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## Montessori education and its scientific basis

Angeline Stoll Lillard, *Montessori: The science behind the genius*, Oxford University Press, Oxford (2005)  
ISBN 0-19-516868-2, 224 pp., \$35 (cloth).

Italians have always revered the arts and promoted the infusion of beauty and fine design into the quality of everyday life. Perhaps it is this distinctive cultural flair, revealed in fields such as architecture, painting, interior design, graphics, fashion, and cuisine, that has influenced Italy also to become a giant in the field of early childhood education. In the 20th century, Italy has produced two of the world's most innovative and influential leaders: Maria Montessori (1870–1952) from Rome, in southern Italy; and Loris Malaguzzi (1920–1994) from Reggio Emilia, in the northern part of the country.

Montessori education is the subject of Angeline Lillard's book. Montessori, a brilliant figure who was Italy's first woman physician, created an approach that reflected a late 19th century vision of mental development and theoretical kinship with the great European progressive educational philosophers, Jean-Jacque Rousseau, Johann Pestalozzi and Fredrich Froebel (Edwards, 2002 and Edwards, 2003). The many parallels between her ideas and those of the American progressive, John Dewey, her contemporary, are due to the fact that their ideas grew out of shared theoretical roots and were responsive to the social and cultural transformations engendered by the industrial revolution. Montessori is the only woman regularly listed as one of the very great figures in the history and philosophy of education, and up until 2002 when the European Union issued the Euro as common currency, her country's deep regard was indicated by her face on the Italian 1000 Lira bill.

As Lillard's book explains, Montessori's vision anticipated many of the twentieth century's developments in child psychology and education. Montessori was convinced that children's natural intelligence involved, from the start, rational, empirical, and spiritual aspects. After drawing on Edouard Seguin's and Jean Itard's work to innovate a methodology for working with children with disabilities, she started her Casa dei Bambini (Children's House) in 1907 for children aged 4–7 in a housing project in the poor slums of Rome. Her educational movement (including her highly original concepts for curriculum materials, child-sized furniture, classroom layout, mixed age grouping of children, and teaching strategies) spread to other countries, especially once Mussolini's Fascist regime denounced her methods and Montessori left Italy to live the rest of her life abroad.

In the United States, there was strong but brief interest in the Montessori method from 1910 to 1920, but then it fell out of favor (Torrence & Chattin-McNichols, 2000), though during that time the movement began to flourish in Europe and India. In the second half of the 20th century, Montessori education finally became a world force in education. In the 1950s, American educator Nancy Rambush led a movement of renewal, and Montessori education spread as an independent (private) school movement (Loeffler, 1992). Today, there are probably 5000 or more schools in the US calling themselves "Montessori." Of these, about 20% are affiliated with two major accrediting organizations. The larger organization within this country, the American Montessori Society (AMS), supports Montessori education in the context of contemporary American culture, and has been more influential in outreach to the American public school system as well as in promoting a network of teacher-based classroom research. Association Montessori Internationale (AMI), founded by Montessori in 1929, promotes the study, application and propagation of (original) Montessori education worldwide, and is the branch of Montessori to which Angeline Lillard holds allegiance. To prepare teachers for North American Montessori schools, there are many training institutes, some adapting more to the cultural contexts of contemporary times and others staying close to Montessori's original methods. For example, in the United States, over 70 training programs are affiliated with AMS, and 16 with AMI. In the 1960s, American parents began to advocate for Montessori education in public schools, leading to hundreds of programs (often magnet programs) at the pre-K and elementary levels, and now increasingly the middle and high school levels. Montessori infant-toddler programs are also becoming numerous.

We owe a debt to Montessori for influencing educators to see young children as intelligent in a qualitatively unique way. She saw development as a series of periods (birth to age 6, 6–12, and 12–18 years), like repeating waves, each with its own particular strengths and sensitivities. A pioneering constructivist, she posited an active child, eager for knowledge and prepared to learn, seeking perfection through reality, play, and work (“follow the child” was her grand rule). In contrast with some later constructivists such as Jean Piaget (whom she may have influenced), she believed that even young children can approach big, abstract topics like the earth’s geography through sensorial exploration and guided construction of knowledge.

Angeline Lillard is a cognitive-development psychologist at the University of Virginia, and her book is an attempt to examine systematically the developmental research literature to evaluate some of the central principles of Montessori theory and practice. Because Montessori’s contributions are often underappreciated by educators and psychologists, a fresh and close examination of them is certainly called for. It is also timely, given the current educational climate, where enormous pressures are placed on educators to reverse achievement gaps in American students by introducing more direct instruction and narrow training in academic skills in the early years. In many cases, changes in teaching strategies (such as removing time for purposeful play and exploration) are made even though they are not developmentally appropriate and not likely to produce lasting gains in literacy, math, and science (e.g., Neuman & Roskos, 2005).

Lillard’s methodology in the volume is to devote a chapter to each of eight central principles, first drawing together some key pieces of research that are consistent with it, and then explaining how the principle is instantiated in Montessori practice. In doing so, she contrasts Montessori philosophy and methods with what she refers to as “traditional education,” painted in such an oversimplified and exaggerated way that it becomes a caricature of every imagined evil of American factory-style schooling. However, leaving aside for the moment this problem of the straw man, the discussions of Montessori practice should be particularly interesting for developmental psychologists because they clarify how tightly woven Montessori’s pedagogy was to her elaborate and systematic vision of teaching and learning.

Principle 1 is that movement and cognition are closely intertwined and that physical movement can enhance thinking and learning. The author supports this principle with studies of human infant grasping and crawling that demonstrate that advances in movement are related to advances in cognition (e.g., Needham, Barrett, & Peterman, 2002), animal literature on the impact of self-generated locomotion on visual depth perception and density of neural connections (e.g., Kleim et al., 1998), and cognitive studies that show that mental representation, processing, memory, and facial discrimination are improved when people’s movements align with what is to be learned. The principle of movement and cognition relates to some of the most familiar components of Montessori curriculum, in particular, the Practical Life Exercises (e.g. washing, pouring, polishing, tying, and buttoning), Sensorial Materials (e.g. pink tower, brown stairs, red rods, and sound cylinders), and Math Materials (spindle box, beads, binomial and trinomial cubes). For the reader, the description is rich enough and sufficiently enlivened by detailed examples that it allows one to understand fully the methods and reasons for their effectiveness.

The next three principles concern issues of child motivation: (2) choice and perceived control promote children’s concentration and contentment in the learning process; (3) personal interest enhances learning in a context where interests build on prior knowledge and the children’s own questions; and (4) extrinsic rewards negatively impact long-term motivation and learning. The author marshals ample evidence for these principles from many examples of educational and cognitive psychology research. Much of it is indirect support for the particular educational method, however. (For example, there is no experimental evidence presented for Principle 2 that increasing task concentration in preschool classrooms improves child learning outcomes.)

The principle with strongest direct evidence may well be Principle 4 about detrimental effects of extrinsic reinforcement on motivation to learn. The evidence suggests that extrinsic reinforcements are most harmful when tasks are open ended and nonboring (e.g., Lepper, Greene, & Nisbett, 1973), when reinforcements are tangible, and once they are removed (Deci, 1971). The author seeks to present a balanced view, and points out where there are gaps or weaknesses in the evidence, but she does not address the case literature of special education, which surely would be relevant. Nevertheless, it is impressive to see how a cognitive-developmental psychologist can marshal support for a vision of learning as ideally self-regulated, self-directed, and self-motivated. Montessori strongly believed that all young children naturally prefer to learn in an organized but supportive environment that permits a high degree of choice, control, and self-direction, and where children are not distracted by extrinsic rewards and punishments that distort their preferences (for instance, by grades, stars, awards, demerits, honor rolls, smiley faces, and the like). The three principles translate into Montessori classroom practices that provide children with generous (but not infinite) choice

and control over what they work on, with whom, and how long they work on it; lack of grades and formal evaluations; and lessons that provide scope and sequence to the curriculum in a cohesive, organized way that builds over time from infancy through adolescence.

Principle 5, that collaborative (child–child) arrangements are conducive to learning, is supported by a strong and clear-cut body of recent studies concerning observational learning, peer tutoring, and collaborative learning. There is a general perception (actually false, it turns out) that Montessori education reinforces children for working alone. The author's review of the research on collaborative learning is nuanced and provides insight into the many ways that children have been shown to learn from others through observation, imitation, tutoring or being tutored, and working in collaborative small groups. Montessori education increases child–child collaboration through the organizational features of three-year age groupings (that naturally elicit older/younger nurturance and teaching) and the relatively large class size (that increases child/child contact) in the context of a prepared environment.

Principle 6 is that learning situated in and connected to meaningful contexts is more effective than learning in abstracted contexts. Here, as well, appropriate and well-regarded studies are cited (e.g. Vanderbilt University Cognition and Technology Group's "Jasper Project" in math education). This principle seems almost self-evident (would anyone argue that conditions for learning improve when situated in meaningless contexts, disconnected from prior knowledge, or presented in dull, uninvolved ways?). Yet, Montessori implemented the principle with uncommon commitment and thoroughness. The scope and sequence of the Montessori curriculum ensure that new lessons build systematically on past ones, construct lessons and exercises in ways that build on children's wonder and curiosity, and connect classroom projects to the real world to make learning meaningful.

Principle 7 is that sensitive and responsive (nurturing) teaching is associated with more optimal outcomes. Like Principle 5 on peer collaboration, this one addresses the social system of the classroom, and it is supported by strong evidence from recent literature on social-emotional development. Indeed, in my view, both of the social principles are essential and paramount for understanding how, when, and why Montessori schools (or any excellent early education programs) have the potential to promote child development and well being. Secure relationships are increasingly recognized today as the sine qua non of high-quality early childhood education and care (e.g. Baker & Manfredi/Pettit, 2004 and Butterfield et al., 2004), so it is refreshing and important to think about social-emotional needs for attachment and close relationships as part of good teaching in Montessori education. The evidence for Principle 7 draws from findings on attachment (the studies of Mary Ainsworth et al.; e.g. Ainsworth, Blehar, Waters, & Wall, 1978) and parenting styles (the work of Diana Baumrind et al., e.g. Baumrind, 1989) which indicate that young children need a secure base for learning and benefit from "authoritative" parent or teacher guidance that is high in warmth and firm but flexible in control style. Montessori said that a teacher must be "ready to be there whenever she is called in order to attest to her love and confidence. To be always there—that is the point" (Montessori, 1956, p. 76). In Montessori education, children usually are grouped into multi-age classrooms spanning 3 years, which promotes continuity and close relationships. During the infant–toddler (birth to age 3) and primary (age 3–6) years, classrooms typically have more than one adult to meet state mandated adult/child ratios.

The eighth principle is hard to characterize but so fundamental that most Montessori educators would consider it preeminent: (8) order in the environment promotes and establishes mental order and is beneficial to the child. This principle addresses four kinds of order, according to the author (temporal, spatial, noise/crowding, and orderly education of the senses), and it clearly accords with and anticipates the Vygotskian theory of mental structure developing out of progressive internalization of the structures inherent in culture and language ("tools of the mind"). The research evidence for this principle draws from disparate sources indicating the benefits of temporal routines for children, the negative effects of noise, crowding, and physical chaos in homes, and neuroscience research on training in making progressively finer distinctions. Montessori classrooms are very orderly and prepared with respect to their spatial arrangement and their organized use of materials.

The book concludes with a chapter called "Education for Children," which attempts to address frequently asked questions and concerns about Montessori education, such as whether it is too free (or too structured), whether it is suitable for all children, whether it can be implemented in public school settings, and so on. Lillard is candid about her own bias that the best kind of Montessori is that recognized by the Association Montessori Internationale (AMI), the association that complies with Montessori's original methods. Lillard thereby appears to take a different position on education than she does on science. When discussing the research findings of developmental psychology she draws

widely from different theories and methodologies and appreciates a range of kinds of evidence, acknowledging the complexities of evaluating the strengths and weaknesses of research findings. When it comes to education, however, the perspective is narrow and foreclosed throughout the book. The author prefers to contrast an idealized prototype (“good” Montessori = AMI) with a stereotype (“bad” factory model = American traditional education) rather than consider the complex range of variation found in the real world. Progressive and developmentally informed principles of education underlie many kinds of good educational work (Bowman, Donovan, & Burns, 2001), and indeed, the spectrum of Montessori children’s schools and teacher training programs may strengthen rather than weaken the potential of the Montessori philosophy to endure and continue to influence American education.

In fairness, Lillard is not an educational expert, as evidenced by errors (even misspellings) when mentioning other major progressive programs of early childhood today (such as Waldorf and Reggio Emilia, which, for example, she mistakenly says require the whole group to work in unison). Instead of following this author’s preference for strict adherence to one tradition in Montessori training, I would contend that guiding early childhood teachers to acquire advanced skills in formulating researchable questions, observing systematically, and engaging in collaborative teacher action-research can inform, improve, and energize their work with children (Darling-Hammond & Bransford, 2005 and Genishi et al., 2001). Research across program types has suggested that such key features as staff qualifications, teachers as reflective practitioners, and program intensity and coherence relate to higher program quality in early childhood education (Bowman et al., 2001). Lillard says, “innovations can, in practice, result in suboptimal Montessori classrooms,” but she does not note that mediocrity also results from rigid adherence to a formula.

Nevertheless, this book makes a wonderful case for the genius and enduring contributions of Montessori education and its visionary founder. It can inform but should not limit readers’ search to understand Montessori education today.

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