Studies in Educational Evaluation xxx (2013) xxx–xxx

Contents lists available at ScienceDirect

Studies in Educational Evaluation

journal homepage: www.elsevier.com/stueduc

The importance of connection to nature in assessing environmental education programs

Cynthia McPherson Frantz *, F. Stephan Mayer

Department of Psychology, Oberlin College, United States

ARTICLE INFO

Article history:
Received 31 May 2013
Received in revised form 30 September 2013
Accepted 3 October 2013

Keywords:
Connectedness to nature
Assessment
Environmentally responsible behavior
Electricity use
Environmental education

ABSTRACT

Environmental education imparts knowledge and creates experience to change beliefs, attitudes – and most importantly – behavior. What are the deep motivators of human behavior? Theory and research suggest that feeling connected to someone or something motivates protective and self-sacrificing behavior. This paper reviews the large body of research demonstrating that connectedness to nature is an important predictor of environmentally responsible behavior. We review past research on self-reported behavior, then summarize new research from our lab that demonstrates a link between connectedness to nature and actual conservation behavior (electricity use). We conclude that promoting connectedness to nature should be a goal for environmental education programs, and should therefore be an important part of any assessment.

Planet Earth is heading toward climate destabilization, and the window of opportunity to avert it is narrowing rapidly (IPPC, 2013). Technology and scientific knowledge are not the limiting factors in responding to this crisis. Rather, humans' ability to change their political and economic systems, as well as their choices and lifestyle, will determine whether we respond in time. People at all levels need to change their behavior: elected officials in the laws they promote, corporate CEOs in the practices they adopt, individual voters in the candidates they select, and consumers in the choices they make about resource use.

Environmental educators are at the forefront of the effort to change behavior by striving to teach "children and adults how to learn about and investigate their environment, and to make intelligent, informed decisions about how they can take care of it" (NAAEE, 2011) and to foster "attitudes, motivations, and commitments to make informed decisions and take responsible action" (UNESCO, Tbilisi Declaration, 1978). Intuitively, it seems reasonable to assume that imparting accurate knowledge and pro-environmental beliefs is enough to create behavior change. This assumption can be found on the North American Association of Environmental Education (NAAEE) website (NAAEE, 2011): "What do environmentally literate people do? Environmentally literate people act on their beliefs". But do they? Are beliefs enough to reliably motivate behavior change? What are the deep drivers of human behavior that will most effectively predict environmentally responsible behavior?

Connectedness to nature as an important driver of behavior

The concept of connectedness to nature has a long history in ecology and ecopsychology, and has recently generated a great deal of interest and empirical research. As Leopold (1949, p. viii) wrote years ago: "We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect". In Leopold's view, environmentally responsible behavior (ERB) will result from seeing ourselves as a "plain and simple member" of the natural world.

Modern empirical work by social psychologists on interpersonal relationships supports Leopold's assertion that a sense of "we-ness" makes protective behavior more likely, even if that behavior is inconvenient. For example, the extent to which one includes another person as part of the self is a core operationalization of relationship closeness (Aron, Aron, Tudor, & Nelson, 1991). As relationship closeness increases, so does empathy and willingness to help (Cialdini, Brown, Lewis, Luce, & Neuberg, 1997). Similarly, acts that lead to a greater self–other overlap, such as perspective taking, (Davis, Conklin, Smith, & Luce, 1996; Galinsky & Moskowitz, 2000) also increase willingness to help (Coke, Batson, & McDavis, 1978). Among human-to-human relationships, expanding one's sense of self to include another does lead to more empathic and protective behavior.

We argue that the deep motivation that comes from a sense of "we-ness" is one of the few psychological forces strong enough to

* Corresponding author at: 175 West Lorain Street, Oberlin College, Oberlin, OH 44074, United States. Tel.: +1 440 775 8499.
E-mail address: cindy.frantz@oberlin.edu (C.M. Frantz).

0191-491X/$ – see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.stueduc.2013.10.001

compete with the prevailing counterforces required to engage in environmentally responsible behavior (ERB). Doing the environmentally responsible thing is often, to quote Al Gore, inconvenient. Whether it is an elected official deciding to vote in a way that angers big donors or an individual deciding whether to drive or bike to work, environmentally responsible choices often come at a short-term cost. Humans *will* engage in effortful and inconvenient behavior for people and causes they care about (Frantz, in press). To the extent that connectedness to nature represents the same sense of caring, it should also reliably lead to ERB.

Measuring connectedness to nature

Currently there are at least nine published assessment tools that measure connectedness to nature or something highly conceptually related. Tam (2013) provides an excellent review and comparison of most of these measures, but we briefly summarize them below for readers' convenience.

Kals, Schumacher, and Montada (1999) developed a 16-item scale that measures emotional affinity toward, or love of, nature. Schultz (2001) developed the Inclusions of Nature in the Self measure, a single item adopted from a technique used to assess emotional closeness in human relationships (Aron, Aron, & Smollan, 1992). This measure presents participants with a series of paired circles (one representing nature, the other representing the self) that increase in the extent to which they overlap. Clayton's (2003) Environmental Identity Scale (EID) is 20 items, and assesses "the extent to which the natural environment plays an important part in a person's self-definition" (p. 52). Mayer and Frantz introduced the 14-item Connectedness to Nature Scale (CNS) in 2004, and have since developed a revised 10-item version (CNS-R) suitable for children (Frantz, Mayer, & Sallee, 2013). The CNS is based on Aldo Leopold's concept of the land ethic, and is intended to measure people's sense that they are egalitarian members of the natural world.

Dutcher, Finley, Luloff, and Johnson (2007) developed a scale called Connectivity with Nature that is designed to measure "a sense of a shared or common essence between the self, nature, and others" (p. 474). Davis, Le, and Coy (2011) developed a 15-item measure of commitment to nature based on interdependence theory: to the extent that we recognize we are interdependent with someone or something, we are more committed to it. Nisbet, Zelenski, and Murphy (2009) developed the Nature Relatedness Scale, 21 items that assess "one's appreciation for and understanding of our interconnectedness with all other living things on the earth" (p. 718) and includes "affective, cognitive, and experiential aspects of individuals' connection to nature" (p. 715). The most recent additions to the plethora of measures include Brügger, Kaiser, and Roczen's (2011) Disposition to Connect with Nature scale (which conceptualizes connection to nature as an attitude) and Cheng and Monroe (2012) measure of connectedness to nature designed for use with children.

How do these scales differ? In their validation of the Disposition to Connect with Nature scale, Brügger et al., 2011 compared it to the CNS, the INS and the EID. They concluded that all these scales load on a single factor, and found similar correlations with self-reported ERB among the DCN, CNS and EID (r's = .49, .54, and .40 respectively), although the DCN explained 1.7% variability in ERB above and beyond the other measures when included in a single regression equation.

Tam (2013) conducted the most complete empirical comparison of seven of these scales (Brügger et al., 2011 Disposition to Connect with Nature scale and Cheng & Monroe, 2012 connection to nature index were not included). Like Brugger et al., Tam concluded that all the scales he examined have good psychometric properties and converge on the same central factor. All the scales correlate with theoretically relevant criterion variables (e.g., self transcendence, self-reported ERB) at similar levels – with the exception of the Inclusion of Nature in the Self item, which tended to have lower correlations. The extent to which any one measure explained unique variability in the criterion variables above and beyond the common factor was limited (1–3% of the variance). In short, all of these assessment tools seem to effectively assess connectedness to nature.

Connectedness to nature and environmentally responsible behavior

Self-reported behavior

However connectedness to nature is measured, research consistently shows a reliable relationship between connectedness to nature and self-reported environmentally responsible behavior. All of the authors cited above included a measure of self-reported ERB in their validation studies. For example, Clayton (2003) asked participants to rate on a 5-point scale how often they engaged in 21 different ERBs (e.g., turning off lights, donating to environmental organizations). The EID correlated strongly with self-reported behavior, $r = .67$. Brügger et al. (2011), Dutcher et al. (2007) and Davis et al. (2011) used similar measures to validate their respective scales, and found similar results ($r = .49$, $b = .12$, and $r = .50$ respectively). Nisbet et al. (2009) predicted individual ERBs (e.g., buying organic, buying fair trade) from the NR scale, and found it strongly significantly predicted these self-reported behaviors (β's $> .80$).

One of the most widely used measures is Mayer and Frantz's (2004) Connectedness to Nature scale. This scale has been used around the world and translated into many languages. The CNS-R (Frantz, Mayer, & Sallee, 2013) is a shorter version suitable for use with children and low-income adult samples. The CNS consistently predicts self-reported ERB and often explains the relationship that other variables have to ERB. For example, Markowitz, Goldberg, Ashton, and Lee (2012) found that the CNS, together with the New Ecological Paradigm (NEP, discussed further below), mediated the relationship between openness to experience and ERB. Tam, Lee, and Chao (2013) found that the CNS mediated the relationship between anthropomorphism of nature and several self-reported indicators of ERB: the intention to use and promote green products, support for the use of environmental impact as a factor in policy decisions, and support for the environmental movement. Using an adult sample of Australian farmers and a modified version of the CNS, Gosling and Williams (2010) found that connectedness to nature predicted self-reported native vegetation protection behavior.

Research from our own laboratory is consistent with these findings. For example, in the 2004 paper introducing the CNS, Mayer and Frantz showed that the CNS related to self-reported environmentally responsible behavior (ERB), $r = .44$, $p < .01$; this relationship held when statistically controlling for ecological worldview (as measured by the NEP).

The CNS-R has also been shown to predict self-reported ERB across multiple populations, including college students, children, and a general adult population (Frantz, Mayer, Gordon, & Handley, 2010, Frantz, Mayer, & Sallee, 2013; Gordon, Frantz, & Mayer, 2012). In all, seven data sets involving 2030 participants including children, college students, and adults have produced correlations between the CNS and self-reported ERB ranging from .35 to .58.

Actual behavior

All of the research reviewed above used self-reported ERB. Do people report their behavior in an accurate and unbiased way?

Please cite this article in press as: C.M. Frantz, F.S. Mayer. The importance of connection to nature in assessing environmental education programs. *Studies in Educational Evaluation* (2013), http://dx.doi.org/10.1016/j.stueduc.2013.10.001

Research on the accuracy of self-reported ERB is limited. While two studies have shown no systematic bias in reporting errors (Lam & Cheng, 2002; Warriner, McDougall, & Claxton, 1984), a third study did show substantial inaccuracy (Hamilton, 1985). Research in other domains (e.g., charitable giving, Bekkers & Wiepking, 2011; TV viewing behavior, Nenycz-Thiel, Beal, Ludwichowska, & Romaniuk, 2013; exercise behavior, Warner et al., 2012) has uncovered systematic bias in self-reported behavior for at least some sub-populations studied, suggesting that self-report data must always be interpreted with caution.

Because researchers and environmental educators ultimately care about changing actual behavior, measures of actual behavior are preferable to self report. Unfortunately, measuring actual behavior is notoriously difficult, for at least two reasons. First, robust, valid measures of any psychological construct require multiple observations (Ajzen, 1987; Epstein, 1979, 1980). This is why personality and attitude scales include multiple items that are all related to the variable of interest (e.g., attitudes toward recycling). A single behavior is unlikely to be a valid measure of behavior in general any more than a single questionnaire item is a valid measure of attitude or personality.

Measuring multiple behaviors related to environmental responsibility is logistically difficult to do in most assessment settings. Further, many ERBs that occur naturally in daily life are not easily or unobtrusively observed: environmental educators can not easily verify for themselves the length of peoples' showers, whether or not they have turned off lights and appliances, or how often they bicycle or walk.

Second, demand characteristics and social desirability concerns make it logistically difficult to present participants with a situation in which they feel free to take an action *or not.* Particularly in an assessment context, where the link between the program and assessment is often quite clear, it is difficult to ensure that respondents do not feel as if they must act in a particular way because they are expected to, or because they are concerned about how others will see them.

We have conducted three studies on connectedness to nature that use actual electricity use as the measure of ERB (Frantz, Mayer, Petersen, Shammin, & Bent, 2011; Frantz, Mayer, Petersen, & Shammin, 2013; Trostle, 2008). Electricity use is an excellent measure of actual behavior for several reasons. First, it is widely applicable; the vast majority of people living in Western cultures make decisions about electricity use every day. Second, it has environmental significance; except in those rare communities who have a largely renewable portfolio, electricity use results in significant carbon emissions and pollution. Finally, when measured over a period of time, electricity use is, in fact, an aggregate measure of multiple behaviors (e.g., turning off lights, unplugging appliances) related to a single construct. This makes it a much more reliable measure of behavior than any single behavior could be (Ajzen, 1987).

In two of these studies we compared connectedness to nature as a predictor of behavior to the New Ecological Paradigm (NEP, Dunlap, Van Liere, Mertig, & Jones, 2000), a measure of an environmentally sustainable worldview that recognizes humans as part of natural systems and constrained by the finite nature of these systems. Since its initial publication in 1978 as the New Environmental Paradigm scale, the NEP is the most widely used scale to measure environmental attitudes (Dunlap & Jones, 2002; Stern, Dietz, & Guagnano, 1995). The NEP is routinely used in program assessments published in the *Journal of Environmental Education (JEE)*, for example (e.g., Rideout, 2005; Rideout, Hushen, McGinty, Perkins, & Tate, 2005; Sherburn & Devlin, 2004). None of these published assessments included a measure of actual behavior, however.

For all of these studies, electricity data were collected through Oberlin College's Campus Resource Monitoring System (CRMS, http://es.oberlin.edu/~envs/home/; a more detailed description of the CRMS technology can be found in Petersen, Shunturov, Janda, Platt, & Weinberger, 2007). This system monitors electricity use and (when activated) provides dorm residents with real time feedback about their electricity use through a web-based portal.

In our first study (Trostle, 2008), surveys and electricity data were gathered from two different sets of residents in eleven apartment-style college dormitories (with 3–4 apartments per building); a total of 268 people living in 22 apartment units were involved. Participants completed a brief survey either online or in paper form, including demographic information, the NEP, and the CNS. The overall response rate was 46%, with at least one resident in every apartment answered the survey. CNS and NEP scores were averaged at the level of building because that was the level at which electricity data was available. Electricity use for each building was averaged across a three-week period.

A multiple regression was run predicting kilowatt-hours per person from mean CNS, mean NEP, the percent of women living in the building, and number of respondents per building. NEP was dropped from the equation because it was not significant. Controlling for gender and respondents per building, mean CNS significantly predicted kilowatt hours per person, $\beta = -.248$, $t(18) = -2.59$, $p = .01$. Houses with a higher mean CNS had lower electricity use.

This basic finding was replicated in a three-year study of electricity use in a wider sample of dormitories at the same institution (Frantz, Mayer, Petersen, et al., 2013). Electricity use was tracked at the dorm level throughout the semester; electricity use during a winter shutdown period served as a baseline measure of each building's nondiscretionary electricity use. All electricity data were put in the units of kilowatt-hours per person, to ensure appropriate comparisons despite variations in the number of dorm residents.

We also surveyed dorm residents via an online questionnaire. Although the content of the questionnaire varied slightly from year to year, all participants completed the original Connectedness to Nature Scale (CNS), the New Ecological Paradigm (NEP), and a measure of attitudes toward electricity use. Across all three years, approximately 24% of the student body participated in the surveys. In total, psychological data were collected from 2141 people.

Because electricity data is only available at the dormitory level, psychological data from individual respondents were averaged together within each dorm; thus the unit of analysis is dormitory. Electricity data included the electricity use of all residents living in monitored dorms. However, only dorm residents who completed the questionnaire were represented in the psychological data.

Because of the nested structure of the electricity use data (dormitory within year within point in the semester), analyses were conducted using Hierarchical General Linear Modeling (HGLM) in the program HLM (Raudenbush, Bryk, & Congdon, 2000). Controlling for the number of dorm occupants and winter shutdown electricity use, only the CNS significantly predicted electricity use, $b = -.05$, $p = 01$. Dorms with higher average CNS scores used less electricity over the course of the semester. Electricity-specific attitudes and the NEP were non-significant, p's $> .18$.

In a third study (Frantz et al., 2011), dorm residents in 27 units (hallways within two different dormitories) were presented with one of two real-time feedback displays of electricity use, and the change in their electricity use was tracked.[1] Participants completed a survey before and after exposure to the display that included the CNS-R. A regression analysis showed that controlling for the

[1] The main purpose of this study was to test the impact of different data display formats on electricity use. Type of display had only a marginal effect on electricity use ($\beta = .24$, $t = 1.71$, $p = .10$), and is not relevant to the main point of this paper.

Please cite this article in press as: C.M. Frantz, F.S. Mayer. The importance of connection to nature in assessing environmental education programs. *Studies in Educational Evaluation* (2013), http://dx.doi.org/10.1016/j.stueduc.2013.10.001

number of occupants per unit and type of display, dorm units that started with higher average levels of CNS-R decreased their electricity consumption more in response to real-time feedback, $\beta = .45$, $t\ (21) = 2.87$, $p = .01$. Above and beyond this effect, units whose CNS-R scores increased more from Time 1 to Time 2 had larger reductions in electricity use, $\beta = .57$, $t\ (21) = 2.90$, $p = .01$. These results suggest that changes in CNS-R mediate changes in electricity use.

The results of these three studies are notable because the level at which electricity data could be measured meant that the relationship between individual characteristics and individual electricity use could not be examined. In, short, we were working with a rather blunt instrument, using the psychological characteristics of a subset (on average, 33%) to predict the behavior of the whole. The fact that reliable relationships were found at the aggregate level in spite of this lack of precision speaks to the strength of the relationship. If individual electricity use could be tracked, we would expect this relationship to strengthen.

Conclusion

Survey research consistently shows a strong positive relationship between self-reported ERB and connectedness to nature. This relationship holds across multiple measures of connectedness to nature and across multiple demographic groups (age, ethnicity socio-economic status, and political orientation). Most recently, field studies using electricity use as an actual measure of ERB bolster the conclusion that connectedness to nature is an important predictor of ERB. The "we-ness" that characterizes this type of relationship and the personal responsibility that in all likelihood results from this connection may be a necessary driving force, motivating people to take action (Frantz & Mayer, 2009).

It is important to note, however, that all the data reviewed in this paper are correlational. Therefore while there are strong theoretical reasons to assume a causal relationship between connectedness to nature and ERB, this has yet to be proved conclusively. The final electricity use study presented above did demonstrate a relationship between increases in connectedness to nature and decreases in electricity use, which is suggestive of a causal relationship. However, this also was a correlational study. Testing the effects of connectedness to nature on ERB in a true experiment would be a significant contribution to the field.

Nevertheless, given the robust relationship between both self-reported and actual behavior, connectedness to nature should be considered not only as an important assessment tool for environmental education programs, but also an important goal of these programs (see Lieflander, Frohlich, Bogner, & Schultz, 2012, for a similar argument). Indeed for many programs it already is. Our own study of an Audubon program for school children provides direct evidence that environmental education programs that expose people to the natural world directly increase connectedness to nature (Frantz, Mayer, Petersen, et al., 2013; Frantz, Mayer, & Sallee, 2013, Study 2). Lieflander et al. (2012) found similar results. Our research shows that relatively short exposures to nature, even via film or through a window, increase connectedness to nature (Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2009). Environmental educators working in a natural setting are almost certainly impacting people's sense of connection to the natural world.

Although measures of actual behavior are always ideal, they are not always – or even often – practicable. Given its robust relationship to ERB, connectedness to nature might be considered a proxy variable for making inferences about a program's effect on behavior. We also note that the NEP, although widely used in environmental education assessment, may not be the best assessment tool if researchers and practitioners wish to make extrapolations to behavior change. Although some researchers reported independent contributions of the NEP to predicting self reported ERB (e.g., Davis et al., 2011; Markowitz et al., 2012) other researchers have not (Mayer & Frantz, 2004). It also failed to predict actual electricity use in our field studies.

In sum, we argue that connectedness to nature is an important variable to assess when evaluating the effectiveness of environmental education programming, particularly if long-term behavior change is a stated goal. Environmental education is a crucial component of confronting climate destabilization. The urgency and magnitude of the problems before us demand that we use the best tools possible.

References

Ajzen, I. (1987). Attitudes, traits, and actions: Dispositional prediction of behavior in personality and social psychology. In Berkowitz, L. (Ed.). *Advances in experimental social psychology* pp. 1–63). (Vol. 20) New York: Academic Press.
Aron, A., Aron, E. N., Tudor, M., & Nelson, G. (1991). Close relationships as including other in the self. *Journal of Personality and Social Psychology, 60*, 241–253.
Aron, A., Aron, E. N., & Smollan, D. (1992). Inclusion of other in the self scale and the structure of interpersonal closeness. *Journal of Personality and Social Psychology, 63*, 596–612.
Bekkers, R., & Wiepking, P. (2011). Accuracy of self-reports on donations to charitable organizations. *Quality & Quantity: International Journal of Methodology, 45*(6), 1369–1383.
Brügger, A., Kaiser, F. G., & Roczen, N. (2011). One for all? Connectedness to Nature, Inclusion of Nature, Environmental Identity, and Implicit Association with Nature. *European Psychologist, 16*(4), 324–333.
Cheng, J. C., & Monroe, M. C. (2012). Connection to nature: Children's affective attitude toward nature. *Environment and Behavior, 44*, 31–49.
Cialdini, R., Brown, S., Lewis, B., Luce, C., & Neuberg, S. (1997). Reinterpreting the empathy–altruism relationship: When one into one equals oneness. *Journal of Personality & Social Psychology, 73*, 481–494.
Clayton, S. (2003). Environmental identity: A conceptual and operational definition. In S. Clayton & S. Opotow (Eds.), *Identity and the natural environment* (pp. 45–65). Cambridge, MA: MIT Press.
Coke, J., Batson, C., & McDavis, K. (1978). Empathic mediation of helping: A two stage model. *Journal of Personality and Social Psychology, 36*, 752–766.
Davis, M. H., Conklin, L., Smith, A., & Luce, C. (1996). Effect of perspective taking on the cognitive representation of persons: A merging of self and other. *Journal of Personality and Social Psychology, 70*, 713–726.
Davis, J. L., Le, B., & Coy, A. E. (2011). Building a model of commitment to the natural environment to predict ecological behavior and willingness to sacrifice. *Journal of Environmental Psychology, 31*, 257–265.
Dunlap, R. E., & Jones, R. (2002). Environmental concern: Conceptual and measurement issues. In R. E. Dunlap & Michelson (Eds.), *Handbook of environmental sociology* (pp. 482–542). London, UK: Greenwood Press.
Dunlap, R. E., Van Liere, K. D., Mertig, A. G., & Jones, R. E. (2000). Measuring endorsement of the new ecological paradigm: A revised NEP scale. *Journal of Social Issues, 56*(3), 425–442.
Dutcher, D. D., Finley, J. C., Luloff, A. E., & Johnson, J. B. (2007). Connectivity with nature as a measure of environmental values. *Environment and Behavior, 39*, 474–493.
Epstein, S. (1979). The stability of behavior: I. On predicting most of the people much of the time. *Journal of Personality and Social Psychology, 37*, 1097–1126.
Epstein, S. (1980). The stability of behavior: II. Implications for psychological research. *American Psychologist, 35*, 790–806.
Frantz, C. M. (2014). Tapping into core social motives to drive sustainability transformation. *The Solutions Journal* (in press).
Frantz, C. M., & Mayer, F. S. (2009). Why are we failing to take action against the emergency of climate change? *Analysis of Social Issues and Public Policy, 9*, 205–222.
Frantz, C. M., Mayer, F. S., Gordon, H., & Handley, G. (2010). *Venture outdoors report: Oberlin subsample analysis. Internal report*.
Frantz, C. M., Mayer, F. S., Petersen, J., Shammin, R., & Bent, H. (2011). Conveying real-time feedback on resource use through empathetic gauges. *Paper Presented at the ACEEE Behavior, Energy, and Climate Change Conference*.
Frantz, C. M., Mayer, F. S., Petersen, J., & Shammin, M. R. (2013). *What Best Predicts Resource Conservation Behavior? The Case for Connectedness to Nature* (in preparation).
Frantz, C. M., Mayer, F. S., & Sallee, C. (2013). *A children's Version of the Connectedness to Nature Scale Revised* (under revision).
Galinsky, A., & Moskowitz, G. (2000). Perspective-taking: Decreasing stereotype expression, stereotype accessibility, and in-group favoritism. *Journal of Personality & Social Psychology, 78*, 708–724.
Gordon, H., Frantz, C. M., & Mayer, F. S. (2012). The relationship between ego- and eco-motivation, environmental attitudes, and environmentally responsible behavior. *Poster Presented at the Annual Meeting of Society for Personality and Social Psychology*.
Gosling, E., & Williams, K. J. H. (2010). Connectedness to nature, place attachment and conservation behavior: Testing connectedness theory among farmers. *Journal of Environmental Psychology, 30*, 298–304.
Hamilton, L. (1985). Self-reported and actual savings in a water conservation campaign. *Environment and Behavior, 17*, 315–326.

Please cite this article in press as: C.M. Frantz, F.S. Mayer. The importance of connection to nature in assessing environmental education programs. *Studies in Educational Evaluation* (2013), http://dx.doi.org/10.1016/j.stueduc.2013.10.001

IPPC. (2013). *Working Group I Contribution to the IPCC Fifth Assessment Report Climate Change 2013: The Physical Science Basis* Retrieved from the IPPC website: http://www.climatechange2013.org/images/uploads/WGIAR5-SPM_Approved27-Sep2013.pdf.

Kals, E., Schumacher, D., & Montada, L. (1999). Emotional affinity toward nature as a motivational basis to protect nature. *Environment and Behavior, 31*, 178–202.

Lam, S., & Cheng, S. (2002). Cross-informant agreement in reports of environmental behavior and the effect of cross-questioning on report accuracy. *Environment and Behavior, 34*(4), 508–520.

Leopold, A. (1949). *A Sand County Almanac: With essays on conservation from Round River*. New York: Ballantine Books.

Lieflander, A. K., Frohlich, G., Bogner, F. X., & Schultz, P. W. (2012). Promoting connectedness with nature through environmental education. *Environmental Education Research*, 1–15.

Markowitz, E. M., Goldberg, L. R., Ashton, M. C., & Lee, K. (2012). Profiling the pro-environmental individual: A personality perspective. *Journal of Personality, 80*, 81–111.

Mayer, F. S., & Frantz, C. M. (2004). The connectedness to nature scale: A measure of individuals' feeling in community with nature. *Journal of Environmental Psychology, 24*, 503–515.

Mayer, F. S., Frantz, C. M., Bruehlman-Senecal, E., & Dolliver, K. (2009). Why is nature restorative? An integration of two competing explanations. *Environment and Behavior, 41*, 607–643.

NAAEE (North American Association of Environmental Educators) (2011) http://www.naaee.net/what-is-ee (retrieved 6.15.11).

Nenycz-Thiel, M., Beal, V., Ludwichowska, G., & Romaniuk, J. (2013). Investigating the accuracy of self-reports of brand usage behavior. *Journal of Business Research, 66*, 224–232.

Nisbet, E. K., Zelenski, J. M., & Murphy, S. A. (2009). The nature relatedness scale: Linking individuals' connection with nature to environmental concern and behavior. *Environment and Behavior, 41*, 715–740.

Petersen, J. E., Shunturov, V., Janda, K., Platt, G., & Weinberger, K. (2007). Combining real-time feedback on resource use with incentives stimulates dormitory residents to reduce electricity consumption. *International Journal of Sustainability in Higher Education, 8*, 16–33.

Raudenbush, S. W., Bryk, A., & Congdon, R. (2000). *HLM 6 hierarchical linear and nonlinear modeling*. Scientific Software International Inc.

Rideout, B. E. (2005). The effect of a brief environmental problems module on endorsement of the new ecological paradigm in college students. *Journal of Environmental Education, 37*(1), 3–11.

Rideout, B. E., Hushen, K., McGinty, D., Perkins, S., & Tate, J. (2005). Endorsement of the new ecological paradigm in systematic and e-mail samples of college students. *Journal of Environmental Education, 36*(2), 15–23.

Schultz, P. W. (2001). Assessing the structure of environmental concern: Concern for the self, other people, and the biosphere. *Journal of Environmental Psychology, 21*, 327–339.

Sherburn, M., & Devlin, A. (2004). Academic major, environmental concern, and arboretum use. *Journal of Environmental Education, 35*(2), 23–36.

Stern, P. C., Dietz, T., & Guagnano, G. A. (1995). The new environmental paradigm in social psychological perspective. *Environment and Behavior, 27*, 723–745.

Tam, K.-P. (2013). Concepts and measures related to connection to nature: Similarities and differences. *Journal of Environmental Psychology, 34*, 64–78.

Tam, K.-P., Lee, S.-L., & Chao, M. M. (2013). Saving Mr. Nature: Anthropomorphism enhances connectedness to and protectiveness toward nature. *Journal of Experimental Social Psychology, 49*, 514–521.

Trostle, J. (2008). *Connectedness to Nature and Electricity Consumption: An Interdisciplinary Study of Behavior and Emotional Response to Nature in the Union Street Housing Complex* Unpublished honors thesis.

UNESCO. (1978, January). *Connect, the UNESCO-UNEP Environmental Educational Newsletter, III*.

Warner, E. T., Wolin, K. Y., Duncan, D. T., Heil, D. P., Askew, S., & Bennett, G. G. (2012). Differential accuracy of physical activity self-report by body mass index. *American Journal of Health Behavior, 36*, 168–178.

Warriner, G., McDougall, G. H., & Claxton, J. D. (1984). Any data or none at all? Living with inaccuracies in self-reports of residential energy consumption. *Environment & Behavior, 16*, 503–526.

Please cite this article in press as: C.M. Frantz, F.S. Mayer. The importance of connection to nature in assessing environmental education programs. *Studies in Educational Evaluation* (2013), http://dx.doi.org/10.1016/j.stueduc.2013.10.001