

# Nature and Embodied Education

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**Abstract:** *An embodied educational environment is one that is in tune with the intimate connection of the body and the mind. This article explores the importance of nature in creating such environments. The main theme is that emerging multidisciplinary thought on the embodied mind can provide new ways to understand the positive role of nature in children's education. New perspectives on embodiment can help explain: a) why we resonate with nature and find experiences of nature so engaging; b) why experiences of awe and aesthetic beauty often motivate learning and change attitudes about our relationship with the environment; and c) why engagement with nature often has positive health and psychological benefits, including a restorative effect on attention.*

Most educators and parents intuitively know that nature experiences are beneficial for children. They know this from their own experiences during childhood and from interacting with and observing children. Many sources of information—from poetry to scientific studies—confirm such intuitions. Add to this a growing cultural awareness of the importance of nature for children as illustrated by recent, best-selling publications (see Louv, 2005), and it would seem unnecessary to call further attention to the topic of nature and education. However, while there are many positive signs that the benefits of nature for child development are being increasingly recognized, there also seems to be a continuing emphasis on indoor, disembodied forms of education in classrooms that are overly focused on abstract cognition at the expense of emotion, movement, and other processes rooted in body-environment interactions.

One explanation for why these pro- and anti-nature trends can exist simultaneously is the absence of a widely accepted perspective on human nature that grounds explanations for the benefits of the natural environment. In the absence of such a perspective, the intuitions of teachers and parents, the exhortations of literature, and the occasional empirical findings of science cannot stand against the utilitarian motives that often drive education policy. In a political environment where efficiency and finances are primary concerns, a stronger case should be made for the importance of integrating nature in education, one that can point to deeply rooted needs in the human organism.

The present article considers the topic of nature and education in light of an emerging, multidisciplinary perspective on the embodied mind. The main theme is that this contemporary framework can provide new ways to understand the posi-

tive role of nature in children's education. The article begins by briefly discussing the illusion of a disembodied mind and highlighting key ideas about body-mind connection that have important implications for education. The second part of the article suggests how perspectives on the embodied mind can bolster three arguments often made in support of the greater integration of nature and education: our innate attraction to nature; the motivational influence of awe and aesthetic beauty on learning; and the various health and psychological benefits associated with contact with nature, especially improved concentration and attention.

### *The Illusion of the Disembodied Mind*

In a push to reach higher levels of achievement, and pressured by the threat of international competition, many schools have increasingly practiced a form of education that might be called *disembodied*. Disembodied education is overly focused on end results and the cognitive or abstract part of the learning process. It takes the body—including the activity, movement, and emotions associated with it—out of the mind. In curriculum terms, what is referred to here as “disembodied education” resembles what is described in the educational literature as a “traditional approach” (Webb, Metha, & Jordan, 2007). Traditional approaches have held a preeminent place in U.S. education for generations; current estimates suggest that it is the preferred disposition in approximately 90% of U.S. schools (Barbour, Barbour, & Scully, 2008). To varying degrees, depending on the details of specific implementations, such an approach generally places a strong emphasis on teacher-dominated classrooms. Students are expected to look to teachers for guidance and stimulation. There is an emphasis on

a highly structured curriculum, lecture presentations, and detailed learning objectives. There is a core of knowledge that all children are expected to master, and standardized tests are often used for assessment. As might be expected, most government initiatives designed to improve schools (e.g., the No Child Left Behind legislation) often assume such a curriculum approach.

It is not surprising that traditional, disembodied practices have become commonplace in many schools. Education policy reflects broader themes that have developed in Western culture, and the highly rational and scientific culture of the West has emphasized objectivity while disparaging the so-called “subjectivity” of emotion (see Frege, 1892/1970). The underlying thinking is: if one wants to transfer knowledge in the fastest, most efficient way possible, one should focus on a formal presentation of important facts and develop basic skills that presumably enhance cultural literacy.

There is no doubt that many aspects of traditional approaches are worthwhile and successful with students. One could point to the “learning gap” that has been identified between students in Japanese and Chinese educational systems and students in the US and argue that highly organized, teacher-dominated, and textbook-based classrooms are superior for educational achievement (Stevenson & Stigler, 1994). Although the higher value placed on education in Asian cultures and families may explain some of this gap, and some critics within the Japanese and Chinese systems worry that students’ creativity is not being fostered (see Stevenson & Stigler, 1994), the facts suggest that many traditional techniques can be highly effective. The point here is not to disparage rigor in education, or such practices as note taking during lectures, completing textbook assignments, writing and revising papers, and so on. Instead, the critique being leveled here has to do with the degree of disembodiment and the lack of *integration* of experiential, affective, and other body-based activities that could improve education and make it more well rounded. When does a particular approach become too disembodied? This is a judgment call that must be made by students and teachers within a particular school context, based on their assessments of the overall quality of experience and performance in the school, and their assessments of other educational models that are available.

Many scholars have started to question the epistemological assumptions that support disembodied approaches. The impetus for this questioning comes from many different fields, including biology, cognitive neuroscience, philosophy, and psychology (see Damasio, 1994; Gibson, 1966; Lakoff & Johnson, 1999). Johnson (2007) comments, “For at least the

past three decades, scholars and researchers in many disciplines have piled up arguments and evidence for the embodiment of mind and meaning. However, the implications of this research have not entered public consciousness” (p. 1). Johnson goes on to state that grasping human embodiment, and the notion that every aspect of our thought is related to forms of bodily engagement with our environment, is a profound and threatening undertaking that is at odds with our inherited Western philosophical and religious traditions.

Embodiment suggests that it is through our bodily perceptions, movements, emotions, and feelings that meaning becomes possible. In other words, anything that is meaningful to us is shaped in some fashion by our incarnation as creatures of flesh. Consider the abstract concept of “justice.” Such a concept is, of course, enriched and partially determined by cultural meanings that help illuminate it and relate it to other concepts such as fairness, democracy, pluralism, and so on. However, would the concept have any meaning whatsoever if we were not creatures that experientially learned a sense of balance, stability, and steadiness by orienting our bodies in space and moving through the world? In other words, embodiment suggests that many abstract concepts like justice are metaphorical extensions of experiential, body-based movements (Lakoff & Johnson, 1999).

It is impossible in the present article to further summarize the large literature on embodied knowing or articulate the many facets of this radical rethinking of human nature. The more limited goal of this article is to highlight a few key implications of embodiment that might stimulate novel ways to think about education and nature.

Perhaps the most obvious and consequential implication of understanding that the body is *in* the mind is realizing that the mind-body dualisms that are pervasive in our philosophical and religious traditions are false. In other words, the notion of a disembodied mind, or a mind that transcends the “limitations” of the body, is an illusion. Especially in relation to school contexts, the ramifications of this idea alone are significant. It suggests that reason cannot and should not be separated from emotion, and thought cannot and should not be separated from feeling and doing. In other words, learning is diminished when parts of the process that are mistakenly seen as a source of error, or at least unnecessary and frivolous, are excised from the curriculum. Such a shortcut back to the “basics” can undermine the complexity of thought.

One of the best demonstrations of how thought and emotion work together has been provided by the neurologist Antonio Damasio, a leading researcher on embodied cognition. His studies have shown that when injuries occur to areas of the brain that are important for experiencing emotion, the process

of reasoning is adversely affected. He comments (1994):

The process of emotion and feeling are indispensable for rationality . . . The lower levels in the neural edifice of reason are the same ones that regulate the processing of emotions and feelings, along with the body functions necessary for an organism's survival. In turn, these lower levels maintain direct and mutual relationships with virtually every bodily organ, *thus placing the body directly in the chain of operations that generate the highest reaches of reasoning, decision making, and, by extension, social behavior and creativity.* (p. xiii)

There is a great deal of evidence that suggests the separation of emotion from cognition is detrimental to learning and growth. Some striking examples come from interviews with eminent individuals recognized for their creativity (see Csikszentmihalyi, 1996; Rathunde & Csikszentmihalyi, 2006). The interviews revealed that creative insight was not simply a matter of learning all that had been written about a particular subject and then working hard to come up with a new insight. The *process* of creativity included interludes of walking to the refrigerator to think about dinner, chopping wood, sitting by a stream, riding a bike, and countless other techniques that aided the individual in whatever problem they were working on. In some cases, such techniques intentionally delayed the premature use of analytical processes that could short-circuit the creative process. Many of the individuals had learned how to let their emotions and intuitions compliment their intellect and knowledge of their field, and to recognize times when an overly emotional or cognitive approach was leading them astray (Rathunde, 1995). Embodied education would not diminish the importance of rational and analytic processes that are celebrated in many traditional education approaches; instead, it would do a better job of recognizing the entire learning/creative process and the essential roles that emotion and movement often play.

If these observations are true, how could the illusion of a disembodied mind—what Damasio calls Descartes' error—take such a strong hold in Western culture and education? One answer apparently lies in the way the body hides itself when perceiving and engaging the world. Phenomenologist Drew Leder (1990) notes, "Insofar as I perceive through an organ, it necessarily recedes from the perceptual field it discloses. I do not smell my nasal tissue, hear my ear, taste my taste buds but perceive with and through such organs" (p. 14). Likewise, we cannot see our eyes when they are seeing, and we are not consciously aware of the fine adjustments our bodies makes in order to support our eyesight (e.g., holding the head a certain way). Even the internal rhythms of our bodies, including our

heart rate and respiration, affect our perception. However, they are so automatic that they seldom enter consciousness (see Gallagher, 2005). This automaticity allows us to function effectively in our environments, yet it also props up the illusion that the mind functions independently of the body.

Language and writing also play key roles in the illusion of disembodiment. The ability to represent objects with the written word can seal us off from our sensory environment and create a relatively self-referential system of meanings (Abram, 1996). In other words, language allows us to create and become immersed in *human* channels of communication (e.g., books, television programs, computer games, and so on) that make it easier to believe that the mind is detached from the influence of the body. Abram (1996) suggests that the phonetic writing system adopted by Greece aided the foundational insights of Western philosophy and were the "hinge on which the sensuous, mimetic, profoundly embodied style of consciousness proper to [oral traditions] gave way to the more detached, abstract mode of thinking" (p. 109).

It would be a mistake to dismiss these conceptual and academic ideas about mind and body as irrelevant for the practical, day-to-day realities of child development and education. Leading ideas in a culture influence parents' and teachers' beliefs about human nature; these beliefs, in turn, can profoundly affect the way children are perceived and treated. Just as cultural constructions of gender affect the day-to-day treatment of individuals, the disembodied view of the mind that is so ingrained in our technological society affects the daily practice of education. It lends itself to a fragmented view of learning where facts are taken out of context, and the personal experience and activity of the learner is seen as superfluous. It also lends itself to a production line view of schools that over-emphasize a business-like and efficient transfer of information and extrinsic rather than intrinsic student motivation. A disembodied view of the mind that is implicitly accepted, therefore, can manifest itself in well intentioned schools where students are expected to sit still, listen to lectures, and focus only on the symbols and concepts they are manipulating because their teacher expects them to do so. While such an approach may not be debilitating for all students, especially those who have benefited from active educational experiences in their families, an abundance of research suggests that educational approaches that adopt this style too exclusively often do lasting damage to the intrinsic motivation to learn (see Csikszentmihalyi, Rathunde, & Whalen, 1997; Deci & Ryan, 1985).

In summary, these introductory observations on the illusion of the disembodied mind are not meant to disparage the role of reason, science, or abstract thought in schools. Nor are they meant as a sweeping indictment of all education. In addi-

tion to the many dedicated teachers in traditional classrooms, there are thousands of examples of schools that take into account students' interests, activity, and hands-on, embodied experiences. Influenced by thinkers such as Dewey, Piaget, and Vygotsky, *constructivist* approaches employ strategies that focus more on process rather than product. Such approaches, which are more common in private and charter schools, employ a more project-oriented approach, more individualized and small group instruction, holistic methods of evaluation, and more integration across subject areas (Barbour, Barbour, & Scully, 2008). Instead, the point of these introductory comments is to suggest how misunderstanding the embodiment of human nature can distort the process of learning and have unforeseen and negative consequences. At a time in history when media of various sorts are saturating children before and after the school day, further cutting them off from nature and isolating them in exclusively human channels of communication, it is important to find ways to put the body back into the mind and create more embodied educational environments. One of the most obvious and fitting ways to do this is through the greater integration of nature.

### **Perspectives on Embodiment: Expanding the Importance of Nature for Education**

Many scholars and educators have made strong arguments for why children's education should maintain close contact with nature. Three of the most familiar are: humans have a special resonance with nature and students benefit from direct contact with it; nature inspires awe and beauty and thereby motivates learning; and nature experiences have many psychological benefits, including a restorative effect on attention. Each of these is discussed here with the intent of demonstrating how contemporary perspectives on embodiment can enrich these arguments and allow advocates of nature in education to make their case in some new ways.

#### *The Attraction to Nature*

The human organism, by virtue of our evolutionary past and its formative influence, has a strong attraction to nature. This is the meaning of E.O. Wilson's well-known concept of *biophilia*—our innate love for nature (see Kellert & Wilson, 1993). Other scholars have likewise observed this deeply engrained resonance. For example, Steven and Rachel Kaplan (1989) comment:

For some reason many people seem to experience nature as particularly high in compatibility. It is as if there were a special resonance between the natural environ-

ment and human inclinations. Functioning in a natural setting seems for many people to be less effortful than functioning in more "civilized" settings . . . It is hard to avoid the conjecture that the fact that humans evolved in environments far more natural than those in which we live now has something to do with the special resonance. (p. 193)

John Dewey (1934/1980) expressed a remarkably similar view about our attraction to nature:

I do not see any way of accounting for the multiplicity of experiences of this kind (something of the same quality being found in every spontaneous and uncoerced esthetic response), except on the basis that there are stirred into activity resonances of dispositions acquired in primitive relationships of the living being to its surroundings, and irrecoverable in distinct or intellectual consciousness. (p. 29)

Maria Montessori (1973) is one of many educators who have recognized this instinctive connection between children and nature and incorporated it into her pedagogy. She thought that there was something immediately given in direct contact with nature that was not conveyed by the written word in texts:

There is no description, no image in any book that is capable of replacing the sight of real trees . . . in a real forest. Something emanates from those trees which speaks to the soul, something no book, no museum is capable of giving (pp. 35-6).

All of these quotes are convincing in many ways. Beyond the logical connection to formative, evolutionary forces, however, they do not suggest with much specificity *why* nature resonates with us and may be of great import to education. Perspectives on embodiment may offer new views on why this connection exists. Human embodiment suggests that conceptual thought is grounded in our sensorimotor experience and aesthetic grasp of a situation (see Johnson, pp. 69-71). Such a perspective is referred to as the "principle of continuity" (see Dewey, 1930/1988), and it cautions against forgetting the sensory source of meaning (i.e., the sight of real trees) by over-emphasizing its representation in thought (i.e., the description of trees). Johnson (2007) comments:

An embodied view of meaning looks for the origin and structures of meaning in the organic activities of embodied creatures in interaction with their changing environment. It sees meaning and all of our higher function-

ing as growing out of and shaped by our ability to perceive things, manipulate objects, move our bodies in space, and evaluate our situation . . . If we reduce meaning to words or sentences (or to concepts of propositions) we miss or leave out where meaning really comes from . . . Any philosophy that ignores embodied meaning is going to generate a host of extremely problematic views about mind, thought, and language. (p. 11)

Having an embodied mind suggests that meaning making begins in more primitive sensorimotor processes and our visceral connections to world. From this radiating point, meaning works its way up through differentiated thought that abstracts part of the ongoing flow of organism-environment relations (see Dewey, 1934/1980; James, 1911/1979). Abstracted words and concepts are essential to the meaning-making process and interact with more immediate perceptions in dialectical fashion. Meaning is diminished, however, if concepts are completely cut off from their affectively rich foundations and are mistakenly seen as independently existing things.

In developmental psychology, the work of James and Eleanor Gibson suggests how sensorimotor forces provide the preconceptual starting point for how infants and children make meaning. These starting points are never completely transcended with adult development and conceptual sophistication. Infants and children learn about the meaning of objects through “affordances,” that is, the possibilities for interaction with the object (Gibson, 1966). The meaning of an object is relative to the functional makeup of an organism (i.e., its sensorimotor capacities), and perception and action are locked in a continuous cycle—one provides information for the other (Gibson & Pick, 2000). It is the illusion of disembodiment that leads us to think of an object as having fixed properties that exist independently of the organism that manipulates them.

This way of looking at human nature helps to explain our intrinsic attraction to nature. The foundations of knowledge are more visceral and aesthetic than generally recognized. Nature experiences evoke these foundations more directly and are intimately connected with the sensorimotor and perceptual systems that support conceptual thought. If this is true, it has implications for the way we think about the role of the natural environment in education. In other words, to the extent that disembodied philosophies go unchallenged, and traditional educational practices take a more hands-off, drill-and-skill approach, words and concepts taught in school may have a reduced affective and motivational force due to the absence of authentic engagement with the processes under study. Although it is not the only source of active engagement with relevant objects and processes, the direct experience of nature

through school field trips, or a greater integration of nature to school campuses, would seem to afford essential opportunities for intrinsically motivated meaning making that has lasting impact and force, especially in the domains of the natural and physical sciences.

### *The Importance of Awe and Beauty*

A second, often-discussed reason for connecting nature with children’s education is the former’s capacity to inspire and motivate learning through experiences of beauty and awe. Part of the reason Maria Montessori advocated direct contact with nature, for example, was to stimulate children’s interest to learn: “What he learns must be interesting, must be fascinating. *We must give him grandeur*. To begin with, let us present him with the world” (1973, p. 37, emphasis in original). According to Montessori, the grandeur of nature elicits awe, fuels imagination, and motivates the work of a child (i.e., learning). When the child feels an intrinsic connection to the world, learning becomes less of an extrinsic chore. Instead of “having to” learn something because a teacher says they should, children want to learn because they are fascinated. Such are the dynamics of intrinsic motivation (see Rathunde & Csikszentmihalyi, 2006).

In addition to stimulating interest, experiences of awe and beauty in nature have the capacity to give us insight about connections to something larger than ourselves. Awe can be a catalyst for cognitive adaption and flexibility in understanding one’s environment (Keltner & Haidt, 2003). The environmental philosopher Emily Brady (2005) comments: “Aesthetic experience is first-hand and immediate, sometimes the most visceral, felt experience we can have of nature, and in that sense it can be very penetrating, have a strong impact and just *stay with us*” (p. 4). She believes such experiences are educative: they have a moral dimension whereby we gain insight about our relationship to nature. Abraham Maslow (1971) often used nature experiences to exemplify *peak* experiences and noted a similar moral consequence: “Perhaps [our] thrilling to nature will one day be understood as a kind of self-recognition or self-experience, a way of being oneself and fully functional, a way of being at home, a kind of biological authenticity” (p. 333). Maslow, like Brady, suggested that in moments of experiencing beauty we gain a spiritual understanding of how humans are “isomorphic with nature.” We learn, in a sense, that what we perceive in nature is a part of ourselves.

The power of awe and beauty to change environmental attitudes is often underestimated (Hartig, Kaiser, & Bowler, 2001). The more common method for trying to change atti-

tudes and behavior is to provide information about threats to the environment (e.g., global warming). Although such an approach has its place, facts without a context of feeling can have a numbing effect on a person. David Abram (1996) refers to such an ironic lack of feeling among some environmentalists as “conferencing to solve global environmental problems while oblivious to the moon rising about the rooftops.” In contrast, many of the most devoted advocates for the environment, for example, Arne Naess, the Norwegian philosopher responsible for the deep ecology movement, and Rachel Carson, one of the progenitors of the global environmental movement, point to transcendent experiences in nature as their source of motivation and passion. Carson (1998) commented: “I believe natural beauty has a necessary place in the spiritual development of any individual or any society” (p. 160). Brady (2005) agrees: “Aesthetic valuing is a route to valuing nature for its own sake rather than any benefits it has for people. This strategy could support a non-anthropocentric environmental ethic” (p. 10).

Some support for the connection between the experience of awe and environmental attitudes is supported by preliminary analyses of data collected by the author from approximately 200 students at five middle schools (Rathunde, 2008). The participating students filled out a background questionnaire and then were randomly assigned to two groups—one took a nature walk at the start of the school day while the other group continued doing schoolwork indoors. The following day the students reversed roles. The background questionnaires contained one section that asked if students had ever had a deeply engaging experience of awe in nature. Another section of the questionnaire contained a survey of environmental attitudes. Results showed a positive correlation between the two: those who had experienced awe in nature also had more pro-environment attitudes and behaviors. Such correlational findings say nothing about the direction of causation, but they support the notion that pro-environmental attitudes and behaviors go hand-in-hand with a feeling-based, aesthetic appreciation of nature. Further analyses will explore this interrelation by looking at subsequent student experiences on the nature walks.

Perspectives on embodiment are entirely consistent with these observations about the capacity of nature to motivate learning and give insight about our relationship with nature. Once again, in addition, such perspectives can add valuable insights to further elucidate the importance of nature experience in children’s education. In most disembodied philosophies of how we learn, aesthetic experience is devalued as too subjective and emotional. An embodied approach, in contrast, elevates aesthetic experience to a preeminent position: it is

seen as the qualitative beginning of the process of meaning making. Johnson (2007) draws heavily from John Dewey’s 1934/1980 book *Art as Experience* to argue the importance of aesthetic experience as a condition of life. He comments:

We need a philosophy that sees aesthetics as not just about art, beauty, and taste, but rather as about how human beings experience and make meaning. Aesthetics concerns all of the things that go into meaning—form, expression, communication, qualities, emotion, feeling, value, purpose, and more . . . we must realize that aesthetics is about the conditions of experience as such. (p. 212)

Dewey (1934/1980) envisioned the goal of his classic book as “recovering the continuity of esthetic experience with normal processes of living” (p. 10). Following a period of experienced disorder or tension, he saw in the emerging order and intensified rhythms of an aesthetic experience a dynamic model for all of learning and creativity, whether based in the arts, sciences, or everyday life. “If Dewey [is] right,” Johnson (2007) asserts, “then one cannot do epistemology, logic, metaphysics, or any other philosophical undertaking adequately without first exploring aesthetics” (p. 213).

Embodied perspectives suggest that aesthetic experiences are far more important to learning than has been recognized in disembodied views of the mind. They matter because the beginning of meaning starts with a *qualitative* grasp of a unified situation. The heightened affect and intensity of an aesthetic experience animates whatever differentiated and abstract thought follows. Such views of human nature not only support the assumption that awe-inspiring nature experiences can motivate learning and transform attitudes about our relationship to the world, they suggest that the integration of aesthetics in education—through nature *and* by other means—is a fundamental facet of education in need of much greater attention. In other words, schools contexts not only need to recognize the importance of traditional aesthetic domains, such as music, dance, and the visual arts, they need to integrate nature—arguably the most potent source of aesthetic feeling available.

### *Nature and Attention Restoration*

A third reason often raised by advocates of integrating nature in children’s education is the positive health and psychological benefits resulting from nature experience. Of the three rationales for nature discussed in this article, this one has generated the most research and empirical support. Many studies have revealed a variety of benefits from exposure to nature,

including reduced stress, improved moods, and enhanced self-esteem (Frumkin, 2001; Ulrich et al., 1991). The most developed line of research, however, involves nature's restorative effect on attention (Kaplan, 1995). Just as was the case with the previous two reasons for integrating nature to education—our innate resonance (biophilia) and the importance of awe and aesthetic experience for learning—perspectives on embodiment offer additional insights about nature's positive effects on attention.

Kaplan's (1995) *attention restoration theory* (ART) suggests a person's selective attention or concentration is more efficient after exposure to natural settings. Why is this the case? According to the theory, our hectic daily lives rely heavily on selective attention to juggle and organize the many tasks we have to perform, and this often leads to mental fatigue. ART suggests that nature experiences, because they are intrinsically interesting or fascinating, engage automatic rather than selective attention (see James, 1890/1950). Therefore, selective attention processes are rested and one returns from a natural setting with a recovered ability to focus (see also Kaplan & Kaplan, 1989).

Several key studies have provided empirical support for the theoretical connection between natural environments and attention restoration. Hartig, Mang, and Evans (1991) randomly assigned participants to three conditions: natural environment, urban environment, and passive relaxation. After a pre-treatment manipulation that was intended to fatigue attention, those in the former two conditions took a 40-minute walk, and those in the latter condition listened to soft music and relaxed. Results showed that those who took the nature walk performed better on a selective attention task (i.e., proofreading). In a more recent study, Hartig and colleagues (2003) used physiological measures and self-report measures to assess the restorative effects of a walk in natural and urban environments. Results showed that walking in a nature reserve had positive effects on stress reduction as indicated by a decline in diastolic blood pressure. Performance on an attention test also improved after the nature walk and so did self reports of positive affect.

The same walking effect has recently been found with children. Faber Taylor and Kuo (2009) found that children who were diagnosed with ADHD concentrated better after walking in a park setting as compared to either a downtown or residential setting. They found relatively large effect sizes that approximated the benefits of medication and suggested that "doses of nature" might serve as a safe, inexpensive, and widely accessible new tool for managing ADHD symptoms. Even videotaped presentation of natural environments, or

views of nature from windows, have also elicited greater improvement in mood and better concentration performance. Tennessen and Cimprich (1995) found that university dormitory residents with more natural views from their windows scored better on tests of directed attention than those with less natural views. Van den Berg et al. (2003) found that viewing videotaped natural environments elicited greater improvement in mood and marginally better concentration than viewing built environments.

Although research guided by attention restoration theory has not been focused on school contexts, the theory has obvious implications for nature and children's education. Concentration is crucial for success at school because students must sometimes inhibit distracting thoughts and focus on tasks that they might not enjoy. They must inhibit social responses that might be disruptive, plan to complete assignments, and use their attention to self-regulate their behavior and cultivate independence and autonomy. In addition, since concentration is fundamental for memory and learning, one could argue that a greater integration of nature in school settings would improve students' focus and performance.

Perspectives on embodiment suggest there might be more to the restorative effect of nature than providing temporary relief for an overtaxed selective attention process. More specifically, the notion of embodiment offers insights as to why automatic attentional processes not only are involved in the *recovery* or restoration of attention, they may also affect its *quality* and intensity.

As has been stated earlier, the notion of embodiment suggests there is a false dichotomy between body and mind, feeling and thought, and perceiving and thinking. Human-environment interactions affect information processing in many subtle and unconscious ways (Gallagher, 2005). One key reason is that abstract thinking—and selective attention—is not the beginning of the meaning-making process. Abstract thought is grounded in our embodiment, in our ability to perceive things, manipulate objects, and move our bodies in space (Gibson, 1966). One of the fundamentals of gestalt perception, for example, is that our experience of a complex scene is organized first by simple features (Arnheim, 1969): a young child experiences "doggyishness" before he or she is able to distinguish one dog from another. Furthermore, emotions constitute a precognitive response to our environment (Ittelson, 1976; Zajonc, 1980). What is first experienced is how a situation *feels* to us, and these pervasive qualities are not reducible to abstractions. Johnson (2007) explains: "If you pay attention to how your world shows itself, you will indeed see the flow of experience comes to us as unified wholes (ges-

talts) that are pervaded by an all-encompassing quality that makes the present situation what and how it is” (p. 73).

If this is indeed the way we come to know and learn, it does not diminish the importance of selective attention and rational processes of abstraction, but it does significantly elevate the often invisible processes of feeling and aesthetic perception that have often been devalued in Western science. Some models of creativity, unrelated to current perspectives on embodiment, have captured the implications of an embodied learning process and are worth considering here. For example, Heinz Werner (1956; see also Crain, 2000) suggested the creative person was able to combine *physiognomic perception* and *geometric-technical thinking*. The former is an immediate, body-based mode of perception—associated especially with children and artists—where a person feels emotionally connected and immersed in what he or she perceives. The latter mode, linked with adult or scientific thinking, involves the use of constructs to articulate and represent our perceptions. Werner suggested a creative person had *mobility* between these complementary modes and could, therefore, more fully engage and develop an experience. Without this mobility, creative thought was curtailed. A similar account of creativity has been suggested by pointing to the holistic/analytic processing differences between the right and left hemispheres of the brain and the needed involvement of both in the creative process (see Martindale, 1999).

Empirical studies provide some support for these ideas about creativity. Creative artists and scientists often combine affective and rational modes in their most productive work: they are sometimes passionate and sometimes detached, depending on where they are in the unfolding situation and what is the most appropriate response at that moment (see Rathunde & Csikszentmihalyi, 2006). For example, Jonas Salk, the inventor of the first successful polio vaccine, described peak moments of growth and creativity as a combining intuition and rationality: “I speak of going from the intuition department to the reasoning department and then back and forth to check it out to make sure it’s still true, so to speak.” This dialectical synchrony was also apparent in studies with adolescent students. For example, boys and girls who were identified as talented by their teachers, compared to average teenagers, had personality dispositions that combined affective sensitivity and cognitive discipline. Those who were able to synchronize their affective and cognitive engagement while working in their chosen domains developed their talents to a greater degree over the course of high school (see Csikszentmihalyi, Rathunde, & Whalen, 1997).

Attention restoration theory acknowledges that fascinating nature experiences engage automatic attentional processes.

However, aside from suggesting that these processes give selective attention a break and a chance to recover, the theory does not specify a positive or direct role of automatic attention in subsequent information processing. The notion of embodiment, consistent with these brief observations on creativity, may help in this regard. Why does nature restore attention? Perhaps it is because nature helps to *integrate* the processing system. By engaging the part of the system that is ontologically prior to selective attention and abstract processing, the part more associated with feeling, aesthetic perception of the pervasive qualities of a situation, physiognomic thinking, the holistic processing of the right hemisphere, and so on, subsequent concentration and selective attention gains added quality and force. Perhaps this is why a handful of studies have associated nature with children’s creativity (see Louv, 2005), and the creativity literature abounds with anecdotes of nature interludes that facilitate the creative process (Csikszentmihalyi, 1996). Some indirect support for the notion that nature may affect the interplay of automatic and selective processes was provided by a recent study by Heathen et al. (2007). Using a priming paradigm where photographs of natural settings were shown to subjects before a timed facial recognition task, settings with more natural elements (i.e., trees and vegetation) decreased the recognition times of happy faces. In other words, the affective priming of the nature photographs increased the efficiency of selective processing.

### **Conclusion: Toward Embodied Education**

If learning is a process that unfolds from felt quality to abstraction, then there is a need to reevaluate how educational environments are set up and what activities should be cultivated with students. Whereas disembodied education tends to emphasize only the abstract end of the learning process, models of embodied education would emphasize the entire, holistic process, including body-based feelings and perceptions. Based on the insightful critiques of the disembodied mind that have already appeared, embodied educational approaches would make a greater effort to reintegrate movement, affect, and aesthetics to the learning process.

As perspectives on embodiment emerge across several disciplines, the possibility exists for envisioning new models of embodied education. In addition, there are existing educational approaches, consistent with the themes presented here, that do not draw inspiration from the embodiment literature. For example, constructivist approaches advocate changes in schools that are consistent with the insights of embodiment. These approaches place a stronger emphasis on sensorimotor processes, the importance of the arts, movement both in and

outside of the classroom, and student interest and affective involvement (Barbour, Barbour, & Scully, 2008). Not surprisingly, the thought of John Dewey and the progressive education movement of the 1930s and 1940s heavily influenced the constructivist orientation. Dewey's thoughts on aesthetics and its relation to knowing and learning are thought to be central to understanding embodiment (Johnson, 2007).

The process of creating more embodied educational environments could also benefit by looking at other educational approaches that intuitively grasped the mind-body connection and anticipated contemporary perspectives on embodiment. Maria Montessori was an early practitioner of embodied education and inspired an educational movement that is still very active in the US and across the world. She understood that the most important path to a child's natural gifts was "activity concentrated on some task that requires movement of the hands guided by the intellect" (1966, p. 138). In other words, it was the *combination* of body/senses and intellect—not one or the other—that was key to education. Many aspects of the Montessori method were tied to this general principle. Movement was encouraged and children were allowed to actively explore their environment. Everything in the classroom—from the layout to the child-sized tables and chairs—was there to encourage hands-on activity. Sensory materials were used to educate the senses. Children presumably refined their senses through the use of a variety of materials—sound cylinders to match like sounds, color tablets to discriminate subtle hues, and sandpaper tablets to feel gradations from rough to smooth. Most importantly, nature was seen as essential part of children's education and was integrated into the classroom.

Steiner/Waldorf schools also incorporate principles of embodied education. Ashley's (2009) overview notes that the approach is based on spiritual tenets that may be hard for secular teachers to accept, but the philosophy is child-centered and holistic. In the years between the ages of 7 and 14, for example, students focus on aesthetics and an appreciation of the beauty of the world; teachers, in turn, are expected to have a degree of personal artistic accomplishment. An embodied approach is also evident in the Goethe-inspired science curriculum. For example, the initial study of physics is heavily based on observation and starts with acoustics using musical instruments that are familiar to children. In all of the sciences, a purely quantitative approach is avoided in order to preserve the essential nature or "being" of phenomena (see Ashley, 2009).

Two other contemporary educational approaches—place-based education and experiential education—can also serve as models of embodied education. Place-based education promotes learning that is rooted in a student's immediate natural

and cultural environment (Sobel, 2004). It is a hands-on and project-based approach that attempts to connect learning activities to the real world. For example, a history unit on WWII might draw on interviews with individuals living in the local community who fought in the war. Experiential education engages students through direct experience and, like constructivism, has been greatly influenced by Dewey's (1938) writings on education. Teachers are perceived as experience providers, not just transmitters of facts. Students are encouraged to explore outside of the classroom and spend time reflecting on their activities. A basic tenet is that action should precede the attempt to synthesize knowledge. The term "experiential education" is used widely by a number of different active learning approaches (e.g., service learning, environmental education, and cooperative learning) and employs a variety of pedagogical techniques (e.g., games, role play, storytelling, and creative play; see Beard & Wilson, 2006).

All of the examples just provided, and many others that cannot be summarized here, can serve as starting points for reflecting on the meaning of embodied education. To their credit, they also emphasize that different activities are more or less appropriate depending on a child's developmental stage and ability level. Constructivist, Montessori, and Steiner/Waldorf approaches, for instance, recognize the importance of tailoring instruction to fit with students' individual differences, as well as the sensorimotor skills of early childhood, the emerging rationality of middle childhood, and the formal operations of adolescence. Embodied education is not a one-size-fits-all approach and has different effects on different children.

The meaning of embodied education, however, is not encompassed by the examples presented here and is only tentatively sketched in this article. Many of the assertions being made about the meaning of embodiment, and how education may benefit from an awareness of it, await further empirical proof and more developed theoretical frameworks. The perspective here should be thought of as an invitation to consider issues related to embodiment and education and to formulate new ideas for research. The main point is that research on nature and education, in particular, can benefit from the embodiment literature to see children's development and education in a new light. The present article suggests that some of the main arguments nature advocates seize upon, namely, our strong attraction to nature, the power of awe and aesthetic appreciation to inspire learning and motivate pro-environment behaviors and attitudes, and the psychological and attentional benefits associated with nature engagement, can find new depth in ideas about embodiment. As these ideas start to enter public consciousness and transform how we think about hu-

man nature and learning, new models of embodied education will recognize engagement with nature as an indispensable component of children's education.

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