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Hands On or Hands Off? Disgust Sensitivity and Preference for Environmental Education Activities

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ABSTRACT: Detailed descriptions of barriers to environmental education (EE) can provide opportunities for educators to foresee potential problems in programs. High disgust sensitivity is an intrapersonal barrier that constrains preference for learning opportunities involving manipulation of some organic materials. Middle school students in Texas ($N = 450$) completed a science activity preference scale and a disgust-sensitivity scale. Respondents who expressed the lowest interest in activities that required manipulation of organic substances also had the highest disgust-sensitivity scores. However, no differences were found among students for activities that required observation only. Using a photographic scale, students rated their preference for lake shore environments as places to conduct an aquatic entomology study. Students with high disgust sensitivity were significantly more likely to prefer the poorer locations, which were characterized by clear water and no algae or submerged objects. The addition of a barriers analysis to EE curricula and formation of strategies for working effectively with students with high disgust sensitivity are recommended.

Identifying, describing, and developing methods for lessening barriers to environmental education (EE) is a promising research area. The eventual availability of a comprehensive typology of barriers and a detailed description of each barrier will allow environmental educators to foresee more potential problems with programs. In this article we describe high disgust sensitivity as an intrapersonal barrier to developing positive environmental attitudes and interests, and we empirically test whether this barrier lowers reported preference for different EE activities.

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Barriers to EE

Lessening barriers to EE may be particularly important to increasing the effectiveness of programs for groups and individuals who have not been responsive to EE efforts. Most of the barriers identified through research can be categorized as follows:

Structural: External forces that obstruct the ability of motivated students and educators to engage in EE activities. These include a wide range of logistical, funding, policy, and liability issues.

Interpersonal: Unresolvable disagreements among educators within an organization about philosophical or conceptual issues in EE. This barrier may result in a dysfunctional program or organization. Also of concern are student misbehaviors unique to EE settings, which may interfere with other students' ability or motivation to learn.

Intrapersonal: A large category of cognitive and attitudinal barriers held by educators and students. These include insufficient knowledge, motivation, or interest and the existence of belief systems that interfere with accurately learning concepts (Ausubel, Novak, & Hanesian, 1978; Buethe & Smallwood, 1987; Driver, 1981; Hooper, 1988; Kremer, Mullins, & Roth, 1990–1991; Saegart & Hart, 1979; Samuel, 1993; Simmons, 1987–1988).

Analysis of barriers to EE should proceed along at least two complementary pathways. The first is the development of a detailed typology (or taxonomy) of known types of barriers. An excellent start has been made by Ham and Sewing (1987–1988) on barriers among educators, but additional work is needed, particularly with issues dealing with students.

The second path involves developing a detailed description of each barrier along with empirical investigations that determine whether barriers are significant and, if so, whom the barrier affects and what interventions serve to eliminate or minimize it. Descriptions should be comprehensive enough to allow environmental educators to foresee a barrier's negative role in a learning situation and provide for solutions. Eventually, EE curricula should contain an analysis of barriers for each program. In this article we begin the process of describing high disgust sensitivity as an intrapersonal barrier to effective EE programs involving contact with organic materials.

Disgust as a Barrier to Environmental Learning

High disgust sensitivity can be a barrier to both educators and students. Teachers may choose not to offer activities that involve handling soils, water samples, manure, microbes, or invertebrates and to avoid field trips where insects, dirt, or facilities without modern bathrooms may be encountered. Similarly, some students may react negatively to activities that require manipulating disgust-evoking materials.

Disgust is a basic emotion that moderates reactions to organic objects with certain perceptual characteristics. Disgust responses to objects may be innate, learned, or an interaction of the two and may be dramatic or so subtle as to be imperceptible to others. Listed below are a few hypothetical situations in which people's attitudes or behaviors may at least partially be shaped by their degree of disgust sensitivity:

- Two couples with similar financial means are visiting a national park: One couple camps and the other stays in a motel.
- Two families live in the same middle-class neighborhood: One family has a wildflower meadow in their backyard and the other keeps a highly manicured lawn.
- A child refuses to try fishing for the first time because "You have to touch worms!"
- A parent refuses to let his or her child attend a residential EE program because it is "dirty in the woods."
- A couple sprays their apartment with insecticides every week even though they have never seen a roach.
- An otherwise highly motivated elementary student quickly loses interest in a pond study when asked to pick through algae to find invertebrates.
- A municipality refuses to use treated gray water for irrigating its golf courses.
- A student cannot understand why anyone would want to protect an endangered insect species.

Descriptive writing and research on EE have occasionally focused on negative reactions of students on school field trips to wildland settings. Most analyses of negative reactions to wildland areas categorized these responses as fear. Fearful responses to forests, plants, and animals can be quite dramatic and catch the attention of group leaders, but there are other not so dramatic negative responses made by students that may be equally important. In a content analysis of negative reactions made by school children on outdoor field trips, a broader range of negative perceptions was identified, including disgust reactions to insects, spiders, and the dirtiness of the environment, as well as lack of comfort in the outdoors (Bixler, Carlisle, Hammitt, & Floyd, 1994). LaPage and Cormier (1977) identified the dirtiness of the environment as a barrier to developing a preference for recreational camping.

What Is Disgust?

Disgust is a negative response to real or perceived contamination of the body envelope. Webster's New World Dictionary (1988, p. 393) defines *disgust* as "a sickening distaste or dislike; deep aversion; repugnance." As a primary emotion, disgust is often described in terms of physiological responses, a state of feeling, stereotypic facial expressions, and a behavioral component (Epstein, 1984). As with other emotions, disgust also has evolutionary, cognitive, social, and cultural components (Levenson, 1992; Mandler, 1984).

When someone experiences disgust, physiological changes may include nausea, salivation, and a decreasing heart rate. The lack of increased heart rate may be a function of disgust-evoking objects not necessitating fight or flight responses that would be expected with fear or anger. The feeling state of disgust is revulsion, and the behavioral component is distancing oneself from contact with the object or situation (Rozin & Fallon, 1987). Charles Darwin (1872/1965) identified a distinct facial expression associated with disgust, and Rozin, Lowery, and Ebert (1994) have more precisely identified the many variations in this facial expression as a function of the elicitor. Major components of a disgust face include a gaping mouth, distended tongue, and wrinkled-up nose (Rozin et al., 1994). These facial expressions led Darwin and later theorists to stipulate that core disgust responses were made to eating or tasting objects that were spoiled. In extreme cases, nausea, vomiting, and gagging may occur.

Core disgust elicitors include rotten food, vomit, feces, decaying flesh, and any substance expelled from the body (e.g., mucus). Objects and animals (e.g., slime molds, fungi, vulture, slug, flesh fly) associated with these core substances may also evoke disgust. Similarly, neutral objects that have been in contact with, or even near, disgust elicitors may also produce a negative response (Rozin & Fallon, 1987).

Acquisition of disgust sensitivity occurs through social learning, direct instruction, and generalization of perceptual characteristics of disgust-evoking objects to other stimuli. Young children learn from their parents' revulsion of feces and its odors during diaper changing and toilet training. Because young children will pick up almost any unfamiliar object, the parents' response to what they are grabbing also begins to shape disgust sensitivity. For instance, one parent might react negatively to a young child's interest in touching an earthworm by scolding, declaring the worm dirty, and dragging the child to the bathroom to wash his or her hands. Another parent might encourage the child to observe the worm and help the child learn its name, other relevant vocabulary, and how to touch it.

Once disgust to core disgust elicitors is established, other objects with similar perceptual characteristics will also evoke disgust. For instance, once roaches are viewed as disgusting, many other insects may take on this connotation (Wilkinson, 1988). Consequently, completely benign objects that have even one of the perceptual characteristics found in core disgust objects may elicit revulsion in some people. For instance, slugs are not harmful to humans, but their mucus coating makes them repulsive. Table 1 presents an informal lexicon of visual, olfactory, tactile, and auditory disgust-eliciting perceptual characteristics.

TABLE 1. Perceptual Disgust Elicitors Classified by Mode of Perception

Visual[a]	Olfactory	Tactile[a]	Auditory[b]
deformed	fecal-like	crawling	bubbling
gooey	fetid	creeping	flatulent
limp	moldy	crusty	glugging
maggoty	musty	glutinous	gurgling
misshapen	putrid	granular	rumbling
mushy	rancid	grimy	splattering
oozy	sickly-sweet	gelatinous	spurting
phlegmatic	skunk-like	muddy	squirting
pustule	smoky	oily	squishing
scummy	smutty	scaly	
silty	swamp-gas	sticky	
slick		slimy	
slithery		viscid	
sludgy		waxy	
ugly			
wiggly			

[a]Most of these elicitors could be perceived both visually and tactilely.
[b]Some of these elicitors could be perceived visually.

Contagion as a Disgust Elicitor

Any interpretation that contagion is present on an object or in the air may elicit a disgust reaction. The increased understanding of the disease-causing role of "germs" has largely supplanted superstitious explanations for illness. Unfortunately, many individuals have a poor understanding of germs and reason about them in a superstitious manner. Wilkinson (1988) documented the difficulty children have in understanding the concept of germs. To minimally understand the presence of germs, an individual must believe that invisible particles can exist. This ability emerges by 7 years of age, although some empirical evidence suggests it may emerge as early as age 4 (Rozin, Haidt, & McCauley, 1993; Wilkinson, 1988). Preschool students tend to believe that germs are large enough to be seen, but they have not yet seen one because germs are sneaky (Wilkinson, 1988).

Informal learning about germs comes from parents and peers. Wilkinson (1988) documented that some parents indiscriminately use the presence of germs as a rationale for a range of restrictive rules. Of particular relevance is the common warning to avoid dirt because of the presence of germs.

Adult reasoning about germs varies considerably. Nemeroff and Rozin (1994) found that adults tend to explain their avoidance of disgust-evoking substances as a means of preventing disease but that this rationale does not adequately explain their actual behavior. For instance, individuals tend to reject food made to look like core disgust elicitors (e.g., fudge brownies shaped like dog feces) and refuse to wear laundered clothing belonging to repulsive people (e.g., Hitler's sweater). This type of behavior is more consistent with a belief system called *the laws of sympathetic magic*, which is well documented by anthropologists as existing in many traditional cultures (Rozin & Fallon, 1987). The law of contagion (once in contact, always in contact) and the law of similarity (like produces like; the image is equal to the object) describe these superstitious rejections of food and clothing better than a disease avoidance explanation does. These cognitive strategies suggest that people view objects and people as having an "essence." This essence can be identified by the appearance of the object or person and can be transmitted through direct or indirect contact (Nemeroff & Rozin, 1994).

Disgust and Perceptions of Natural Objects

Much of the literature focuses on core disgust elicitors, particularly spoiled or contaminated food. But in a growing body of literature, researchers have used disgust sensitivity to explain negative reactions to animals, particularly invertebrates. Research suggests that negative reactions to large predatory animals are a function of fear, whereas reactions to spiders may have both a fear and a disgust component. Aversions to slugs, snails, and crawling insects are primarily due to disgust sensitivity (Matchett & Davey, 1991). The literature on disgust suggests that many of the objects and substances that are a common part of both field and classroom labs may be strongly revulsive to some people. Any work with soils, dead or decaying vegetation, invertebrates, some reptiles and amphibians, or internal organs or body fluids of animals may produce some degree of a disgust response in humans.

In this research we tested whether students who differ in disgust sensitivity express different preferences for EE activities that involve manipulating organic substances and outdoor environments, such as lake shores, where outdoor labs might be conducted.

Method

Study Population

The sample was composed of students in two rural (n = 280), one suburban (n = 101), and one urban (n = 69) middle schools in Texas. Suburban and urban school students were enrolled in both community-based and magnet programs; all rural school students attended community schools. The sample was 47% female, 28% Hispanic, 15% African American, 50% Anglo, and 7% "other." The response rate was 89%.

Data Collection

Data were collected during normal classroom periods by a research technician. Students were told that the study was to determine which school activities they preferred. All instructions and scale items were read aloud to control for reading level. Students were encouraged to ask questions for clarification but not to state opinions aloud. To prevent negatively biasing the results, the research technician read the EE activity and lake shore preference scales first, followed by the disgust sensitivity scale. The order of the items within each scale was randomly assigned. The sequence of both scales and scale items was identical in all administrations of the questionnaire.

Independent Variable: Disgust Sensitivity

Sixteen disgust-evoking items were selected on the basis of the above review of literature. Respondents circled a number between 0 (*not disgusting*) and 4 (*extremely disgusting*). Pretesting with college students enrolled in a business-oriented tourism class and a plant pathology class indicated that the scale exhibited adequate discriminant validity, with the business students having significantly higher disgust-sensitivity scores.

The sample was divided into high and low disgust-sensitivity groups using the quick cluster procedure in SPSS (SPSS, 1988). Dividing the sample into two groups creates a more conservative test than using only the lowest and highest quartiles. Using a clustering algorithm, instead of dividing the sample at the mean or median, takes advantage of the differing discrimination power of each item in the scale. The clustering algorithm assigned 46% of the respondents to the high disgust-sensitivity group (Table 2). The scale had a Cronbach's alpha of .91.

Dependent Variables

Preference for EE Activities

Biology and EE curricula books and conversations with biology teachers were used to generate a list of science activities. Several of the items were chosen because the activity had apparent disgust-evoking properties; others required no manipulation of organic substances. The items were rated on a bipolar scale that ranged from 1 (*greatly dislike*) to 5 (*greatly like*). Principal components analysis with varimax rotation produced a two-factor solution (Table 3). The fac-

TABLE 2. Grand Mean and Cluster Means for Disgust Scale Items

Item	Grand mean	Mean low disgust cluster (n = 239)	Mean high disgust cluster (n = 201)
Finding a tick biting my scalp	3.17	2.65	3.76
Feeling a roach crawl across my hand	2.91	2.38	3.53
Accidentally stepping in animal droppings	2.86	2.15	3.66
Finding a tick crawling up my leg	2.54	1.82	3.41
Accidentally touching a slug	2.07	1.27	3.03
Having to stick my hand in swamp water	2.02	1.08	3.10
Feeling flies landing in my hair	1.50	.87	2.23
Getting itchy from dust and sweat on my skin	1.32	.54	2.26
Getting itchy from bug bites and scratches	1.19	.54	1.95
Having to sit in wet grass	1.06	.35	1.90
Getting five or six mosquito bites on my arm	1.05	.50	1.71
Getting itchy from walking through weeds	.98	.41	1.69
Accidentally stepping in mud around a pond	.76	.24	1.38
Having to sit on an old log in the woods	.58	.17	1.06
Having to sit on the ground in the woods	.35	.05	.72

Note. Scores are based on a unipolar scale where 0 = *not disgusting*, 1 = *a tiny bit disgusting*, 2 = *a little bit disgusting*, 3 = *somewhat disgusting*, 4 = *very disgusting*. Cronbach's α = .91.

tors were labeled *Science Activities Requiring Manipulation* (eigenvalue = 3.52, percentage variance = 35.2, Cronbach's α = .78) and *Observational Science Activities* (eigenvalue = 1.74, percentage variance = 17.4, Cronbach's α = .70).

Preference for Water Environments for Conducting an Aquatic Entomology Lab

Respondents were shown 10 slides of lake shore that might be used for a lab assignment in which they were to collect aquatic insects using a net with a 6-ft-long handle. The items were rated on a bipolar scale that ranged from 1 (*greatly dislike*) to 5 (*greatly like*). Principal components analysis with varimax rotation produced a two-factor solution (Table 4). The factors were labeled *Eutrophic Water* (eigenvalue = 4.23, percentage variance = 42.3, Cronbach's α = .83) and *Clear Water* (eigenvalue = 1.65, percentage variance = 16.5, Cronbach's α = .80). Eutrophic water slides were characterized by the presence of algae and other debris in the water—areas that should be rich in aquatic invertebrates. Clear water slides were photographs of manicured lake shores with clear-appearing water, including one of a swimming beach, where few invertebrates would be found. These areas would be poor choices for an introductory lab on aquatic entomology.

Analysis

Student's t tests were conducted on individual items to identify any significant differences between the high and low disgust clusters in preference for EE activities and preference for water environments for conducting an aquatic entomology lab scales. An alpha level of .05 was set, on the basis of tradition in social science research.

Results

The five highest ranked disgust items dealt with ticks, roaches, animal droppings, and slugs. The five lowest ranked items dealt with mosquito bites, itchiness from walking through weeds, stepping in mud around a pond, and sitting on logs or on the ground.

The highest ranked EE activity items were the three observational activities and one involving collecting invertebrates, fruits, and mushrooms to see which of these are preferred as food by box turtles. The four lowest ranked items were activities requiring manipulation. These items dealt with dissecting fish to examine their livers for cancer, catching and identifying aquatic insects, collecting invertebrates from forest duff, and testing water samples for chemicals and sewage. In the scale measuring preference for aquatic entomology lab sites, five of the seven eutrophic

TABLE 3. Factor Analysis and Grand Means for Environmental Education Activity Preference Scale

Item	Grand mean	Loading	Eigenvalue	Percentage variance	Cronbach's α
Science Activities Requiring Manipulation			3.51	35.2	.78
Grow fungi and bacteria in the lab and study them under a microscope	2.84	.69			
Collect soil samples from the bottom of swamps, lakes, and rivers and compare the soils and living things in the soils	2.76	.68			
Collect dead fish along a river, cut them open, and examine their livers for diseases and tumors	2.25	.68			
Collect leaves off the forest floor and find and identify all the insects, centipedes, and other creatures living among the dead leaves	2.45	.66			
Collect water samples from a polluted lake and test for chemicals and sewage	2.72	.63			
Catch 30 water bugs in a pond and identify them	2.29	.61			
Collect different fruits, insects, slugs, and mushrooms and offer them to a box turtle to see what foods it likes	3.27	.61			
Observational Science Activities			1.74	17.4	.70
Put out six types of seeds for birds and count what each type of bird eats to see if different birds like different seeds	3.21	.82			
Place different colors of yarn outside and observe which colors the birds take away to make their nests	3.54	.81			
Make four 2-hr visits to a zoo to watch and take notes on the behavior of a zoo animal	3.68	.62			

Note. Scores are based on a scale where 1 = *greatly dislike*; 2 = *dislike*; 3 = *no opinion, not sure*; 4 = *like*; 5 = *greatly like*.

TABLE 4. Factor Analysis and Grand Means for Water Environments for Conducting a Biology Lab Preference Scale

Item	Grand mean	Loading	Eigenvalue	Percentage variance	Cronbach's α
Eutrophic Water			4.23	42.3	.83
Photo 8: small, deep, clear pool full of leaves and branches, overgrown edges with steep bank	3.17	.75			
Photo 7: pond with scattered algae, mowed bank	2.34	.74			
Photo 5: small, deep, clear pool full of leaves and branches, overgrown edges with steep bank	3.32	.71			
Photo 4: pond with scattered clumps of algae on surface	2.98	.67			
Photo 2: creek with mud banks	3.09	.65			
Photo 6: small pool of water covered with thick green algae	3.43	.63			
Photo 9: small eutrophic pond with tall, lush, green grass on edge	3.60	.59			
Clear Water			1.65	16.5	.80
Photo 3: swimming beach with buoys	3.41	.80			
Photo 1: boat dock over deep, clear water	3.51	.80			
Photo 10: clear lake (reservoir) with lawn to edge	3.73	.79			

Note. Scores are based on a scale where 1 = *greatly dislike*; 2 = *dislike*; 3 = *no opinion, not sure*; 4 = *like*; 5 = *greatly like*. Photo number represents the order of presentation of the photographic slides.

slides had means below the means of the clear water slides; two were ranked among the clear water slides.

There was a significant difference between high and low disgust-sensitivity groups on all the EE activities that required manipulation of organic materials but no significant differences for observational activities (Table 5). The high disgust-sensitivity group expressed significantly lower preference for activities that involved manipulating organic materials.

Significant differences were found between high and low disgust-sensitivity groups on all items dealing with preference for water environments when conducting an aquatic entomology lab (Table 6). Respondents in the high disgust-sensitivity group expressed significantly lower preference for the eutrophic water sites and higher preference for the clear water sites.

Discussion and Implications

The patterns of differences across the two groups on two different scales, one using written descriptions of activities and the other using photographs, provided empirical evidence that disgust sensitivity plays a role in preference for activities. Students with high disgust sensitivity expressed lower preference for activities requiring contact with organic materials. As should be expected, there were no differences between the two groups on the observation-only activities.

Results were similar with the scale that measured preference for water environments for an aquatic entomology lab. The high disgust-sensitivity group expressed lower preference for water bodies with algae, eutrophic water, and weeds along the edges. These locations appear ideal for easily finding large quantities of aquatic invertebrates. The high disgust-sensitivity group expressed significantly higher preference for the three sites that were characterized by clear water, no algae, and easy lake shore access. This result suggests that students with high disgust sensitivity would be more likely to choose less productive lab sites.

These clear patterns of differences across the two groups on two different scales should encourage additional research on disgust sensitivity. This study depended on self-report of both activity preference and disgust sensitivity. More work should be done to test whether disgust sensitivity is predictive of actual behavior of students participating in activities involving the manipulation of organic materials.

Also, disgust elicitors can probably be separated into different domains to more precisely predict behavior and develop strategies to deal with each type. Core disgust elicitors, animals that evoke both fear and disgust, or reactions to the perceived presence of contagion may be distinct enough to require different educational strategies.

EE curricula, at every opportunity, should include both cognitive and affective strategies in activities dealing with microbes and invertebrates. Every attempt should be made to help students develop an awareness of the diversity of microbes and invertebrates, focusing on how few are harmful to humans. Apparently, beliefs regarding the negative aspects of microbes and insects are readily acquired through childhood socialization and health education.

On the affective side, further research should be done to identify what different age groups find interesting about microbes and invertebrates. These data may help with de-

TABLE 5. Differences in Preference for Environmental Education Activities Between Low and High Disgust-Sensitivity Clusters

Item	Mean low disgust cluster	Mean high disgust cluster	t	p
Science Activities Requiring Manipulation				
Grow fungi and bacteria in the lab and study them under a microscope	2.99	2.64	2.76	.006
Collect soil samples from the bottom of swamps, lakes, and rivers and compare the soils and living things in the soils	3.02	2.43	4.56	.000
Collect dead fish along a river, cut them open, and examine their livers for diseases and tumors	2.58	1.89	4.95	.000
Collect leaves off the forest floor and find and identify all the insects, centipedes, and other creatures living among the dead leaves	2.68	2.19	4.38	.000
Collect water samples from a polluted lake and test for chemicals and sewage	2.87	2.54	2.48	.014
Catch 30 water bugs in a pond and identify them	2.47	2.07	3.57	.000
Collect different fruits, insects, slugs, and mushrooms and offer them to a box turtle to see what foods it likes	3.41	3.14	2.50	.041
Observational Science Activities				
Put out six types of seeds for birds and count what each type of bird eats to see if different birds like different seeds	3.14	3.28	−1.14	.12
Place different colors of yarn outside and observe which colors the birds take away to make their nests	3.47	3.63	−1.31	.19
Make four 2-hr visits to a zoo to watch and take notes on the behavior of a zoo animal	3.63	3.77	−1.09	.275

Note. Scores are based on a scale where 1 = *greatly dislike*; 2 = *dislike*; 3 = *no opinion, not sure*; 4 = *like*; 5 = *greatly like*.

TABLE 6. Differences in Preference for Water Environments for Conducting an Aquatic Entomology Lab Between Low and High Disgust-Sensitivity Clusters

Item	Mean low disgust cluster	Mean high disgust cluster	t	p
Eutrophic Water				
Photo 2: creek with mud banks	3.33	2.83	4.50	.000
Photo 4: pond with scattered clumps of algae on surface	3.30	2.67	4.71	.000
Photo 5: small, deep, clear pool full of leaves and branches, overgrown edges with steep bank	3.63	2.99	4.93	.000
Photo 6: small pool of water covered with thick green algae	2.72	2.11	4.32	.000
Photo 7: pond with scattered algae, mowed bank	3.58	3.05	4.31	.000
Photo 8: small, deep, clear pool full of leaves and branches, overgrown edges with steep bank	3.50	2.81	5.40	.000
Photo 9: small eutrophic pond with tall, lush, green grass on edge	3.73	3.45	2.40	.017
Clear Water				
Photo 1: boat dock over deep, clear water	3.38	3.64	−2.32	.029
Photo 3: swimming beach with buoys	3.18	3.64	−3.51	.001
Photo 10: clear lake (reservoir) with lawn to edge	3.50	3.99	−3.42	.001

Note. Scores are based on a scale where 1 = *greatly dislike*; 2 = *dislike*; 3 = *no opinion, not sure*; 4 = *like*; 5 = *greatly like*. Photo number represents the order of presentation of the photographic slides.

signing more appealing programs and identifying misconceptions that may hinder learning (Driver, 1981).

The development of disgust sensitivity seems to occur during childhood. A growing body of literature strongly suggests that childhood play in wildland areas is an important component in developing environmentally concerned citizens (Chawla, 1998). Playing and exploring in the outdoors at an early age, with encouragement from adults, may be all that is necessary to promote a moderate view of dirt and insects (Chipeniuk, 1995). The need to formally provide childhood experiences in wildlands by establishing preschools in parks and nature centers has been documented by R. Wilson (1993). These preschool programs would provide young children with daily contact with wildlands and teachers who encourage curiosity about invertebrates and model appropriate responses to their presence. This strategy may be particularly important for children from homes where the outdoors is not valued. Unfortunately, few parks and nature centers have elected to start preschools (R. Wilson, 1996).

We have addressed the role of disgust sensitivity only in the narrow context of preference for education activities that involve manipulating organic materials. Its role is certainly broader. In the past, high disgust sensitivity may have played a positive role in efforts to garner support for control of water pollution caused by sewage. Currently, high disgust and contamination sensitivity may be hindering development of broader environmental concerns. A discouraging aspect of the environmentalism in North America is the lack of attention to issues other than local environmental health. There is limited understanding of biodiversity (Detjen, 1995) and little evidence of interest in wildlife other than large charismatic mammals and birds (Kellert, 1993). Many disgust-evoking invertebrates are important parts of food webs and are the species facing extinction in the greatest numbers (E. Wilson, 1987). Developing an adequate understanding of ecological concepts is difficult without some awareness and knowledge of invertebrates, microbes, and soil science. Developing methods for lessening the tendency of individuals to view these creatures as revulsive while simultaneously fostering a positive interest in them should be a priority of EE.

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