J Urban Health (2017) 94:170–179
DOI 10.1007/s11524-017-0139-0

The Role of Social Influences on Pro-Environment Behaviors in the San Diego Region

Mica Estrada · P. Wesley Schultz · Nilmini Silva-Send · Michel A. Boudrias

Published online: 6 March 2017

Abstract From a social psychological perspective, addressing the threats of climate change involves not only education, which imparts objective facts upon a passive individual, but also a socializing process. The Tripartite Integration Model of Social Influence (TIMSI) provides a theoretical framework that connects acquiring climate change knowledge with integration into a community, which results in greater engagement in climate friendly behaviors. Survey data were collected from 1000 residents in San Diego County. Measures included (a) knowledge about climate change; (b) *self-efficacy*, what pro-environmental actions they felt they could do; (c) *identity*, to what extent they identified as part of a community that is concerned about climate change; (d) *values*, endorsement of values of the community that is concerned about climate change; and (e) *pro-environmental behavior*, engagement in conservation behaviors. Results indicated that self-efficacy and values mediated the relationship between knowledge and pro-environmental behavior.

Keywords Social influence · Climate change education · Efficacy · Environmental identity · Values

M. Estrada (✉)
Department of Social & Behavioral Sciences, Institute for Health Aging, School of Medicine, University of California San Francisco, 3333 California Street, Suite 340, San Francisco, CA 94118-0646, USA
e-mail: mica.estrada@ucsf.edu

P. W. Schultz
Department of Psychology, California State University San Marcos, San Marcos, CA, USA

N. Silva-Send · M. A. Boudrias
Department of Environmental and Ocean Sciences, College of Arts and Sciences, University of San Diego, San Diego, CA, USA

Introduction

Over the past 10 years, average global temperatures have consistently exceeded the long-term average temperatures found in the past 10,000 years of human history [1]. The impacts on urban environments include increases in health risk, infrastructure strains, and economic hardship. This shift in temperature can be attributed to human behaviors such as burning of fossil fuels, deforestation practices, and a large variety of other carbon dioxide producing behaviors [2]. While climate scientists strongly agree on the facts of climate change and even on some of the solutions to mitigate the emerging threat, the US citizens regularly choose behaviors that favor the use of fossil fuels for their daily needs over the welfare of the global population and future generations. In short, the science is clear, yet many people continue to consume energy in unsustainable ways that results in negative impacts to health and well-being.

Increasingly, educators, scientists, policy analysts, and community practitioners are working to increase climate change literacy and identify interventions that will increase engagement in behaviors that reduce their carbon footprint [2–3]. While infrastructures regarding

transportation and recycling can influence engagement [4–5], research suggests that reasonably achievable emissions reduction could be 20% in the US household sector over the next 10 years [6] if people were willing to modify their behaviors. The key to manifesting such behavioral shifts may require modifying current climate change education approaches to include behavioral science informed practices that increase motivation, shift personal and social norms, and integrate people into communities that care about climate change [7–8]. Social psychological research and theory can potentially contribute towards more effective methods for addressing the challenges of global climate change [9–12]. The research described in this paper utilizes a social influence model to provide a different lens through which to understand climate change education.

Traditional Science-Based Climate Change Education

Traditional approaches to climate change education have focused primarily on K-12 science curriculum and informal education for the general public at zoological gardens, museums, and aquaria. While teaching climate science has the goal of imparting *facts* regarding climate change [13], there is little evidence that traditional climate change education alone results in increased engagement in pro-environmental *behaviors*, especially among adults [14]. Similarly, information campaigns designed to impact the general population show outcomes wherein people do not consistently engage in the encouraged pro-environmental behaviors despite increased knowledge [15–16].

Knowledge Deficit Model

The traditional approach to climate change education has been built upon the *knowledge deficit model* where increased knowledge results in positive behavioral changes [17]. Schultz [17] argues that this model is not a strong framework to promote pro-environmental behaviors. Findings from experimental research show that providing information alone does not directly cause changes in behavior [18–19], even though people will often self-report that the information changed their behavior [20]. More nuanced discussions of this literature contend that the lack of strong relationship between knowledge acquisition and engagement in pro-environmental behavior is an artifact of the *type* of information taught [21]. While knowledge is a necessary precondition for individual action, it is essential to recognize *how* science knowledge can result in engagement in pro-environmental action [22].

Social Influence

There is abundant evidence that social influence research is relevant to and informative in increasing engagement in pro-environmental behaviors [23]. From a social psychological perspective, climate change education is not an objective imparting of facts upon a passive individual but a socializing process. Climate change education potentially shifts not only knowledge about scientific facts and processes but also provides information that can impact the efficacy, identity, and value system of those being educated. In this way, acquiring climate change knowledge can be seen as one variable in a social influence model that results in a person feeling more integrated into a community that is concerned about climate change. This framing differs from the existing theory of planned behavior (TPB), which shows that attitudes, perceived social norms, and perceived behavioral control predict intentions and then engagement in pro-environmental behavior [24]. Our theory also differs from value-belief-norm model (VBN), which predicts that values lead to beliefs (or attitudes) which then predict behaviors [25–26]. The TPB and VBN set individuals as independent actors, positing that effective education successfully shifts the individuals' attitudes and beliefs, but these theories do not articulate the impact of shifting their social placement and relationship to a community concerned about climate change.

While not utilized previously in the environmental psychology field, the Tripartite Integration Model of Social Influence (TIMSI) [27] provides a theoretical framework to understand how climate change science knowledge can result in people engaging in the behavioral norms common to those concerned about climate change. The primary components of this model are derived from Kelman's classic social influence work in which there is an influencing agent and a target of influence [28–31]. In the context of climate change education, the influencing agents are representatives or members of the community concerned about climate change such as concerned educators, scientists, or other citizens who seek to inform and educate people about climate change. This community is an *opinion-based community* that has no strict boundaries or definition but

is "psychologically meaningful, in a sense suggested by self-categorization theory" [32]. Members see themselves as collectively defined and adhere to the norms of that group usually related to positive social change. The targets of influence are potential and current persons of the larger community.

TIMSI Model Components in Environmental Psychology

In the proposed TIMSI model, climate change education is added such that science knowledge acts as a catalyst for integrating individuals into a community of citizens who care about the impacts of climate change. Following this educational TIMSI model (E-TIMSI), individuals integrate to the extent that they gain science knowledge in a way that increases *efficacy*, *identity*, and *values* [27] (please see Fig. 1). Previous research shows that these measures of integration predict short- and long- term engagement in the normative behaviors of the community to which the person feels integrated. Those results suggest that persons integrated into a community concerned about climate change would be more likely to engage in the behavioral norms of that community, which may include a variety of conservation behaviors. Thus, efficacy, identity, and values should mediate the relationship between climate science knowledge and engagement in pro-environmental behaviors. Science knowledge does not inherently lead to an increase in efficacy, identity, or values but to the extent that these accompany knowledge, it would increase a person's integration into a community.

Efficacy One of the widely studied social psychological predictors of individual engagement in behaviors is self-efficacy [33] Bandura [33]. described self-efficacy as "the belief in one's capabilities to organize and execute courses of action required to produce given attainments" (p. 3). In diverse settings, a person's self-appraisal of ability strongly predicts that person's likelihood of performing those actions in the future [34]. Self-efficacy differs from response efficacy, which assesses the extent to which a person feels their action will reduce larger threats such as mitigate climate change [35] and is similar to the TPB construct of perceived behavioral control. In the context of the TIMSI model, when a person believes that they can do what a community requests or expects of their members (i.e., efficacy), a person is more likely to feel integrated into the community [27].

In the environmental psychology field, efficacy is sometimes measured as perceived competency. For instance, Gifford and Comeau [36] asked questions such as "I feel able to meet the challenge of controlling the greenhouse gases that I am responsible for" (p. 1303). Efficacy has also been measured directly and in relation to knowledge and has been found to be positively associated [37], suggesting that when people know the science, they are more likely to also feel they can do something to mitigate or adapt to the changing climate. In addition, there is evidence that efficacy and engagement in pro-environmental behaviors are positively associated [38–39] and last across time [40]. Previous research measuring perceived control would suggest that efficacy should mediate the relationship between knowledge and engagement, as the E-TIMSI model would predict [41].

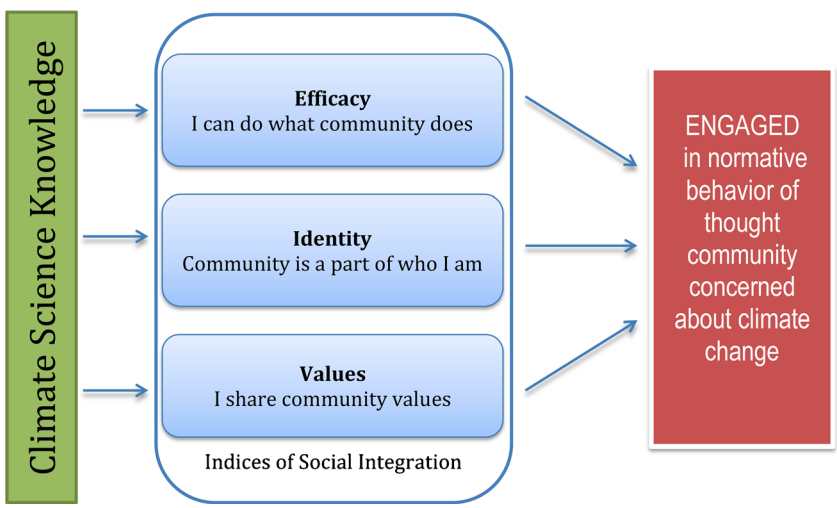

Fig. 1 Educational tripartite integration model of social influence (E-TIMSI)

Identity In TIMSI, identification occurs when "an individual accepts influence from another person or a group in order to establish or maintain a satisfying self-defining relationship to the other" (pp. 3–4) [31]. A person is most likely to do this when they share a social identity or self-concept, with that relevant group or other [42]. In short, identity is the way in which people socially define themselves [43]. Research on identity from environmental psychology is plentiful, but the definition of identity is not consistent. Some research has focused on *environmental self-identity*, defined as the extent to which a person self-defines or labels themselves as being the type of person who engages in pro-environmental behaviors [44]. This approach differs from the study of *environmental identity*, which has been conceptualized as a level of connection a person has to the environment [19, 45, 46].

Less research has been conducted on identities such as being a member of a *community* concerned about climate change [46]. This type of identity involves being a part of an opinion-based community rather than an organized group. Kelman and Hamilton [47] suggest that to maintain good group status, people comply with the norms of that group as long as their group identity is relevant to the situation. Specific research on identification with the community that is concerned about climate change has not yet been tested to assess if climate change knowledge significantly relates to stronger identity resulting in greater engagement in pro-environmental behaviors.

Values The research and theoretical models involving values as a predictor of engagement in pro-environmental behaviors are plentiful [25, 48, 49]. Unlike identity, which delineates an association with a particular entity, values can operate independently within a person. Schwartz [50] describes values as "a guiding principle in the life" (p. 521). Kelman [31] describes a process of internalization, which occurs when "an individual accepts influence from another in order to maintain the congruency of actions and beliefs with his or her own value system" (p. 4). That is, a person integrated into a community complies with the norms of a community because they reflect that person's own internalized value system (which is shared with the larger community). Given this conception of values, one would hypothesize that values predict engagement in the normative behaviors of a community.

Evidence exists that values strongly predict pro-environmental actions, although there are different theoretical models describing how values relate to engagement. Schultz and Zelezny's [51] early work showed that values, particularly Schwartz' self-transcendent values, were central to predicting engagement in pro-environmental behavior. For example, De Groot and Steg [52] empirically showed how these different value orientations related to motivations to engage in pro-environmental actions, while Bolderdijk et al. [53] found that biospheric values in particular predisposed persons to utilize environmental information.

Whether broadly defined or more narrowly focused, these environmental values differ from the values measured in the TIMSI model, in which community members define the core beliefs of their group. When a person knows more about climate change, they may strengthen their values shared with a community concerned about climate change impacts and theoretically be more likely to engage in the behaviors that community promotes. Outside of environmental psychology, there is some evidence that this does occur [27]. However, how internalizing the values of a community concerned about climate change relates to science knowledge and engagement in pro-environmental behavior has not yet been studied.

Overview

The current study tests the E-TIMSI model in the context of climate change education. The model suggests that climate science knowledge can result in shifts in efficacy, identity, and values. For example, if people know that CO_2 levels lead to climate change and this results in them feeling more able to act to reduce CO_2 in their lives by taking public transportation, then efficacy would increase. If people become aware of the impacts to their environment, then they will be more likely to be concerned and identify as a part of the community concerned about climate change. And finally, knowing local sea level and tides are rising could result in greater valuing of the planet and the well-being of future generations. This study also examines if to the extent that efficacy, identity, and values increase (indices of integration) individuals will also be more likely to engage in the normative pro-environmental behaviors of the community concerned about climate change. And finally, this research examines the extent to which efficacy, identity, and values independently mediate the relationship between climate knowledge and engagement in

pro-environmental behaviors. The full model suggests that these three variables are indices of integration into a community concerned about climate change, which results in higher level of engagement in the normative behaviors of that group.

Methods

Participants

A telephone survey of 1000 San Diego County (California, USA) residents was conducted in the fall of 2011. Adult participants included a 50% male/female split. The sample self-identified (sometimes indicating more than one category) as Caucasian (58%), Asian (9%), Latinos/Hispanic (28%), African-American (6%), and Native American (2%). The median age of participants ranged from 48 to 52, and the median household income was between US$50,000 and US$74,999. Among those who stated a political affiliation (60%), participants were slightly more likely to report democratic affiliation (29%) than republican (21%). The median education level included some college or junior college education and was representative of the county.

Measures

The survey contained questions regarding (a) climate change knowledge, which included science facts as well as awareness of potential local impacts due to climate change in the next 40 years; (b) efficacy, which assessed perceived ability to engage in mitigation and adaptive behaviors, including both energy saving activities and political gestures; (c) level of identification with the community concerned about climate change in San Diego; (d) endorsement of values related to preserving San Diego's land, water, and resources for the next generation; and (e) actual current engagement in conservation behaviors. A brief description of each measure is provided in the following section.

Climate Change Knowledge This measure was created for this study by climate scientists from the Scripps Institution of Oceanography, University of California San Diego, and climatologists and oceanographers from the University of San Diego. Questions were pilot tested with a convenience sample to assess clarity and psychometric properties. Eleven questions that pertained to both general climate science knowledge and knowledge of climate change impacts on San Diego County were kept. General knowledge was assessed with items, such as "The rise in carbon dioxide in the atmosphere is a major cause of temperatures rising globally," in which responses ranged from one (*not true*) to six (*absolutely true*). These knowledge questions demonstrated high internal consistency ($\alpha = 0.90$). The impacts of climate change were assessed with items, such as "Projected climate change in the next 40 years will result in severe water shortage," with responses on a scale from one (*not true*) to six (*absolutely true*). These items also showed a high degree of internal consistency ($\alpha = 0.91$). Both knowledge constructs were combined ($\alpha = 0.91$) to form a mean knowledge scale score that was utilized in the analyses. The science knowledge measure was "constructed to measure what people know about climate science" and did not ask what they believed [54].

Environmental Self-Efficacy This eight-item measure was created to assess the participants' confidence in their ability to perform diverse, pro-environmental activities. Items were developed with the input of local energy policy experts at the University of San Diego to include individual behaviors that have high impact in lowering carbon dioxide emissions. The scale included items, such as to what extent do you feel you can "intentionally reduce electricity use in your home" or "walk or bicycle to places near your home" measured on a scale from one (*definitely cannot*) to six (*absolutely can*). Efficacy items showed internal consistency ($\alpha = 0.75$). Items were averaged to create an efficacy scale score.

Identification The purpose of this item was to assess to what extent a person identified with the opinion-based community of people concerned about climate change. Participants were asked, "Would you say you identify yourself as part of the local community that is concerned about climate change?" with responses ranging from one (*absolutely NOT a part of that community*) to six (*absolutely a part of that community*).

Community Values Because no existing scale was available to measure concerned community values, this eight-item scale was developed by a group of San Diego experts (from the Climate Education Partners, San

Diego Region) concerned about climate change. Items were validated in a pilot study where concerned and non-concerned citizens rated the extent to which they endorsed a list of values. Using the question-response structure of the Portrait Value Questionnaire [50], participants were asked to think about "how much each person is or is not like you" in response to items, such as "a person who values preserving the earth's resources for the next generation" and "a person who believes it is valuable to the community to prepare a new generation of climate scientists, engineers, and technicians." Response options ranged from one (*not like you at all*) to six (*very much like you*). Community value items showed internal consistency ($\alpha = 0.91$). Items were averaged to create a value scale score.

Pro-Environmental Behavior Engagement in pro-environmental behavior was assessed using two questions: In the past two weeks how often have you "used public transportation" or "intentionally reduced electricity used in your home," measured on a scale from one (*not at all*) to seven (*all the time*). The items had sufficient internal consistency ($\alpha = 0.61$) and were averaged together to create a composite pro-environmental behavior measure.

Procedure

A private polling company was utilized to collect the data for this study. A random digit dialing sampling procedure was used to reach both cell phone and landline numbers. The survey was offered in either English or Spanish to a representative sample of San Diego County residents 18 years and older and took approximately 20 min to complete.

Results

Initial analyses were conducted to assess the attributes of our measures. Means ranged from 3.76 ($SD = 1.89$) for identity to 5.24 ($SD = 1.83$) for pro-environmental behavior. All variables were significantly related to each other (see Table 1). The weakest relation was between knowledge and engagement in pro-environmental behavior ($r = 0.17$, $p < .01$). The strongest relation was between knowledge and values ($r = 0.75$, $p < .01$). Efficacy, identity, and values were all strongly related to each other ($r = 0.43$–0.62, $p < .01$). Having established basic correlations, the mediation analysis was run.

Table 1 Correlation matrix of predictor, mediators, and outcome variables

Variables	Knowledge	Efficacy	Identity	Values	Behavior
Knowledge	–				
Efficacy	0.44**	–			
Identity	0.63**	0.43**	–		
Values	0.75**	0.47**	0.62**	–	
Behavior	0.17**	0.31**	0.19**	0.26**	–

**$p < .01$ (two tailed)

Mediation Analysis

We posited a parallel multiple mediator model [55] to test the influence of science knowledge on pro-environmental behavior directly as well as indirectly through efficacy, identity, and values. To conduct the statistical analyses, we used the PROCESS macro for SPSS [55]. Figure 2 displays the results. As expected, results showed that knowledge was significantly associated with behavior ($b = 0.27$, $t(995) = 5.53$, $p < .001$). In addition, knowledge was found to be significantly predictive of all three proposed mediators: efficacy ($b = 0.41$, $t(995) = 15.27$, $p < .001$), identity ($b = 1.02$, $t(995) = 25.37$, $p < .001$), and values ($b = .78$, $t(995) = 36.14$, $p < .001$). Two of the proposed mediators, efficacy ($b = 0.43$, $t(992) = 7.34$, $p < .001$) and values ($b = 0.33$, $t(992) = 4.52$, $p < .001$), were significantly predictive of behavior; however, identity did not predict behavior ($b = 0.01$, $t(992) = 0.29$, $p = .77$). The effect of knowledge on behavior was lessened but remained significant ($b = -0.17$, $t(995) = -2.28$, $p = .02$) when controlling for the proposed mediators. Interestingly, the positive effect for the c path and negative effect for the c' path indicate inconsistent mediation [56]. A bias-corrected 95% confidence interval for the total indirect effect based on 1000 bootstrap samples was entirely above zero, ranging from 0.3177 to 0.5589. This indicates statistical significance of the indirect effect of knowledge on behavior through the mediators. The indirect effects of efficacy (0.17) and values (0.26) had confidence intervals entirely above zero, 95% CI = (0.1197; 0.2324) and 95% CI = (0.1334; 0.3862), respectively; however, this was not the case for identity (95% CI = (−0.0681; 0.0844). The full model explained

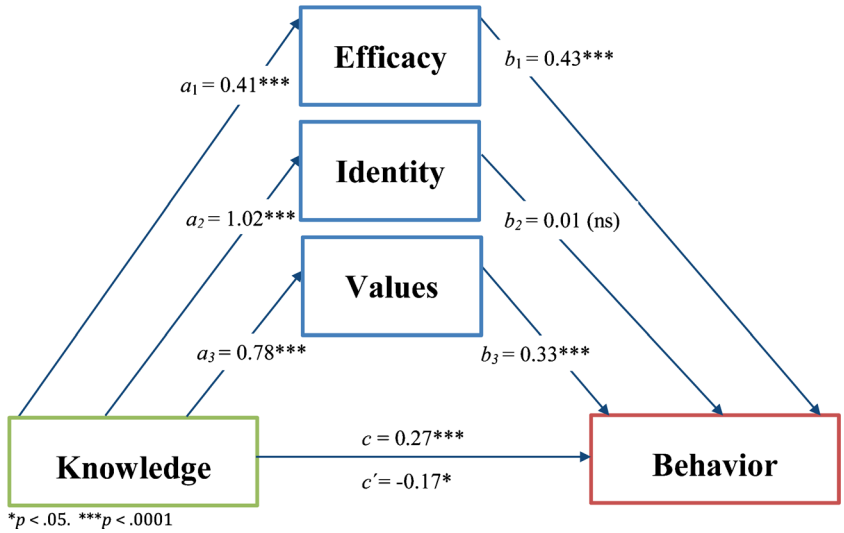

Fig. 2 Parallel multiple mediator model

12% of the variance in behavior ($F(4992) = 33.56$, $p < .001$, $R^2 = 0.12$).

Discussion

Our findings demonstrate that viewing climate change education through a social psychological lens may be useful and theoretically supported if the goal of that education is to increase engagement in pro-environmental behaviors. These results inform our understanding of the knowledge deficit model and future research. First, correlational analyses showed that while all variables—climate change knowledge, efficacy, identity, and values—all significantly related to engagement in pro-environmental behaviors, the psychosocial measures of integration had stronger relations than did science knowledge. The high correlations among the constructs is consistent with previous research on the TIMSI model, which has shown high collinearity when constructs are measured at one time but have different predictive values when assessing longer-term behavioral engagement [27]. Mediation analysis tells a more nuanced story, however. Specifically, mediation analysis showed that efficacy and values uniquely mediated the relationship between climate change knowledge and engagement activity signifying that climate science knowledge that is accompanied by increases in efficacy and values may be most effective for increasing engagement in pro-environmental behaviors.

Revisiting the Knowledge Deficit Model

Findings from this study are consistent with previous research showing that climate change knowledge relates to engagement in pro-environmental behavior. The findings are also consistent with research that extends beyond the classic assumption that learning scientific facts about climate change will automatically lead to pro-environmental behaviors. As shown in prior research [5, 9, 17], when people decide to engage in pro-environmental behaviors, a variety of intervening variables need to be considered. For instance, while a person may know that turning down the heat helps lower carbon emissions, the blustery weather outside may deem that behavior to be perceived as difficult to do (i.e., decreased efficacy) if the person wants to avoid being cold. Our study suggests that considering how science knowledge may impact how people integrate into a community might also be worthy of consideration. This supports previous findings suggesting that a sole focus on increasing climate science factual knowledge may not be the strongest method by which to promote pro-environmental behaviors. Kahan et al. [57] found that cultural worldview, rather than science literacy, predicted concern about climate change. This study adds to the body of research that utilizes theoretical frameworks to understand when and why climate education may result in greater engagement in pro-environmental behaviors. Specifically, this study suggests that shifts in social placement and relationship to a community concerned about climate change may be relevant to consider when thinking about what constitutes effective education.

Mediation Result Implications for Education

Overall, these findings suggest that climate change education may be strengthened by intentionally showing how climate knowledge links to increases in efficacy, identity, and values—indices of integration. For instance, to increase efficacy, activities and information could demonstrate how a person can engage in activities that reduce carbon dioxide emissions in their daily life. To increase identity, educational materials could provide information about how the individual's local community may be impacted—switching from "them" to "us" as those most affected. Also, highlighting how a person is not alone in caring about climate change and that an inclusive community exists could help to increase feelings of belongingness—which is highly associated with developing identification with a group [58–59]. Last, explicitly describing how caring about climate change is directly related to core values, such as preserving a healthy environment for the next generation, may make the science more relevant and motivational. Further research is needed to examine the effectiveness of these sorts of educational shifts, particularly within the context of urban environments.

Not All Are Created Equally

The results of the meditation analysis revealed that while efficacy and values strongly and independently predicted engagement, identity did not. This is rather surprising given the literature suggesting that identity is often strongly related to engagement [45]. Two explanations could account for this discrepancy. First, the measure we used for identity was not similar to environmental self-identity measures that focus specifically on being the type of person who engages in a specific task [44]. Nor was our measure similar to environmental identity measures that examine a person's connection to nature [19–46]. The measure used in our study specified how much a person identifies with the community that cares about climate change. Thus, this type of identity may draw different results from previous environmental psychology research. Second, similar to the TIMSI research conducted with science students integrating into a scientific community [27], we may be identifying a variable that does not uniquely discriminate those who do or do not engage in pro-environmental behavior. The key variables for determining engagement may be whether people feel they can engage in pro-environmental behaviors and whether they hold values consistent with a community that cares about climate change. This suggests that a person feeling they are the type of person who cares about climate change is not the unique determining factor. This does not, however, mean it is non-consequential. In fact, the correlational results show that it is significantly related to engagement. However, when developing climate change education materials for adults, there may be advantages to assuring that efficacy and values are emphasized.

A strength of this study is its large sample size. The polling data were representative of San Diego but may not be generalizable. We also acknowledge that these results are drawn from a cross-sectional analysis, and thus, we can only infer the directionality of the relationships. However, the hypothesized relationships predicted by E-TIMSI exist and future longitudinal and experimental research is needed to confirm the directionality and sustainability of these relationships.

Conclusion

As a first test of E-TIMSI, results suggest that this social integration model may be relevant and informative for the development of effective educational activities about climate change for adults. The findings suggest several causal connections that would benefit from future experimentation to verify the temporal nature of the E-TIMSI model and the causal relationships predicted by it. This study was a useful first step in bringing forward a classic social influence model and making it relevant to the great challenges we face in the twenty-first century with regard to climate change education.

Acknowledgements This study was conducted as a part of the Climate Education Partners—San Diego Region research program and was funded by the National Science Foundation's Climate Change Education Partnership Phase 2 grant (Award Number DUE–1239797). We want to acknowledge with gratitude contributions of Steve Alexander, Scott Anders, Alexander Gershunov, Nicola Hedge, Zhi-Yong Yin, Emily Young, Sharon Danoff-Burg, and Christiana DeBenedict on the execution of this project.

References

1. Intergovernmental Panel on Climate Change. Climate change 2014: synthesis report. Contribution of working groups I, II and III to the fifth assessment report of the Intergovernmental Panel on Climate Change. IPCC; 2014.

2. National Research Council. *Adapting to the Impacts of Climate Change*. Washington, DC: The National Academies Press; 2010.
3. Spence A, Pidgeon N, Uzzell D. Climate change—psychology's contribution. *Psychologist*. 2009; 21: 108–111.
4. Bulkeley H, Betsill MM. *Cities and Climate Change: urban Sustainability and Global Environmental Governance*. Vol 4: Psychology Press; 2005.
5. Steg L, Vlek C. Encouraging pro-environmental behaviour: an integrative review and research agenda. *J Environ Psychol*. 2009; 29(3): 309–317.
6. Dietz T, Gardner GT, Gilligan J, Stern PC, Vandenbergh MP. Household actions can provide a behavioral wedge to rapidly reduce US carbon emissions. *Proc Natl Acad Sci*. 2009; 106(44): 18452–18456.
7. Ajzen I. From intentions to actions: a theory of planned behavior. Action control: Springer; 1985. p. 11–39.
8. Stern PC, Dietz T, Abel TD, Guagnano GA, Kalof L. A value-belief-norm theory of support for social movements: the case of environmentalism. *Hum Ecol Rev*. 1999; 6(2): 81–97.
9. Schultz PW. Strategies for promoting proenvironmental behavior. Eur Psychol. 2014.
10. Stern PC. Contributions of psychology to limiting climate change. *Am Psychol*. 2011; 66(4): 303.
11. Swim JK, Clayton S, Howard GS. Human behavioral contributions to climate change: psychological and contextual drivers. *Am Psychol*. 2011; 66(4): 251.
12. Swim JK, Markowitz EM, Bloodhart B. Psychology and climate change: beliefs, impacts, and human contributions. In: Clayton SD, ed. *The Oxford Handbook of Environmental and Conservation Psychology*. New York, NY: Oxford University Press; 2012.
13. Beatty A. *Climate Change Education in Formal Settings, K-14: a Workshop Summary*. National Academies Press; 2012.
14. Forest S, Feder MA. *Climate Change Education: goals, Audiences, and Strategies: a Workshop Summary*. National Academies Press; 2011.
15. Geller ES, Erickson JB, Buttram BA. Attempts to promote residential water conservation with educational, behavioral and engineering strategies. *Popul Environ*. 1983; 6(2): 96–112.
16. Staats H, Wit A, Midden C. Communicating the greenhouse effect to the public: evaluation of a mass media campaign from a social dilemma perspective. *J Environ Manag*. 1996; 46(2): 189–203.
17. Schultz PW. Knowledge, education, and household recycling: examining the knowledge-deficit model of behavior change. In: Dietz T, Stern PC, eds. *New Tools for Environmental Protection: Education, Information, and Voluntary Measures*. Washington, DC: The National Academies Press; 2002: 67–82.
18. Schultz PW. Changing behavior with normative feedback interventions: a field experiment on curbside recycling. *Basic Appl Soc Psychol*. 1999; 21(1): 25–36.
19. Schultz P, Tabanico J. Self, identity, and the natural environment: exploring implicit connections with nature. *J Appl Soc Psychol*. 2007; 37(6): 1219–1247.
20. Nolan JM, Schultz PW, Cialdini RB, Goldstein NJ, Griskevicius V. Normative social influence is underdetected. *Personal Soc Psychol Bull*. 2008; 34(7): 913–923.
21. Kaiser FG, Roczen N, Bogner FX. Competence formation in environmental education: advancing ecology-specific rather than general abilities. 2008.
22. Kaiser FG, Fuhrer U. Ecological behavior's dependency on different forms of knowledge. *Appl Psychol*. 2003; 52(4): 598–613.
23. Göckeritz S, Schultz P, Rendón T, Cialdini RB, Goldstein NJ, Griskevicius V. Descriptive normative beliefs and conservation behavior: the moderating roles of personal involvement and injunctive normative beliefs. *Eur J Soc Psychol*. 2010; 40(3): 514–523.
24. Ajzen I. The theory of planned behavior. *Organ Behav Hum Decis Process*. 1991; 50(2): 179–211.
25. Stern PC. New environmental theories: toward a coherent theory of environmentally significant behavior. *J Soc Issues*. 2000; 56(3): 407–424.
26. Milfont TL, Duckitt J, Wagner C. A cross-cultural test of the value-attitude-behavior hierarchy. *J Appl Soc Psychol*. 2010; 40(11): 2791–2813.
27. Estrada M, Woodcock A, Hernandez PR, Schultz P. Toward a model of social influence that explains minority student integration into the scientific community. *J Educ Psychol*. 2011; 103(1): 206.
28. Cialdini RB, Trost MR. Social influence: social norms, conformity and compliance. In: Gilbert DT, Fiske ST, Lindzey G, eds. *The Handbook of Social Psychology*, vol. 2. 4th ed. New York, NY: McGraw-Hill; 1998: 151–192.
29. Kelman HC. Compliance, identification, and internalization: a theoretical and experimental approach to the study of social influence. 1956.
30. Kelman HC. Compliance, identification, and internalization: three processes of attitude change. J Confl Resolut. 1958: 51–60.
31. Kelman HC. Interests, relationships, identities: three central issues for individuals and groups in negotiating their social environment. *Annu Rev Psychol*. 2006; 57: 1–26.
32. Thomas EF, McGarty C, Mavor KI. Aligning identities, emotions, and beliefs to create commitment to sustainable social and political action. *Personal Soc Psychol Rev*. 2009; 13(3): 194–218.
33. Bandura A. *Self-efficacy: the exercise of control*. New York: Freeman; 1997.
34. Bandura A, Locke EA. Negative self-efficacy and goal effects revisited. *J Appl Psychol*. 2003; 88(1): 87.
35. Lam S-P. Predicting intention to save water: theory of planned behavior, response efficacy, vulnerability, and perceived efficiency of alternative solutions. *J Appl Soc Psychol*. 2006; 36(11): 2803–2824.
36. Gifford R, Comeau LA. Message framing influences perceived climate change competence, engagement, and behavioral intentions. *Glob Environ Chang*. 2011; 21(4): 1301–1307.
37. Meinhold JL, Malkus AJ. Adolescent environmental behaviors: can knowledge, attitudes, and self-efficacy make a difference? *Environ Behav*. 2005; 37(4): 511–532.
38. Hines JM, Hungerford HR, Tomera AN. Analysis and synthesis of research on responsible environmental behavior: a meta-analysis. *J Environ Educ*. 1987; 18(2): 1–8.

39. Spence A, Poortinga W, Butler C, Pidgeon NF. Perceptions of climate change and willingness to save energy related to flood experience. *Nat Clim Chang*. 2011; 1(1): 46–49.
40. Milfont TL. The interplay between knowledge, perceived efficacy, and concern about global warming and climate change: a one-year longitudinal study. *Risk Anal*. 2012; 32(6): 1003–1020.
41. Bamberg S, Möser G. Twenty years after Hines, Hungerford, and Tomera: a new meta-analysis of psycho-social determinants of pro-environmental behaviour. *J Environ Psychol*. 2007; 27(1): 14–25.
42. Turner JC, Oakes PJ. The significance of the social identity concept for social psychology with reference to individualism, interactionism and social influence. *Br J Soc Psychol*. 1986; 25(3): 237–252.
43. Cook AJ, Kerr GN, Moore K. Attitudes and intentions towards purchasing GM food. *J Econ Psychol*. 2002; 23(5): 557–572.
44. Van der Werff E, Steg L, Keizer K. The value of environmental self-identity: the relationship between biospheric values, environmental self-identity and environmental preferences, intentions and behaviour. *J Environ Psychol*. 2013; 34: 55–63.
45. Clayton SD. *Identity and the Natural Environment: the Psychological Significance of Nature*. Mit Press; 2003.
46. Clayton SD. Environment and identity. In: Clayton S, ed. *The Oxford Handbook of Environmental and Conservation Psychology*. New York, NY: Oxford University Press; 2012: 164–180.
47. Kelman HC, Hamilton VL. *Crimes of Obedience*. New Haven: Yale University Press; 1989.
48. Clark CF, Kotchen MJ, Moore MR. Internal and external influences on pro-environmental behavior: participation in a green electricity program. *J Environ Psychol*. 2003; 23(3): 237–246.
49. Steg L, de Groot JI. Environmental values. In: Clayton SD, ed. *The Oxford Handbook of Environmental and Conservation Psychology*. New York, NY: Oxford University Press; 2012: 81–92.
50. Schwartz SH, Melech G, Lehmann A, Burgess S, Harris M, Owens V. Extending the cross-cultural validity of the theory of basic human values with a different method of measurement. *J Cross-Cult Psychol*. 2001; 32(5): 519–542.
51. Schultz PW, Zelezny LC. Values and proenvironmental behavior: a five-country survey. *J Cross-Cult Psychol*. 1998; 29(4): 540–558.
52. De Groot JI, Steg L. Relationships between value orientations, self-determined motivational types and pro-environmental behavioural intentions. *J Environ Psychol*. 2010; 30(4): 368–378.
53. Bolderdijk JW, Gorsira M, Keizer K, Steg L. Values determine the (in) effectiveness of informational interventions in promoting pro-environmental behavior. *PLoS One*. 2013; 8(12): e83911.
54. Kahan DM. Climate science communication and the measurement problem. *Polit Psychol*. 2015; 36(S1): 1–43.
55. Hayes AF. *Introduction to Mediation, Moderation, and Conditional Process Analysis: a Regression-Based Approach*. Guilford Press; 2013.
56. MacKinnon DP, Fairchild AJ, Fritz MS. Mediation analysis. *Annu Rev Psychol*. 2007; 58: 593.
57. Kahan DM, Peters E, Wittlin M, et al. The polarizing impact of science literacy and numeracy on perceived climate change risks. *Nat Clim Chang*. 2012; 2(10): 732–735.
58. Baumeister RF, Vohs KD. *Self and Identity*, vol. I–V. Thousand Oaks, CA: SAGE; 2012.
59. Tajfel H, Turner JC. The social identity theory of intergroup behavior. 2004.