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Scientifically literate action: Key barriers and facilitators across context and content

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Abstract

Scientific literacy can also be described as a level of public understanding of science that encourages one to act in concert with scientific consensus. Investigating actions concerned with environmental conservation, we examine the context specificity of this form of scientifically literate action and the differential motivations that predict such action across contexts. We report on a large sample of employees of a mixed urban/rural county in the USA, representing a diverse range of careers, who completed an anonymous survey about their environmental conservation actions at home, at work and in the public sphere. Results indicate that individuals engage at different action levels overall and for different reasons across contexts; limited support was found for the importance of perceived knowledge attainment ability in predicting scientifically informed actions. Implications for policy and program designers and scholars interested in scientific literacy are discussed.

Keywords

climate change, context dependencies, environmental conservation, scientific literacy, sustainability

1. Introduction

Scientific literacy is a term often used to describe a level of public understanding of science and scientific practices that would aid the general public. The 'aid' to the general public implied by advocates has included: (a) participating in scientific efforts provide a unique opportunity to develop critical reasoning skills that would in turn improve one's overall thinking and learning capacity; (b) a more generally knowledgeable public would support and direct funding for scientific endeavors; and (c) a general understanding of science would enable one to make more scientifically informed decisions (see DeBoer, 2000; Norris and Phillips, 2003; Roberts, 2007 for reviews). The last notion, which might be called the applied dimension of science literacy, has received much less attention,

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although it does generally correspond to a shift in science education from an emphasis on facts of science to an emphasis on engaging in the practices of science (National Research Council, 1996; 2007) and a shift in the practices of engineering, in which applications of science are explored deeply (Fortus et al., 2005; National Research Council, 2012). In this case we explore the practices needed for citizen science – seeking and consuming scientific knowledge and applying that information to one's daily life (Jenkins, 1999). It is this applied dimension of scientific literacy that is our focus here, as it is the actions taken by people that have a direct impact on many issues of concern; even when the public is capable of critically examining the science presented in the press about an issue, the problem is unlikely to improve is subsequent actions do not condense with that understanding.

There are a number of areas in which people often appear to make uninformed decisions with significant negative consequences. In the area of health concerns, for example, there is uncontested scientific consensus that obesity is a major health concern, particularly for children and adolescents. Despite growing concern and clear guidelines for improvement, the incidence of Type 2 diabetes in children in the USA (previously an adult onset disease) continues to sharply increase (Rabin, 2012). Another such area is environmental conservation. While there is debate about the scope of human-influenced climate change, there is scientific consensus that human actions are contributing to unsustainable environmental conditions (Intergovernmental Panel on Climate Change (IPCC), 2007a). Indeed, scientists warn that continuing on current trajectories will likely lead to clean water and food shortages, (Durack et al., 2012) higher incidences of catastrophic weather events, and changes to animal and insect ecosystems that could lead to species instability and extinction (IPCC, 2007b). The obesity epidemic and environmental conservation are two examples of where applied scientific literacy is required – i.e. public action is required to improve or reverse an alarming trend. We opted to focus on the environmental conservation because there is solid scientific consensus, there are a variety of actions everyone can take across contexts, and the problem is of ever-increasing concern.

Contributing factors

Which factors lead people to act in concert with scientific consensus? Scientific literacy research is often focused on the impact of scientific knowledge and/or one's ability to acquire that knowledge through reading and understanding reports of science (Miller, 1998, 2004). Yet, Feinstein (2010) argues that knowledge of science or experience with scientific practices has little impact on daily decision making, claiming that these decisions are based on heuristics and the specifics of the situation at hand. Additionally, (Kahan, et al., 2012) found that those with the highest level of scientific literacy were not those most concerned about climate change; indeed, the opposite was true. In light of these findings, we (and others) propose a model that expands beyond the usual knowledge factors implicated in scientific literacy research (Sinatra et al., 2012) to focus on perceived knowledge attainment ability, perceived practical concerns (Lorenzoni et al., 2007) and a sense of personal responsibility (Hornik et al., 1995). Each of these model elements is now briefly described.

Perceived knowledge attainment ability

Scientific literacy has often been defined as having a basic understanding of core concepts and processes of science that then enables one to follow and understand reports of science that appear in the popular press (Miller, 2004; Bybee and McCrae, 2011). As mentioned, this narrow definition of scientific literacy has shown to be of limited importance to the applied dimension of scientific

literacy (Feinstein, 2010; Kahan et al., 2012), in part because new scientific knowledge must often be acquired to deal with real issues. Therefore, we refine the knowledge element of scientific literacy to be one's perceived knowledge attainment ability; that is, in the context of conflicting opinions, how sure is an individual that they could come to an understanding of an environmental conservation issue? The focus is on one's perceived competence to attain knowledge rather than one's level of actual knowledge as the literature on perceived competence indicates that this perception has a larger impact on one's likelihood to participate in an activity (e.g. Bandura, 1986; Caroll and Loumidis, 2001).

Personal responsibility

An individual's personal sense of investment in the issue of environmental conservation has been implicated in a number of studies as a strong predictor of such actions. In the large-scale Global Warming's Six Americas audience segmentation analysis (Maibach et al., 2009), the group who engaged in the most sustainable activity were those who were most personally invested (the 'alarmed' group) followed by those who were the second most personally invested (the 'concerned group', and so on). A review of studies on the facilitators and barriers to recycling confirms the importance of personal investment and the relationship between personal investment and social accountability (Hornik et al., 1995). In light of this prior research, we examined the impact of believing environmental conservation 'makes a difference', 'sets a good example' and 'is the responsible thing to do'.

Another key component of personal responsibility is the individual's perception of the relative urgency of climate change and the impact of one's own actions on the problem. In the Six Americas analysis, those who believe that the problem is urgent and that their actions can have an impact are much more likely to engage in sustainable actions (Maibach et al., 2009). This relationship is a common occurrence in the psychological literature on motivation; when one believes that the consequences of one's action today have a direct impact on a valued outcome, one is more willing to make and sustain effort (e.g. Destin and Oyserman, 2010). Thus, we examine whether our respondents believe that environmental conservation actions 'make a big difference' to the conservation effort.

Perceived practicality

Practicality may also matter in determining whether one behaves sustainably. Even in the presence of a strong commitment to sustainable activity, when the practical concerns overwhelm the incentive (whether that incentive is internal, such as a sense of personal benefit, or external, such as financial incentives), it is common for the individual to defect from the action (Hornik et al., 1995). On the other hand, when saving money was among the incentives offered for behaving sustainably, even those who dismiss climate change engaged in the action (Maibach et al., 2009). As such, we investigated the impact of one's perception of the convenience and money-saving aspects of our chosen environmental conservation actions.

Context dependencies

Complicating the relationship between motivating factors and environmental actions are context effects. More broadly, it has long been known that context generally plays a role in learning and memory; that is, what is learned in one context may not be readily retrievable when in another context (e.g. Godden and Baddeley, 1975). Similarly, while we may understand the necessity and

wisdom of an action in one context, transfer by analogy to another context is quite difficult (e.g. Gick and Holyoak, 1980). One's goals are impacted by context as well: we know that while a student may be motivated by mastery in one context, he or she may be more motivated to avoid comparing poorly to others in another context (e.g. Bong, 2001, 2004). But, we do not know of other research that has explicitly examined how one's behavior towards environmental conservation might differ across context. Because of an implied morality to environmental conservation actions (or the lack thereof), we hypothesized that a critical dimension of context will be the extent to which action is hidden from others or widely seen. The most private place in which one can engage in environmental conservation is the home, while work actions are often governed by policy and seen by others, and public actions are meant to prompt attention and explicitly interact with an even wider sphere of individuals. Thus, degree of environmental conservation action might be highest in the public sphere where the perception of a larger number of people will be influenced if an individual acts or not. Alternatively, it might be that responsibility for action is more diffuse as the size of the responsible parties expands (Darley and Latane, 1968), and environmental conservation actions will be more common at home. In general, we explore whether the reasons for environmental conservation actions are the same or different across contexts in addition to examining whether levels of action are correlated within individuals across contexts.

Research questions

In sum, we investigate the relationship between engagement in environmental conservation actions at home, work and in the public sphere, exploring coherence of actions across contexts and the relative impact of practical concerns, perceived knowledge attainment ability, and personal responsibility within and across these contexts. Visibility into these nuances is critical to understanding how people perceive and interact with environmental conservation and provides the beginnings of a more complex model of scientific literacy.

2. Method

Participants

Participants were recruited from the employee pool of a mixed urban/suburban county in the American Midwest, including a wide range of occupations such as lawyers, secretaries, administrators, janitors, road repair workers, parks management and city officials. Of the 6800 county employees, 738 (11%) at least partially completed the survey. Though we do not have information about those who did not complete the survey, separate links were sent to different departments, and respondents returned from almost all links, indicating that our participant pool represents a cross-sample of departments. Participants were 67% female and predominantly (89%) white. The participants were generally well educated with 64% holding a bachelor's degree or higher, 29% with an associate's degree, and only 7% without a university-level degree. Twenty-five percent of the sample held a degree in math, science or engineering (MSE), and most of these (15% of the sample; 60% of those with MSE degrees) held degrees in science.

Sampling procedures

All county employees were notified of the opportunity to participate in the survey by email and notifications placed in the payroll envelopes. They were offered the opportunity to take the survey

online or to take it on paper and fax it to the researchers. Only seven participants opted to take the survey on paper.

Notifications informed county employees that the office of sustainability was collecting information about employee actions regarding environmental conservation. Participants were assured that all responses were anonymous, collected by an independent university organization, and that every entry would qualify for a random drawing; 50 randomly chosen participants were awarded a $100 prize. Responses were accepted over 21 days: 126 partial and 612 complete responses were collected. Only the complete surveys (excluding the page where personal information was collected for entry into the drawing) were included in the analyses.

Measure development

The Sustainable Actions Survey was developed in two-phases. In the first phase, a pilot survey was emailed to a large convenience sample. The survey consisted of open-ended questions ascertaining what actions were taken at home, work and in the public sphere, and why the person did (or did not) take these actions. One hundred and twenty responses were collected and an exhaustive list was compiled for each of the action arenas (home, work and public sphere).

All of the mentioned actions were evaluated by a sustainability expert (a senior PhD student in Environmental Engineering). Actions known to be effective at promoting environmental conservation were selected out, and then given a score for how often the action was mentioned by participants. To make the survey of manageable length and to avoid floor effects when the survey was given to a broader sample, only those actions that were (1) known to be effective and (2) mentioned most often (to ensure that the action was implementable by many) were included in the final survey. The reasons that were most often associated with one's propensity to engage or to *not* engage with the chosen actions were included in the reasons set. Because home and work actions and reasons were relatively overlapping with each other but non-overlapping with public actions, parallel actions and reasons were chosen for home and work but a different set of actions and reasons were chosen for public action. Because some actions are differentially available for individuals at work across job categories and departments, an option 'that action is not available at my job' was included as an answer choice; anyone who chose this option was removed from analysis for that action.

The survey

The resulting online survey included a series of questions regarding each of five environmental conservation actions that can be enacted at home and work. The first question asked how often the participant engaged in the action at home (ranging from 'all the time' to 'never') and was followed by a series of statements about that action (specifically, the action makes a difference to environmental sustainability, the action saves money, the action is convenient, the action sets a good example, the actions is responsible); the participants were asked how much they agreed with each statement (answers ranged from 'strongly agree' to 'strongly disagree').

After each pair of home/work actions (e.g. recycling at home and work) the participants were asked:

> Imagine you are at a party where two people are arguing about the importance of recycling. One person says that recycling has NO long-term impact on environmental sustainability, and another person says that recycling does have a long-term impact on environmental sustainability. You decide to do some research

> to figure out who is right. How sure are you that you have the science knowledge to understand what you read?' Answer options ranged from 'very sure' to 'not sure at all.

This question was designed to assess perceived knowledge attainment ability.

Once the participant had completed these questions for all five categories of home and work reasons, they were asked:

> Sustainable actions can include any of the things we've asked about so far including purchasing products that are better for the environment and taking actions to reduce your water, energy, or gas use. Now we want to know if you have tried to inform or influence others regarding sustainability.

For example, they were asked whether they had ever organized a program or campaign. Answer choices were either 'yes' or 'no'. Those who answered exclusively 'no' were directed to page that asked them why they did not do these things; those who answered with at least one 'yes' were directed to page asking them why they did such things.

After completing questions regarding such actions in the home, work and public spheres, participants were asked a series of demographic questions including age, race, education level, science and math course taking behavior in high school and college, and questions about the home in which they were raised.

3. Results and discussion

Actions: Engagement by context

Actions at home and work. As one of our main goals was to examine the relationship between particular actions across contexts, we begin with an analysis of self-reported frequencies of engagement in actions contextualized at home and at work. Because actions differed between home/work and public sphere, comparisons at the action level between home/work and public sphere were not appropriate. All respondents were included in analyses for home actions; those who indicated that they did not have the opportunity to engage in a particular action at work were excluded from those analyses.

Figure 1 shows the distribution of responses for each action. Wilcoxon signed rank tests indicate that for every action, people are less likely to engage at work than they are to engage in the same action at home (Recycling $Z = 7.07$, $p < .01$; Energy $Z = 5.01$, $p < .01$; Water $Z = 2.87$, $p < .01$; Driving $Z = 14.12$, $p < .01$; Purchasing $Z = 8.84$, $p < .01$). The largest home/work gaps were for recycling, driving and purchasing, despite having excluded those who said they did not have the option to do the given action at work.

Actions in the public sphere. We also analyze self-reported indications of having ever engaged in a variety of actions in the public sphere. The chosen actions were designed to ensure that our measure of public action was neither so rarified that almost no one engaged in the actions nor so common that almost every adult would have a high score. The sampled actions cover a broad range of engagement from encouraging others to take sustainable actions, which most respondents reported doing (59%), to planning a campaign or writing a letter to an official that only 10% of respondents reported doing. Thirty-three percent of respondents had not engaged in any form of public action. Of those who had engaged in *any* public actions, the vast majority (88%) of them had encouraged others to participate in sustainable actions. To create an aggregate measure for subsequent

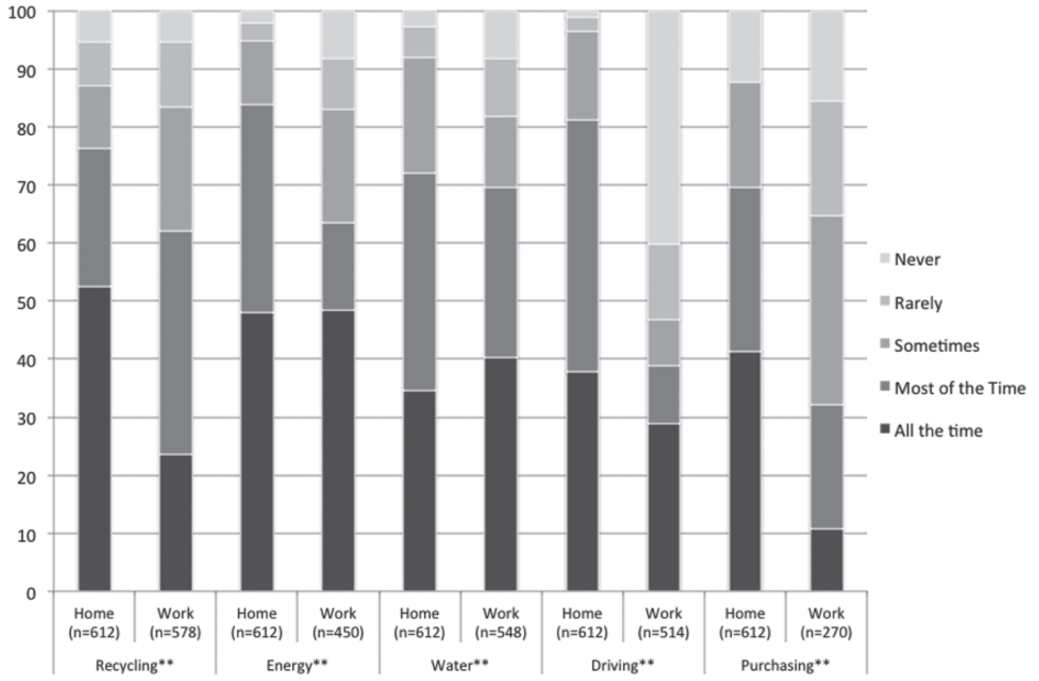

Figure 1. Distributions of responses for self-reported frequency of sampled home and work environmental conservation actions, with statistical information about home vs. work differences in frequency of action.
Note: ** significant at .01 based on Wilcoxon signed rank test

analyses, we noted the percent of the sampled public actions in which the respondent reported that he or she engaged.

Relationships between contexts and contents

Context specificity. An inter-correlation matrix of overall action frequencies at home, at work and in the public sphere indicates that while mean frequency of actions is significantly correlated across contexts; the correlations are only moderate in size (ranging between .30 and .36)

A scatterplot of reported frequencies of mean work against mean home action (see Figure 2(a), left) reveals that while one may engage at a high level at home but not at work, one does not engage in a high level at work unless one is also engaged at a high level at home. Table 1 shows the percentage of respondents who fall into the three comparative categories (more home engagement than work engagement, more work engagement than home engagement, and the same amount of engagement at work and home), confirming that it is more common to engage more at home relative to work than work relative to home.

The scatterplot of reported frequencies of mean home actions against the number of public actions (see Figure 2(b) center) show that while one may engage at a high level at home but not in the public sphere, one does not engage in a high level in the public sphere unless one is also engaged at a high level at home. Table 1 reveals that it is typical to do more home action than public action; it is uncommon to engage in relatively more public action than home action.

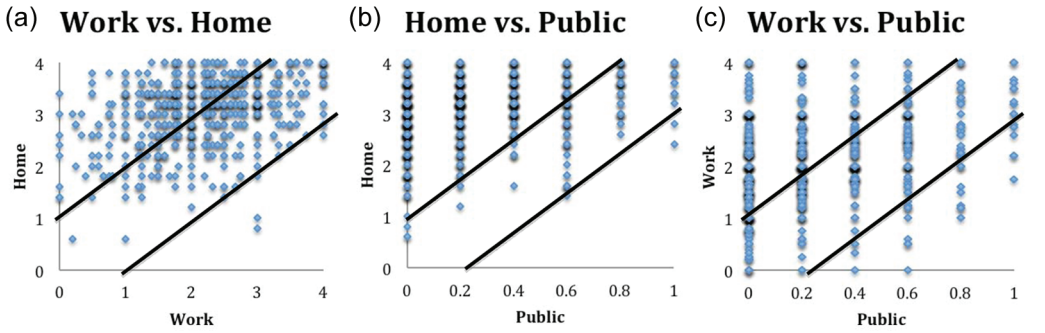

Figure 2. Comparisons of actions across contexts. (a) Mean action levels by home and work; (b) Mean action level at home by percent action in public sphere; (c) Mean action level at work by percent action in public sphere.

Table 1. Comparative engagement across home, work and public.

	N	%
Home vs. work		
Less home than work	20	3%
More home than work	325	53%
Same home as work	267	44%
Home vs. public		
Less home than public	3	0%
More home than public	502	82%
Same public as home	107	17%
Work vs. public		
Less work than public	42	7%
More work than public	346	57%
Same public as work	224	37%

The scatterplot of frequency of work action against public action (see Figure 2(c) right) reveals the same basic pattern as the others, although with a different threshold: one is not likely to engage in all of the public actions if one is not at least moderately engaged at work. From Table 1, we see the most common outcome is more work action than public action, but with a few engaging in less work action than public action.

Content correlations. When an individual action's correlation with the other actions occurring in the same context (e.g. recycling at home correlated with a scale created of all the other home actions) is compared to its correlation to the complementary actions concerning the same content (e.g. recycling at home vs. recycling at work) we see a stronger relationship to context than to the content of the action. For example, the home vs. work correlation for recycling is $r = .23$, but the correlations of recycling at home with other home action frequencies is $r = .27$ and recycling at work with other work action frequencies is $r = .39$. There are only two exceptions to this general pattern: water conservation is more strongly correlated across the contexts, and energy conservation at work is not correlated by content or context.

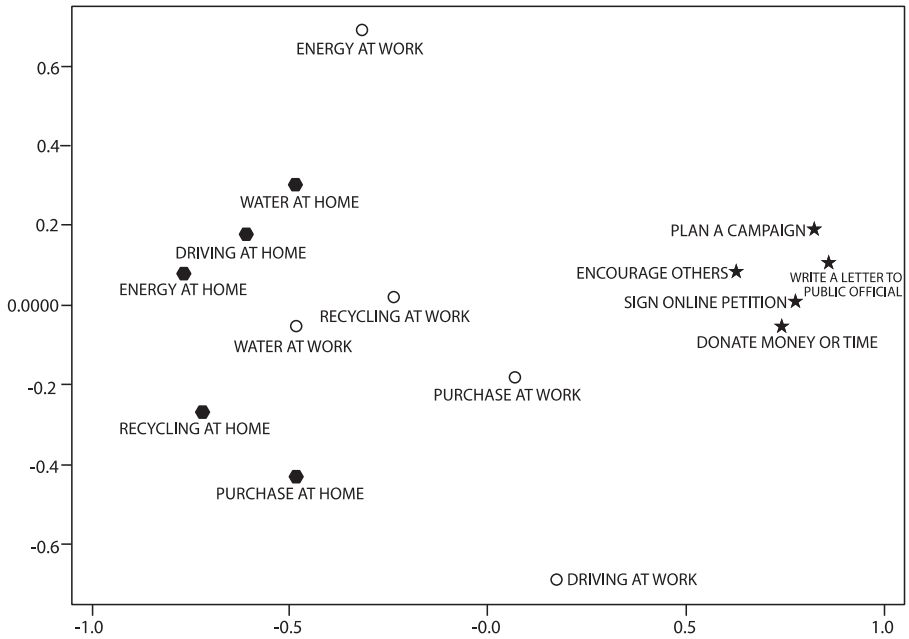

Figure 3. A two-dimensional scale of relative frequency of home, work and public actions.

A multidimensional scaling analysis of the individual action frequencies across home, work, and in the public sphere finds an adequate two-dimensional fit (S-Stress = .04), with a pattern of clustering by context rather than content (see Figure 3). Specifically, the public actions tend to cluster together, and the home actions tend to cluster together. The work actions span the middle, with energy conservation at work and driving at work being outliers.

Facilitators and barriers to actions

Differences in propensity to engage in actions may reflect different thresholds for action by context or content. Small or non-significant correlations by content or context, however, suggest different reasons for action by content or context. We next explore whether there were general patterns for which factors predicted frequency of action across content and contexts.

Reasons and knowledge scales for home and work actions. Each action (for both home and work) was followed by a series of beliefs that one may hold about that action. Factor analyses suggested that three of the reasons for action (or for non-action) tended to group together ('makes a difference to environmental sustainability', 'sets an example for others', and 'is the responsible thing to do'), which we label as 'responsibility'. Inter-item reliabilities for the responsibility scales (measured by Cronbach's alpha) ranged from .85 to .91 for the individual actions. We left 'saves money', and 'convenience' as individual predictors.

In addition to being asked to indicate the degree to which he or she agreed with a series of belief items, respondents were also asked to indicate how sure they were that they could understand the science involved with each action; these items assessed a person's perceived knowledge attainment ability. Means for these items ranged from 3.18 to 3.29. Yet there was the same moderate level of

variability across individuals on each, with standard deviations ranging from 0.70 to 0.76. In a factor analysis, the five knowledge items factored together so closely that this overall perceived knowledge aggregate was used in each model (alpha = .96), indicating that one's perception of one's ability to attain knowledge is not highly content specific.

Home and work actions predicted by reasons and perceived knowledge attainment ability. Respondents' propensity to take each action was predicted by the three reason variables (responsibility, saves money and convenience) and the perceived knowledge attainment ability variable. Results, including standardized beta weights and significance levels can be found in Table 2(a). Convenience and responsibility are important for actions both at home and at work. Saving money plays into most of the home actions, but not at all for actions at work. Similarly, perceived knowledge attainment ability plays a role in most of the actions at home, but only one of the actions at work. Aggregates of responsibility, convenience, and saves money predict the means for each context in a manner consistent with the individual actions: that is, convenience and responsibility predict one's overall likelihood to engage at work, while all reasons and knowledge predict one's overall likelihood to engage at home.

Table 2(b) shows the means and standard deviations of the respondent's perceived level of each item's responsibility, convenience, and likelihood to save money for actions at home and work. The means indicate that the beliefs that predict actions are not simply those that are perceived to be more relevant to the action. For example, despite 'saves money' having the highest mean of the three predictor reasons for conserving water at home, it is not a significant predictor of engaging in the action while convenience is a significant predictor despite having the lowest mean score. More generally, there do not appear to be ceiling effects, floor effects or restricted range problems driving which predictors were significant.

Interestingly, the means are generally high; people commonly believe that these actions are the responsible thing to do, are fairly convenient and save money. Energy at work generally had the lowest ratings across the board, possibly explaining why energy did not have a strong content correlation (i.e. beliefs were different by context). Further, convenience ratings at work were also generally lower; given the importance of perceived convenience in predicting action at work, this may explain why work actions were lower than home actions.

Public action reasons. Although the public actions were not tied with the same specificity to belief questions as home and work actions, we can examine whether general endorsement of reasons for home and work actions predict public action (e.g. does strong belief that recycling, energy conservation, etc. are responsible actions predict public action?). The bottom row of Table 2a shows outcome of regressing the context predictors in a multiple regression on the public action aggregate. We see that responsibility (at both home and work), the convenience of being sustainable at home, and perceived knowledge attainment ability predict the amount of public actions taken.

In addition, respondents who had engaged in at least one of the public actions were asked a series of questions about why they engaged in those actions. The two government-focused reasons ('I want the government to take actions that reflect my views' and 'The problem is so big that we need the cooperation of government to make a difference') were highly correlated ($r = .72$) and a mean of the two was used to predict public actions along with the other reasons. The only predictive reason in our set was the government aggregate. This government aggregate was predictive of all the actions except the action that may have had a ceiling effect, 'encouraging others to engage in sustainable actions'.

Table 2a. Home and work actions (individually and globally) and public actions (globally) independently predicted by beliefs about home and work actions and perceived knowledge by multiple regression.

	Home				Work			
	Personal responsibility	Practical concerns		Perceived knowledge attainment ability	Personal responsibility	Practical concerns		Perceived knowledge attainment ability
		Convenience	Saves money			Convenience	Saves oney	
Context specific reasons predicting context specific actions								
Recycling	.21**	.47**	−.018	−.01	.17**	.49**	.01	−.01
Energy	.26**	.12*	.16**	.05	.12	.22**	−.01	.02
Water	.31**	.21**	.02	.08*	.20**	.24**	−.01	.12*
Driving	.10	.24**	.18**	.11*	.18**	.31**	.05	−.04
Purchasing	.15**	.14**	.28**	.09*	.23**	.21**	−.05	.08
Context Mean	.33**	.19**	.31**	.11**	.49**	.36**	−.03	.07
Context scale reasons predicting public actions								
Public actions	.19**	−.07*	0.07	.05**	.21**	−.03	.05	.05**

*Significant at .05 level; **Significant at .01 level
Note: Values are standardized beta weights

Table 2b. Means and standard deviations for beliefs about action at home and work.

	Home							Work					
	Responsibility		Convenience		Saves money			Responsibility		Convenience		Saves money	
	Mean	SD	Mean	SD	Mean	SD		Mean	SD	Mean	SD	Mean	SD
Recycling	3.5	0.5	2.9	0.8	2.9	0.8	Recycling	3.5	0.5	2.8	1	3.1	0.8
Energy	3.3	0.5	3.2	0.7	3.7	0.5	Energy	2.4	0.7	2.5	0.9	2.6	0.9
Water	3.3	0.6	3.1	0.7	3.5	0.6	Water	3.3	0.6	2.9	0.8	3.4	0.6
Driving	3.4	0.6	2.9	0.9	3.7	0.5	Driving	3.3	0.6	2.3	1	3.3	0.7
Purchasing	3.3	0.6	3.2	0.7	3.3	0.7	Purchasing	3.3	0.6	2.7	0.9	3	0.8
Home Context	3.4	0.5	3	0.5	3.4	0.4	Work Context	3.2	0.4	3.2	0.5	3.1	0.4

Note: 1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree

Generalizability

Our sample has a higher proportion of female respondents than male respondents. To ensure that this higher proportion did not skew the results in a meaningful way, analyses were run on the sample split by gender. Overall, across the five actions by two locations, the self-reported mean frequency correlated $r = .96$ between men and women. Even with a large sample size, 8 of the 10 cases involve no statistically significant differences by gender. The cases with a small difference were recycling at work (women with higher means, $p < .05$, Cohen's d = 0.2) and energy at work (women with lower means, $p < .01$, Cohen's d = 0.3).

Our sample also had a higher proportion of people with university degrees (64% with bachelor's or higher) than the general population (28% in the USA, according to the US Census). We compared those with bachelor's degrees or higher to those with less than a bachelor's degree. Again, there was high consistency overall ($r = .95$) by education level for mean frequency across the five actions by two locations. This time, three of the ten cases show statistically significant differences by education level with those with more education slightly less likely to conserve energy at home ($p < .01$, Cohen's d = 0.2), less likely to conserve water at work ($p < .01$, d = 0.4) and less likely to make sustainable purchases at work ($p < .01$, d = 0.3).

4. General discussion

To the larger question of whether individuals are scientifically literate in an applied sense, our results suggests the answer depends upon where you look: people engage differently across the contexts of home, work and in the public sphere, and are motivated to action for different reasons in these contexts. In short, context matters for environmental conservation actions. Specifically, people are most likely to engage to the highest degree at home, and engaging at home seems to provide a baseline for action at work and in the public sphere. That is, we do not generally see people engaging in a high level of environmental conservation action at work or in the public sphere unless they are also highly engaged at home. This pattern of context effects also holds across a range of actions; people are less motivated to maintain consistent action in a particular domain (such as recycling at home *and* at work) than they are to maintain consistency within contexts (such as at home or at work). In essence, context dependencies appear to play a strong role in how people engage with environmental conservation.

Explaining part of these context dependencies are differences in the reasons motivating action. While people are motivated by personal responsibility across contexts, beliefs about the practical concern of financial impact are only felt at home. Similarly, perceived scientific knowledge affects environmental conservation behaviors at home, but has only a small and limited impact at work. In contrast, the degree to which an action is practically convenient matters a lot at work, but very little at home. In combination, these results suggest that action has a fundamentally different character in the home and work contexts, with more of a personal agency at home (bringing in own financial goals and own knowledge) and more of an obligation framework at work (doing actions that are reasonable requests of outsiders).

Our pilot work established that very different reasons (from those given for work or home action) were named for participating or not in public action. From our survey, we found that whether one engages with environmental conservation in the public sphere is most impacted by whether one feels that government action is important. This finding suggests that whether one believes that collective action is required to accomplish conservation determines whether one takes responsibility for the environment in the public sphere. Importantly, in the case of public actions, there was also a large effect of the kind of action considered: While most people

encouraged others to behave sustainably, far fewer people engaged with the other, more public actions. These constitute yet another type of decision-making frame than primarily personal impact (as in the case of home action) or obligation (as in the case of work action).

Limiting the generalizability of the current work is that while the patterns of context specificity of environmental conservation action are robust across actions, gender and levels of education, all of the respondents worked at the same organization, which could result in organization-specific perceptions about the environmental conservation actions, particularly at work. All respondents were civil servants, and this could have had systematic effects on their perceptions of the role of government in environmental conservation (as related to public action). While the response rate was adequate for regression analyses, it may be the case that those who responded had stronger opinions on environmental conservation than those who did not. Replication with samples from other organizations would help to ensure that the specific motivations implicated were not organization specific. The primary result that motivations differ between contexts, however, is unlikely to be true only for this sample, or within this organization.

Personal responsibility, practical concerns and perceptions of knowledge attainment ability are each important enough to predict action even in the presence of other strong reasons. As such, policy makers and activists would do well to consider the multiple facets that motivate people to engage in environmental conservation actions when planning campaigns and promoting programs. Similarly, generalizability across context should not be assumed; that is, what works to promote environmental conservation actions at home may not work to promote the same at work. Given the work environment's massive contribution to overall waste generation and the substantial impact that those who work within the work environment have on any effort to reduce that waste (Steinberg et al., 2009), this is not an insignificant finding. Additionally, the observed pattern that only those who engage at home are likely to engage at work or in the public sphere also provides insight into where one might begin to target early environmental conservation action messages.

We began our introduction with the notion that we hoped to shed light on the factors that predict scientifically informed actions. Traditional notions of scientific literacy implicate science knowledge as a key factor. The reported results provide only weak support for this notion (and in a few cases, contradict it) in that one's perceived science knowledge attainment ability is a relatively weak predictor in about half of the actions we assessed; in fact, perceived knowledge attainment ability is the weakest predictor in any of the models in which it is significant. As we focused on perceived knowledge attainment ability rather than actual knowledge we cannot comment on the direct relationship between knowledge and action; it could be that there are other important direct or mediated relationships between actual knowledge and action. The relationship we did test – whether perceiving oneself as capable of understanding the science one encounters has a positive impact on one's likelihood to act in accordance with scientific consensus – however, was only weakly supported. In that limited sense, our results are in agreement with the thesis put forth by Feinstein (2010) and Kahan, et al. (2012): knowledge is not the most important predictor of an applied dimension of scientific literacy.

Focusing on the contextual and motivational factors impacting the applied dimension of scientific literacy provides an interesting starting point for a more nuanced and practical definition of scientific literacy. The relationship between context and action, and the role of motivation in applied scientific literacy, are important and deserving of further study.

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