finland, Sweden, Chinese Taipei, and Denmark reported the lowest membership involvement.

Table 2*Descriptive Statistics. Source: ICCS 2016 (n= 82,123)*

Country	N	Climate Change	Female	Educational Goal	Home Literacy Resources	Civic & Citizenship Achievement	Threat Scale	Opportunity to Learn about the Environment	Participation in Environmental Activities	Environmental Club	Trust in UN	Trust in Nat Gov	Trust in Local Gov	Trust in Schools
<i>Bulgaria</i>	2,569	.523	.473	.859	1.842	511.431	2.437	2.330	.575	.546	.700	.553	.610	.828
<i>Chile</i>	4,578	.640	.505	.886	1.500	494.692	2.629	2.305	.470	.307	.617	.492	.531	.722
<i>Chinese Taipei</i>	3,840	.616	.488	.817	1.844	585.105	2.410	2.468	.601	.098	.726	.621	.710	.809
<i>Colombia</i>	4,893	.797	.527	.923	1.085	495.061	2.612	2.669	.650	.425	.639	.545	.558	.847
<i>Croatia</i>	3,650	.487	.500	.779	1.881	531.623	2.471	2.542	.520	.285	.799	.396	.573	.788
<i>Denmark</i>	5,292	.652	.518	.845	2.217	592.471	2.201	1.771	.385	.108	.821	.752	.709	.796
<i>Dominican Republic</i>	2,442	.425	.526	.614	0.949	403.843	2.397	2.562	.669	.576	.729	.752	.690	.913
<i>Estonia</i>	2,718	.476	.502	.607	2.339	547.349	2.394	1.980	.317	.194	.618	.723	.695	.730
<i>Finland</i>	2,973	.630	.479	.690	2.340	580.430	2.192	2.193	.331	.061	.845	.827	.830	.852
<i>Hong Kong</i>	2,466	.715	.487	.754	1.780	521.924	2.504	2.141	.490	.183	.700	.672	.635	.805
<i>Italy</i>	3,183	.453	.485	.657	2.233	531.577	2.464	2.308	.478	.243	.833	.568	.772	.866
<i>South Korea</i>	2,471	.621	.463	.875	2.852	550.499	2.321	2.335	.484	.137	.773	.450	.479	.675
<i>Latvia</i>	2,930	.514	.524	.715	2.180	502.318	2.438	2.283	.530	.323	.660	.597	.600	.697
<i>Lithuania</i>	3,331	.565	.516	.880	1.918	516.804	2.528	2.210	.496	.432	.778	.718	.761	.772
<i>Malta</i>	3,152	.528	.509	.627	2.197	508.845	2.402	2.280	.580	.337	.766	.663	.704	.793
<i>Mexico</i>	4,842	.580	.507	.830	1.100	477.578	2.507	2.395	.647	.365	.708	.558	.563	.737
<i>Netherlands</i>	2,674	.486	.512	.349	2.029	532.434	2.073	1.798	.258	.135	.700	.715	.812	.756
<i>Norway</i>	5,342	.670	.510	.800	2.525	573.893	2.190	1.960	.404	.113	.854	.797	.772	.709
<i>Peru</i>	4,447	.489	.476	.813	1.427	453.758	2.383	2.524	.732	.525	.677	.473	.541	.786
<i>Russia</i>	6,946	.418	.497	.866	1.919	551.674	2.443	2.259	.536	.467	.716	.901	.743	.758
<i>Slovenia</i>	2,665	.478	.489	.798	2.123	535.846	2.478	2.105	.483	.412	.713	.491	.677	.788
<i>Sweden</i>	2,399	.701	.507	.829	2.351	589.534	2.160	2.295	.365	.090	.872	.795	.753	.679

Trust in institutions (the UN, national and local government, and schools) also varied across countries. Students from Nordic European countries consistently reported higher averages of trust in the UN and their national and local governments. Students from Latin American countries reported lower levels of trust in these institutions. When students were prompted on their level of trust for schools, however, the pattern was less clear. Students from the Dominican Republic, Italy, Finland, Colombia and Bulgaria reported the highest levels of average trust, whereas students from South Korea, Sweden, Latvia, and Norway reported the lowest. Taken together, these descriptive statistics suggest that student climate change perceptions, learning and participation in environmental activities, and levels of trust in institutions as sources of information are highly contextual, varying from country to country.

Analytic Strategy

I performed a series of logistic analyses (Fox, 2008) to examine youth climate change risk perceptions. Stata 16.1 was used for all analyses, and all models included student sampling weights (Köhler et al., 2018). The analysis included two steps.

In the first set of analyses, I examined logistic models of climate change risk perceptions for all students from all the educational systems. Because I am only interested in individual-level predictors and conducting a logistic regression analysis on clustered data, the indicator identifying each respondent's country was included as a fixed effect in the models. Schools were clustered and included in the statistical command. This method controls for individual-level covariates and adjusts robust standard errors for non-independence (Hox et al., 2017; Menard, 2010). At individual-level analyses where there are large sample sizes, I can reliably estimate individual-level effects (Bryan & Jenkins, 2016). At the country level, however, there were only a small number of cases (22), so estimating effects at the second level tends to be less reliable and biased downwards (Bryan & Jenkins, 2016). A multilevel analysis was therefore not advisable. Instead, I employed a generalized linear logistic model with country-fixed effects for the first set of analyses.

In the second step of the analysis, I estimated additional multilevel models for each country. Multilevel logistic regression was performed in an effort to address the hierarchical structure of the data where students were nested within schools for each country (Köhler et al., 2018). This approach was appropriate due to the large number of schools (ranging from 53 to 352 schools per country) at the school level (Bryan & Jenkins, 2016).

Using a multilevel approach allows for more flexibility in modelling the effect of schools (non-independence) on the individual level while also providing greater accuracy in adjusting the robust standard errors (Menard, 2010). To confirm the veracity of this approach, I compared the multilevel results from single-level models using schools as a fixed effect (similar to the first analysis with countries) and found there were no significant differences between the two approaches. I chose to keep the results from the multilevel analyses because these models had smaller standard errors and a higher sensitivity to significance.

The full model is shown in the equation below. The Logit (odd) π_{ij} is the individuals' odds of perceiving climate change to be a large threat to the world's future. The primary results of interest are the odds on curricular and co-curricular learning opportunities, and the trust in national and international institutions as sources of knowledge. The variation in individual perception on climate change is represented by ϵ_{ij} .

$$\begin{aligned}
 \text{Logit (odds)} & \text{climate change}_{ij} \\
 & = \beta_{0j} + \beta_{1j}\text{Female}_{ij} + \beta_{2j}\text{Educational Goals}_{ij} + \beta_{3j}\text{Home Literacy Resources} \\
 & + \beta_{4j}\text{Civic Knowledge}_{ij} + \beta_{5j}\text{Learn about Environment}_{ij} \\
 & + \beta_{6j}\text{Environmental Activities}_{ij} + \beta_{7j}\text{Environmental Club}_{ij} + \beta_{8j}\text{Trust in UN}_{ij} \\
 & + \beta_{9j}\text{Trust in National Government}_{ij} + \beta_{10j}\text{Trust in Local Government}_{ij} \\
 & + \beta_{11j}\text{Trust in Schools}_{ij} + \varepsilon_{ij}
 \end{aligned}$$

Limitations

Four limitations to this study merit mentioning. First, the countries included in the analysis are mostly industrialized, high-income or upper-middle-income countries. This poses a potential issue for generalizability of the findings. Second, the variables for how students learn about environmental issues are self-reported. Given this, student perceptions may be biased and either diminish or overemphasize their actual opportunities for environmental learning. Similarly, student reporting may also be biased due to potential social desirability effects. Third, various unassessed factors may also be important to analyze such as environmental events/individual proximity, the political views of parents, and levels of social media use. Fourth, although individual concern may shift over time, the data for this study come from a specific moment in time. While there are limitations, the ICCS 2016 dataset provides a unique opportunity to examine the links between education, trust, and attitudes on climate change.

Findings

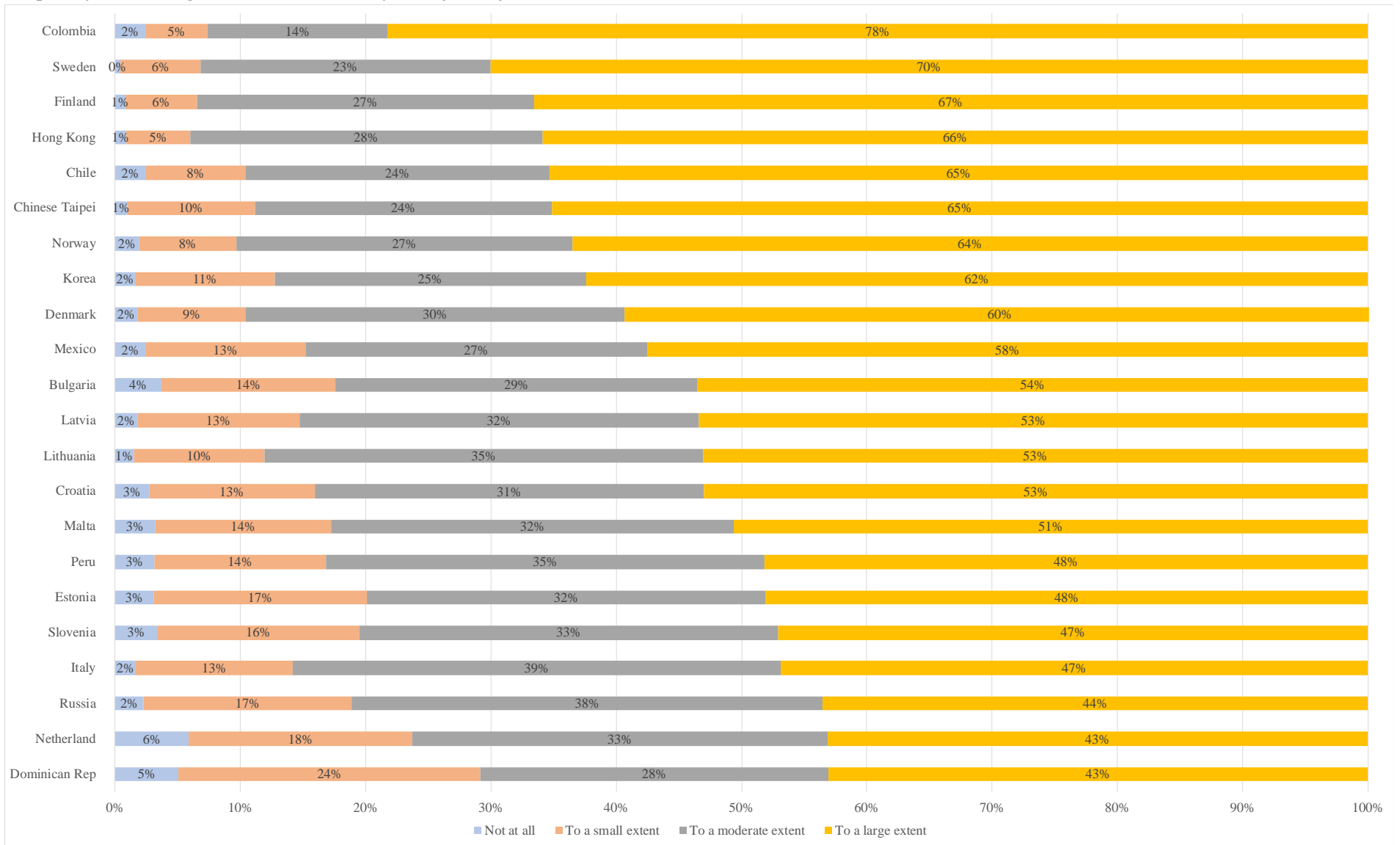
The goal of this study is to contribute to existing literature by characterizing predictors that elevate youth climate change concern across 22 countries. To address this goal, I operationalized a cross-national, comparative research design which included a multilevel, quantitative analysis on youth climate change concern. To date, there are only a few studies similar to this paper (e.g., Stevenson et al., 2019). My findings are discussed below, grouped into three categories: (1) youth concern about global issues across countries, (2) macro multivariate analyses, and (3) cross-country multilevel comparisons.

Youth Concern about Global Issues Across Countries

Several descriptive patterns for youth perceptions of global threats emerged from my analysis. Figure 1 shows student perception of climate change as a threat to the world's future before being dichotomized for the final analyses. Similar to previous comparative research on adults (see, e.g., Kvaløy et al., 2012; Lee et al., 2015), youth perceptions of climate change risk were unevenly distributed across countries in ICCS 2016. The highest levels of perceived risk (over two-thirds indicating climate change as a global threat to a large extent) were students from Colombia, Sweden, Finland, and Hong Kong. By contrast, students from the Dominican Republic, the Netherlands, Estonia, Russia, and Slovenia had the highest percentage of students indicating climate change was a minor or non-threat (on average one-fourth of students). Although a majority of countries had over half of students reporting climate change was a large global threat, there was still considerable cross-national variation in youth climate change concern.

Figure 1

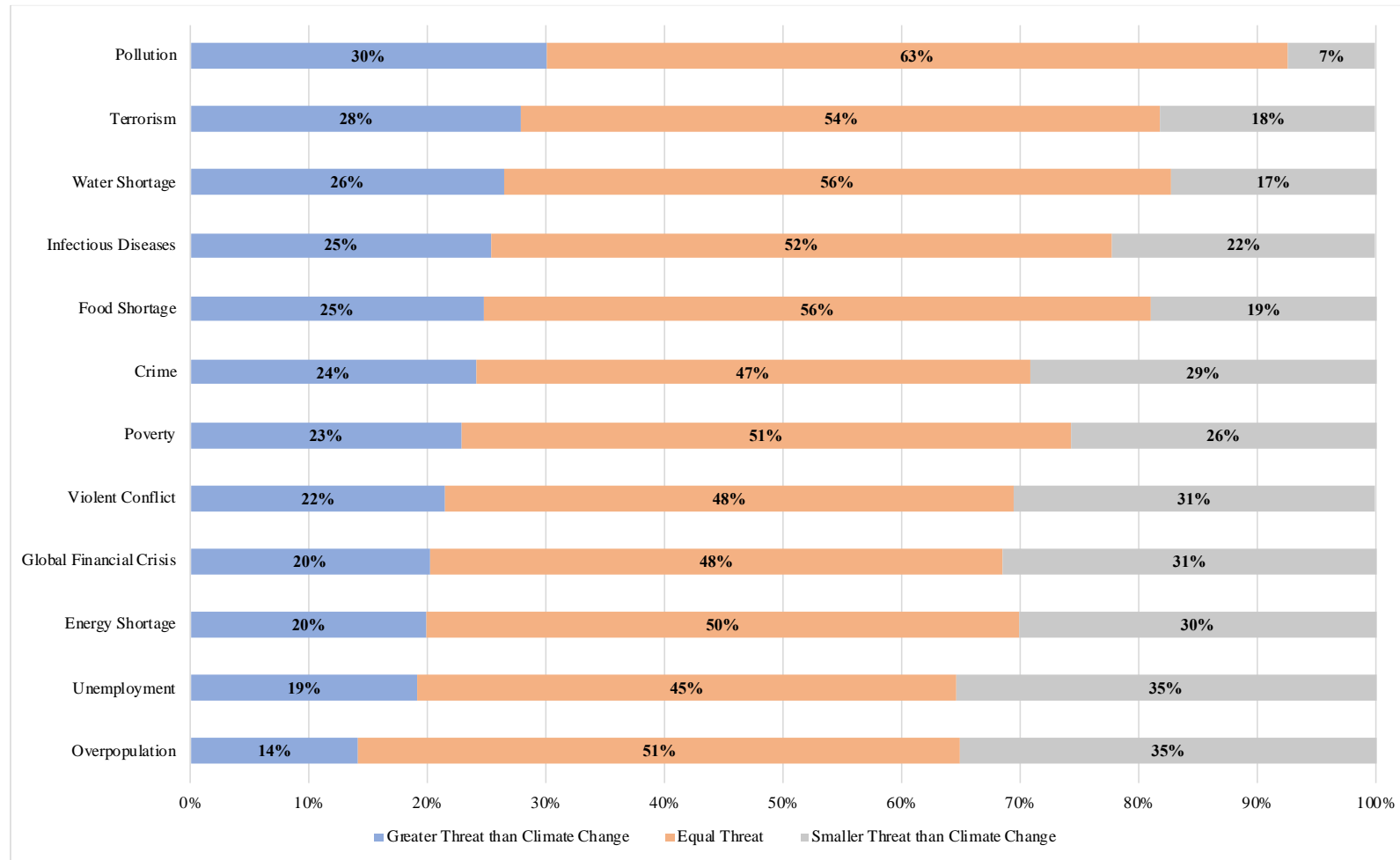
Perception of climate change as a threat to the world's future, by country



Regarding threat relativity, I compared youth perception of climate change to other global threats. For each paired set of threats, using contingency tables, I calculated the share of respondents who viewed them as equal threats, those who viewed climate change as a greater threat, and those who viewed climate change as a lesser threat. Figure 2 presents the results of this analysis.

Figure 2

Comparison of global threat severity relative to climate change (pooled sample)



As seen in Figure 2, climate change is perceived to be equal or less serious than many other global threats. Only about one-third of students reported climate change to be a greater threat when compared to issues such as crime, violent conflict, overpopulation, unemployment, and global financial crises. Of note, environmental issues such as pollution, food shortages, water shortages, and infectious diseases were reported by a large share of students to be even greater threats than climate change. This pattern of perception resembles prior research on public opinion and global concerns, where climate change was considered less threatening than other environmental issues (e.g., Bord et al., 1999; Brechin, 2003; Kvaløy et al., 2012; Yeager et al., 2011). This discrepancy could be due to proximity and relevance to individuals, where specific environmental issues such as pollution and water shortages are often perceived to be more immediate (see, e.g., Brügger et al., 2015; Lujala et al., 2014; Sun & Han, 2018).

When I compared climate change threat with a created scale of all other global threat variables (threat scale, $\alpha = .868$), I found a medium, positive, and significant correlation ($r = .418$, $p < .001$). In other words, students who perceive climate change as a global threat also have higher levels of concern for other types of global issues. It is possible that this correlation of global threats represents underlying world views or broader notions of risk (Slimak & Dietz, 2006).

Macro Multivariate Analyses

The first set of multivariate analyses took a macro perspective to estimate effects on student climate risk perceptions, holding country effects constant. Results are shown in Table 3 with odds ratios and standard errors listed for each variable.

Model 1 presents odds ratios of student background variables. Results indicate students with aspirations for postsecondary education, higher SES, and higher civics and citizenship knowledge are more likely to perceive climate change as a large risk ($p < 0.001$). In other words, students who intend to enroll in higher education and who score higher in civics knowledge are more likely to indicate climate change is a risk to the world's future. Greater access to resources (proxy measured by number of books in their home) also increases the likelihood. Interestingly, female students are significantly less likely than their male counterparts to perceive climate change as a large threat (1.157 times less likely, $p < 0.001$).

Models 2 through 5 explore different curricular and co-curricular opportunities to learn about environmental issues. Model 2 shows the odds ratio of climate change risk perceptions and students who indicated they have learned about protecting the environment in school. Results show that students are more likely to perceive climate change as a large risk when they have greater opportunities to learn about the environment in school (1.129 times more likely, $p < 0.001$).

Model 3 and Model 4 show there is no significant relationship between student risk perception and participating in environmental school activities or being a member of an environmental group. When controlling for participation and environmental clubs, Model 5 shows that perceived opportunities to learn about environmental issues in the classroom remains a positive, and significant, predictor for risk perceptions.

Model 6 and Model 7 add results for risk perception and confidence in institutions as sources of information. Students who have a lot, or complete, trust in the UN are 1.228 times more likely to perceive climate change as a threat ($p < 0.001$). Similarly, when students report high confidence in schools as sources of information, they are more likely to believe climate change is a large risk ($p < 0.05$). Surprisingly, students are less likely to perceive climate change as a large threat when they have higher levels of trust in their national government (1.08 times less likely, $p < 0.01$).

Table 3

Global Fixed-Effects Logistic Regression Models on Student Risk Perceptions of Climate Change as a Global Threat (n = 82,123)

Variables	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7	
	OR	S.E.	OR	S.E.	OR	S.E.	OR	S.E.	OR	S.E.	OR	S.E.	OR	S.E.
Female	.843 ***	.018	.829 ***	.018	.841 ***	.018	.842 ***	.000	.830 ***	.018	.848 ***	.018	.835 ***	.018
Educational Goals	1.096 ***	.029	1.089 ***	.028	1.094 ***	.029	1.096 ***	.029	1.088 ***	.028	1.089 ***	.028	1.082 ***	.028
Home Literature Resources	1.111 ***	.010	1.110 ***	.010	1.110 ***	.010	1.110 ***	.010	1.110 ***	.010	1.109 ***	.010	1.108 ***	.010
Civic and Citizenship Achievement	1.004 ***	.000	1.004 ***	.000	1.004 ***	.000	1.004 ***	.000	1.004 ***	.000	1.004 ***	.000	1.004 ***	.000
Learn to Protect Environment			1.129 ***	.014					1.129 ***	.015			1.124 ***	.015
Environmental Activities					1.022	.022			.989	.024			.985	.022
Environmental Club							1.029	.024	1.011	.024			1.009	.024
Trust in UN											1.228 ***	.031	1.216 ***	.031
Trust in National Government											.920 **	.026	.916 **	.026
Trust in Local Government											.964	.026	.956	.026
Trust in School											1.065 *	.028	1.049 *	.028

* $p < .05$, ** $p < .01$, *** $p < .001$

Note: Country fixed effects are included in all models.

Overall, findings from these models suggest that students who learn about the environment in classrooms are more likely to view climate change as a threat. The manner by which students appreciate sources of information also has a significant relationship with how the risk of climate change is perceived. Not only are local, close sources of information (e.g., trust in schools) related to student climate change risk perceptions, trust in international sources such as the UN also affect student perceptions of the issue and the threat it poses.

Country Comparisons

In order to determine if the findings above remain similar within and across contexts, this section compares student climate change concern across countries with variables of student background (Table 4) and learning, experience, and trust (Table 5). The odds ratio (OR) and robust standard errors (S.E.) are listed for each variable. Overall, the final model results demonstrate that the effects of each predictor variable vary by system in their significance and size.

Student Background

Table 4 presents results for student gender (female), educational goals, and home literature resources (SES) controlling for all other variables. Overall, student background variables were statistically significant and positive in only certain countries. In most countries (18 out of 22), female students are less likely than male students to identify climate change as a large global threat. In 11 countries this pattern is statistically significant (e.g., Bulgaria, Chile, Chinese Taipei, and Russia). In four other countries the pattern is reversed. When compared to male students, female students in Finland and Sweden are 1.826 and 1.254 times more likely to identify climate change as a large global threat ($p < 0.001$). Students in Malta who have post-secondary educational aspirations are 1.378 times more likely to view climate change as a serious threat ($p < 0.001$). Similarly, educational goals increase the likelihood of perceiving climate change as a large risk for students in Chile, Denmark, Finland, Lithuania, the Netherlands, and Norway ($p < 0.05$). Home literature resources were positively and statistically significant for 15 out of the 22 countries. Across all countries, with the exception of the Russia, civic knowledge was a strong and positive predictor for increased climate change risk perception in students.

Table 4

Comparison of Logistic Models Estimating Student Background with Perception of Climate Change as a Global Threat by Country

Countries	Female		Educational Goals		Home Literacy Resources		Civics & Citizenship Achievement	
	OR	S.E.	OR	S.E.	OR	S.E.	OR	S.E.
Bulgaria	.691 ***	.071	1.273	.189	1.089	.050	1.002 ***	.001
Chile	.785 ***	.053	1.217 *	.122	1.120 ***	.036	1.003 ***	.000
Chinese Taipei	.684 ***	.050	1.019	.090	1.098 ***	.031	1.004 ***	.001
Colombia	1.042	.090	1.243	.193	1.063	.058	1.010 ***	.001
Croatia	.591 ***	.061	1.076	.120	1.071	.052	1.005 ***	.001
Denmark	.966	.073	1.240 *	.119	1.169 ***	.043	1.004 ***	.000
Dominican Republic	.932	.087	1.100	.105	.986	.045	.998 **	.001
Estonia	.856	.090	1.016	.095	1.094 *	.043	1.005 ***	.001
Finland	1.826 ***	.161	1.265 *	.138	1.097 *	.047	1.005 ***	.001

Countries	Female		Educational Goals		Home Literacy Resources		Civics & Citizenship Achievement	
	OR	S.E.	OR	S.E.	OR	S.E.	OR	S.E.
Hong Kong	.765 *	.080	.926	.115	1.036	.040	1.004 ***	.001
Italy	.798 **	.065	1.025	.099	1.173 ***	.044	1.004 ***	.001
South Korea	.942	.121	.902	.153	1.149 **	.055	1.005 ***	.001
Latvia	.855	.075	1.212	.123	1.112 *	.049	1.004 ***	.001
Lithuania	.618 ***	.056	1.432 *	.223	1.128 **	.049	1.005 ***	.001
Malta	.835	.096	1.378 ***	.126	1.128 **	.042	1.002 ***	.001
Mexico	.812 **	.054	1.040	.097	1.191 ***	.038	1.005 ***	.001
Netherlands	.844	.079	1.306 *	.144	1.099 *	.048	1.003 ***	.001
Norway	1.235 **	.083	1.210 *	.098	1.131 ***	.041	1.004 ***	.000
Peru	.849 *	.058	1.174	.107	1.060	.038	1.004 ***	.001
Russia	.789 **	.065	1.186	.162	1.051	.035	1.000	.001
Slovenia	.522 ***	.048	.850	.102	1.092 *	.049	1.006 ***	.001
Sweden	1.254 ***	.130	1.653	.226	1.146 *	.051	1.004 ***	.001

* $p < .05$, ** $p < .01$, *** $p < .001$

Note: Results reflect the full model which include female, educational goals, home literature resources, civic and citizenship achievement, learn to protect environment, environmental activities, environmental club, trust in UN, trust in national government, trust in local government, and trust in school.

When controlling for individual background characteristics (such as gender, student socio-economic status, and future educational goals), civic and citizenship knowledge is significantly related to student climate change risk perceptions in nearly all countries. The higher a student's score in civic and citizenship achievement, the more likely they are to perceive climate change as a large global threat (holding all other predictors constant). These findings mirror and add to scholarship that examined adult climate change risk perception, where level of education has been found to be a significant predictor (Kvaløy et al., 2012; Lee et al., 2015). The results also add to existing risk perception literature by demonstrating that the level of civic and citizenship knowledge is important in shaping climate change risk perceptions (holding aspirations for higher levels of education constant).

Learning, Experience, and Trust

Table 5 displays the main variables of interest for each country with regards to student learning, experience, and trust in institutions. The odds ratio (OR) and robust standard errors (S.E.) are listed for each variable in each country's logistic model. Overall, the final model results reveal the effect of learning and engaging in activities about the environment on perceptions of climate change concern vary by system in both significance and effect size.

Table 5

Comparison of Multilevel Logistic Models: Student Learning, Experience, and Trust with Perception of Climate Change as a Global Threat by Country

Countries	Learn to Protect Environment		Environmental Activities		Environmental Club		Trust in UN		Trust in National Government		Trust in Local Government		Trust in Schools	
	OR	S.E.	OR	S.E.	OR	S.E.	OR	S.E.	OR	S.E.	OR	S.E.	OR	S.E.
<i>Bulgaria</i>	1.027	.074	1.009	.106	.929	.099	1.264 *	.128	.780 *	.090	.991	.127	1.434 *	.210
<i>Chile</i>	1.031	.045	1.038	.085	.917	.071	1.196 *	.108	1.051	.101	.900	.085	1.151	.109
<i>Chinese Taipei</i>	1.081	.066	.919	.067	.943	.130	1.173	.113	.909	.119	.844	.102	.930	.091
<i>Colombia</i>	1.026	.064	1.042	.118	.960	.102	1.468 ***	.161	.847	.101	1.005	.135	1.414 **	.190
<i>Croatia</i>	1.139 *	.075	1.001	.099	1.095	.119	1.212	.161	.998	.114	.726 **	.079	1.126	.157
<i>Denmark</i>	1.174 ***	.046	1.162	.091	1.144	.131	1.429 ***	.158	.955	.099	.996	.108	1.229 *	.123
<i>Dominican Republic</i>	1.088	.066	.992	.103	.891	.093	1.403 *	.195	1.041	.146	1.138	.148	1.261	.205
<i>Estonia</i>	1.057	.068	1.031	.092	.833	.106	1.296 **	.126	.846	.093	1.076	.123	.783 *	.081
<i>Finland</i>	1.262 ***	.085	1.018	.114	.925	.170	1.389 *	.204	.800	.130	.930	.152	1.440 *	.227
<i>Hong Kong</i>	1.223 ***	.075	.976	.094	.894	.125	1.415 **	.185	.949	.131	.955	.128	1.065	.166
<i>Italy</i>	1.181 **	.070	.837 *	.075	1.249 *	.132	.978	.118	.921	.097	.928	.095	.931	.108
<i>South Korea</i>	1.145 *	.070	1.081	.102	.969	.124	.933	.118	1.309	.272	.897	.177	1.125	.131
<i>Latvia</i>	1.069	.062	.994	.104	.815	.086	1.435 ***	.144	.745 **	.084	1.049	.107	.837	.080
<i>Lithuania</i>	1.065	.067	.927	.074	.837	.077	1.414 **	.160	.746 *	.090	.922	.127	1.106	.131
<i>Malta</i>	1.182 ***	.060	1.119	.076	1.000	.106	1.532 ***	.142	.796 ***	.053	.867	.094	1.116	.108
<i>Mexico</i>	1.189 ***	.061	.859 *	.067	.998	.079	1.190 *	.091	.892	.089	1.089	.110	1.066	.098
<i>Netherlands</i>	1.140 *	.062	1.229 **	.127	1.483 *	.202	1.256 *	.161	.768 *	.096	1.265	.181	1.008	.128
<i>Norway</i>	1.157 ***	.043	.943	.067	1.127	.127	1.372 **	.148	1.112	.116	.851	.092	1.208 *	.102
<i>Peru</i>	1.143 **	.055	.914	.070	.868	.074	1.288 **	.105	.917	.079	.949	.086	1.142	.093
<i>Russia</i>	1.050	.048	1.010	.074	.984	.083	1.057	.100	.970 *	.168	1.124	.118	1.158	.103
<i>Slovenia</i>	1.077	.068	.989	.085	1.016	.095	1.146	.139	.781 *	.081	.863	.107	.999	.117
<i>Sweden</i>	1.230 *	.114	1.345	.232	1.254	.238	1.838 ***	.293	1.130	.213	.913	.178	.970	.114

* $p < .05$, ** $p < .01$, *** $p < .001$

Note: Results reflect the full model which include female, educational goals, home literature resources, civic and citizenship achievement, learn to protect environment, environmental activities, environmental club, trust in UN, trust in national government, trust in local government, and trust in school.

Learning and Participating in School. The effect of learning how to protect the environment significantly and positively increased the likelihood of student climate change risk perception in 12 out of 22 countries. By contrast, participating in environmentally friendly activities at school showed a significant effect on student risk perception of climate change as a global threat in only three countries (and the direction is mixed). In the Netherlands, students who report participating in environmental activities at school are 1.229 times more likely to perceive climate change as a global threat ($p < 0.01$), whereas students from Italy are 1.163 times less likely ($p < 0.05$) and in Mexico students are 1.141 times less likely ($p < 0.05$), holding other variables constant. Participation did not significantly increase the likelihood of elevated climate change concern in the other 19 countries.

Environmental Clubs. Only two of the surveyed countries had a significant and positive relationship with environmental club membership and perceptions of climate change risk. Students in the Netherlands who report being a member of an environmental action group or organization are 1.483 times more likely to recognize the global threat of climate change ($p < 0.05$), while such students in Italy are 1.249 times more likely ($p < 0.05$). For all other countries, club membership had no significant effect on student climate change risk perception.

Trust in Institutions. Three patterns emerged across countries on the relationship between student climate change risk perception and trust in institutions as sources of information. First, student trust in the UN has a strong positive relationship with increasing student likelihood to identify climate change as a large, global risk (trust in the UN was one of the strongest predictors in the model for 16 out of 22 countries). In Sweden, for example, students who have quite a lot or complete trust in the UN are 1.838 times more likely to be aware of the threat of climate change ($p < 0.001$).

Second, students from Bulgaria, Columbia, Denmark, Finland, and Norway are all positively and significantly more likely to recognize the global risk of climate change when they have higher levels of trust in schools as sources of information. By contrast, students in Estonia have a negative relationship, where the higher levels of trust in schools has a negative effect on climate change concern. These surprising results suggest that the role of trust in schools is important for building concern about climate change – but only in certain countries.

Third, higher levels of trust in national governments results in students being less likely to identify climate change as a large global threat. This finding was significant for Latvia, Lithuania, Malta, the Netherlands, Russia, and Slovenia. Overall, confidence in local – as opposed to national – governments had minimal or no statistically significant effect (except in Croatia where students are 1.274 times less likely to perceive climate change as a risk when they have high trust in local government).

Discussion and Conclusion

Solving the climate crisis requires meaningful changes in policy, society, and individual behavior (IPCC, 2018). Understanding public perceptions of the threat will help determine the best strategies to increase concern and spur people to act. Gaining a better understanding of youth climate change perceptions is essential given that today's young people will bear the brunt of climate change's impacts (and be responsible for addressing them). Increasing youth climate change concern will help forge future pathways toward collective action and policy support.

The goal of this study was to contribute to the literature by characterizing predictors that elevate youth climate change concern. Across the 22 countries assessed for this study, youth perceptions about climate change were uneven. Yet despite variations in perceptions and significant

factors, my analysis showed that student climate change concern can be heightened by increasing civic knowledge and trust in schools/international organizations. Indeed, four key findings emerged.

First, conventional curricular and co-curricular EE/ESE/ESD opportunities do not uniformly contribute to raising youth concern for climate change across contexts. This finding contrasts with previous EE/ESE/ESD research (e.g., Busch et al., 2019; Corner et al., 2015; Nisbet & Mooney, 2007; Stevenson et al., 2019) and arguments for the whole-school approach (e.g., Barr et al., 2014; Henderson & Tilbury, 2004; Mogren et al., 2019). A possible explanation for this result is that EE/ESE/ESD traditionally focuses on issues of waste management, pollution, and sustainability – as opposed to climate change (Aikens et al., 2016; UNESCO, 2019). More recently, however, calls for educational research to respond to the threat of climate change have advocated for CCE to be embedded in classrooms (Krasny & DuBois, 2019; Mochizuki & Bryan, 2015; UNESCO, 2019). In line with such a push, this study reveals potential limitations of conventional EE/ESE/ESD when efforts are not adequately linked to CCE and youth climate change awareness/risk perceptions.

Second, civic education increases student awareness of climate change as a global issue (even after controlling for all other factors). Civic education goes beyond EE/ESE/ESD limitations by providing opportunities for students to explore social issues, such as inequality and poverty, while also learning about the processes for engaging with these issues. Given this, civics curriculum – as opposed to EE/ESE/ESD – may potentially better align with the tools needed to address climate change (civics courses also work to increase political efficacy and civic engagement). Increased knowledge on civic participation and processes could heighten student awareness and concern about issues of climate change. Higher civics knowledge and greater civic engagement can also increase student trust in institutions (Jennings & Stoker, 2004). It is important to consider technical knowledge about the environment and climate change and also knowledge about civic action on how to address contemporary global issues. Further research on the different types of knowledge that can help improve overall approaches to EE/ESE/ESD and CCE should be conducted.

Third, trust in institutions as sources of information plays a key role in elevating or diminishing student acceptance, awareness, and concern about climate change. Notably, this result complements and expands upon prior research conducted within the climate change risk perception literature and discourse about the post-truth era (Chinn et al., 2020; Feinstein & Waddington, 2020; Peters, 2017; Poeck, 2019). Similar to studies on adults, increased institutional trust in national governments lowered the effect of risk perception of climate change (Smith & Mayer, 2018). These findings potentially indicate an over-trust of individuals where people can have such high trust in their national institutions' ability to address environmental issues that there is less of a need for them to perceive climate change as a large threat. Another possibility is that certain governments may downplay information about climate change, diminishing public concern about the threat. At the national and local levels, cultivating trust in schools as sources of information should be a high priority. Trust in schools is also important to raise awareness/concern and reduce skepticism about climate change (Ojala, 2015). Future research should consider additional mitigating factors between trust and climate change risk perceptions such as proximity to environmental events, political views of parents, and social media use.

Fourth, given that trust in the UN was shown to be a crucial factor in determining elevated levels of youth climate change threat perception, there exists a previously unaddressed need for educators to include an international/global focus to increase climate change awareness and concern. This finding, which runs counter to the common EE/ESD/ESE emphasis on localized issues, has significant implications for both how youth trust and gather information about climate change, as well as the ways in which they understand the international discourse addressing its

consequences. Future research should therefore explore how students gather information from different levels of institutions, and how that information shapes their perceptions of climate change.

Overall, this study has implications for research and practice in climate change education and policy makers at the global and local levels. My study is an essential contribution to the growing literature on youth perceptions about climate change by providing comparative evidence of youth climate change concern across 22 countries. I show that climate change concern could be elevated through increasing civic knowledge and trust in both schools and international organizations. Indicators of EE/ESE/ESD, however, are not as strongly associated with increasing concern about climate change among youth. Although attitudes about climate change are context specific, implementing efforts that address issues of trust among youth and providing interdisciplinary curricula about climate change should be given more attention.

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